THE TOSAWIHI QUARRIES: AN ARCHAEOLOGICAL TESTING PROGRAM

Edited by

Robert G. Elston

Contributors: Steven G. Botkin
Margaret C. Brown
Elizabeth E. Budy
Michael P. Drews
Robert G. Elston
C. Lynn Furnis
Kenneth E. Juell
Christopher Raven
Dave N. Schmitt
Melinda Leach

Prepared for
Galactic Services, Inc. and
Ivanhoe Gold Company
5250 S. Virginia, Suite 300
Reno, Nevada 89502

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CULTURAL RESOURCES MANAGEMENT SUMMARY

Minerals exploration, proposed minerals extraction, and development of attendant support facilities in the Ivanhoe Project Area, a subarea of the Ivanhoe Mining District in Elko County, Nevada, prompted in 1987-1989 a program of archaeological surveys, site testing, and cultural resource significance evaluations (Figure A). Proposed mining developments lie peripheral to the Tosawihi Quarries archaeological site (26Ek3032), a prehistoric opalite quarry determined eligible for nomination to the National Register of Historic Places. Currently administered by the Elko District Office of the Bureau of Land Management, cultural resources in selected portions of the project area were identified, recorded, evaluated, tested, and their evaluations subsequently revised in accordance with Federal regulations and then-current BLM policy guidelines (Nevada BLM 1985; USDI-BLM n.d.). The present discussion summarizes the results of those exercises in terms of the predicted effects of the proposed action on the cultural resource base of the project area, measured by the apparent eligibility of the entailed properties for inclusion on the National Register.

Structure of the Proposed Ivanhoe Project

Development will be staged in three activity areas discussed separately here owing to differences in the cultural resource complement of each, the nature and intensity of impacts that each will receive, and the results that archaeological investigations in each have yielded so far. Each activity area is subsumed by one of the study areas discussed in the present volume.

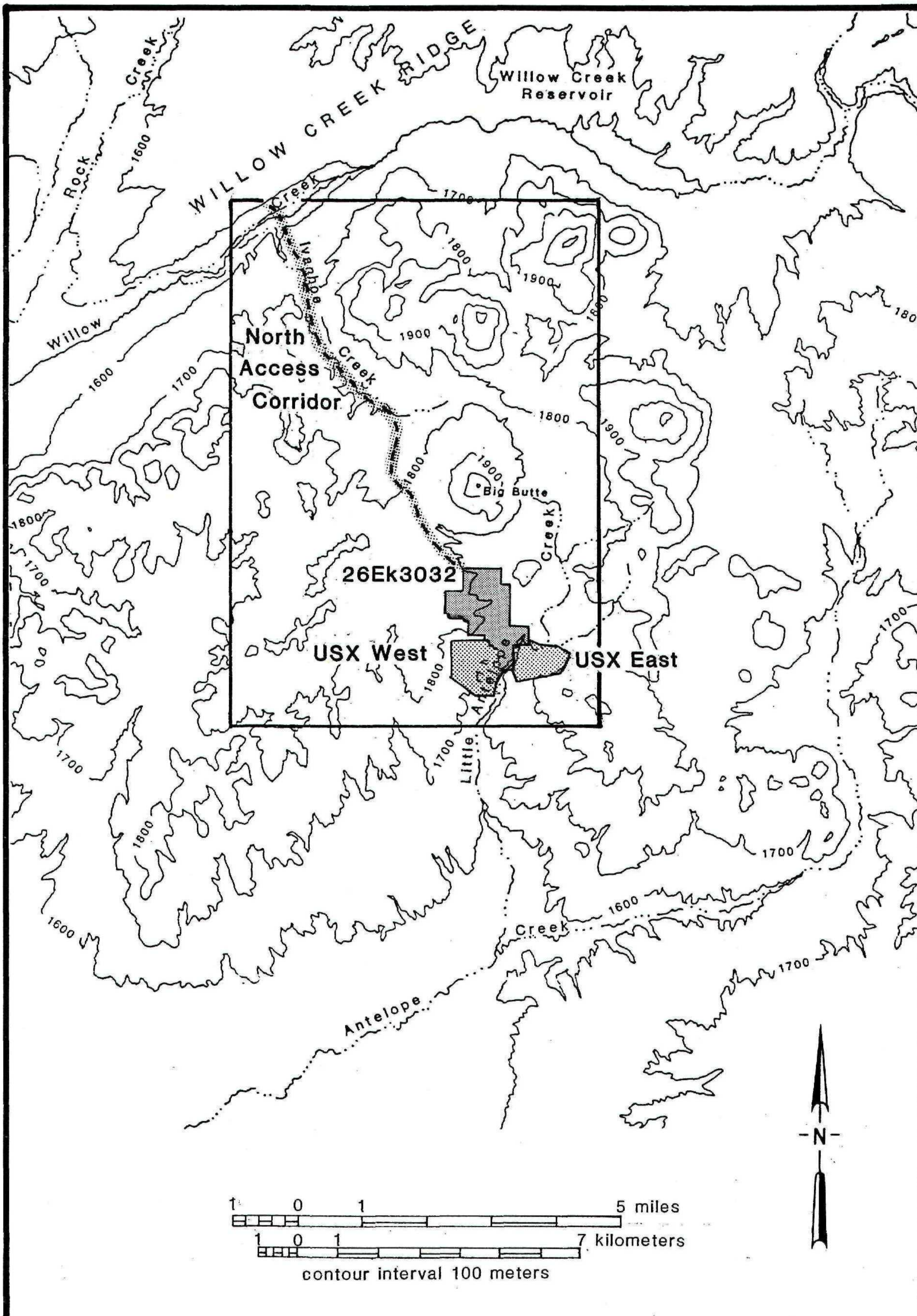
History of Investigations

Developments proposed in each of the three study areas resulted in independent intensive surveys to identify and evaluate cultural resources, assess potential adverse effects, and determine which of the subject properties required testing to clarify their National Register eligibility. Circumstances and findings of the surveys are summarized below.

North Access Corridor Study Area

Extending approximately 7.7 miles to State Route 789 from the northern boundary of the Tosawihi Quarries, proposed improvement (widening and grading) of an existing access road would involve the surface disturbance of about 120 acres. Additionally, four borrow pits (material sites) are proposed in support of road construction, entailing the disturbance of about 27 acres.

Figure A. Location of Ivanhoe Project Study Areas, Relative to Archaeological Site 26Ek3032 (Tosawihi Quarries).



WILLOW CREEK RIDGE
Willow Creek Reservoir
Rock Creek
Willow Creek
Ivanhoe Creek
North Access Corridor
Big Butte
Creek
26Ek3032
USX West
USX East
Little Antelope
Antelope Creek
1600
1700
1800
1900
N
1 0 1 5 miles
1 0 1 7 kilometers
contour interval 100 meters

Survey of the North Access Corridor (Drews 1988) resulted in the recording of 28 previously unrecorded sites (Figure B). Corridor realignment subsequent to survey avoided 18 of them (IMR 1988c), with the result that 10 sites remain within the zone of direct impacts (cf. Table A and Figure B); 2 of these were determined by survey to be ineligible for National Register consideration. The remaining eight sites were evaluated by the testing program described herein.

Table A
Sites Impacted by Proposed Developments,
North Access Corridor.

Design Element	Archaeological *Site*
Road Construction	26Ek3228
	26Ek3231
	26Ek3232
	26Ek3234
	26Ek3237
	26Ek3238
	26Ek3239
	26Ek3251

USX-West Study Area

The USX-West Study Area comprises approximately 480 acres immediately southwest of the Tosawihi Quarries (Figure C). Within this area, approximately 334 acres would sustain direct ground disturbance as a consequence of the proposed action. Project elements within this contiguous block proposed at the time of original survey (November, 1987) consisted of an open pit, a leach pad, a waste dump, a haul road, and a plant and office area. Owing to the degree of disturbance anticipated from the proposed facilities, it was assumed that any archaeological sites coincident with them would be destroyed utterly. Accordingly, testing was designed to evaluate cultural resources within the impact zone of the area.

Subsequent to field operations, design elements of the proposed action evolved; the plant and office facility were relocated outside the study area as were ore processing elements, while topsoil stockpiles and an additional waste rock dump were proposed. Anticipated impacts of the newly proposed facilities required that further testing be undertaken to evaluate sites not entailed in the original plan of operations.

In November, 1987, an intensive cultural resource survey was conducted over about 480 acres in response to proposed developments in the USX-West area (Budy 1988). The survey returned data on 124 previously unrecorded prehistoric

Figure B. Project Design Elements and Impacted Archaeological Sites, North Access Corridor Study Area.

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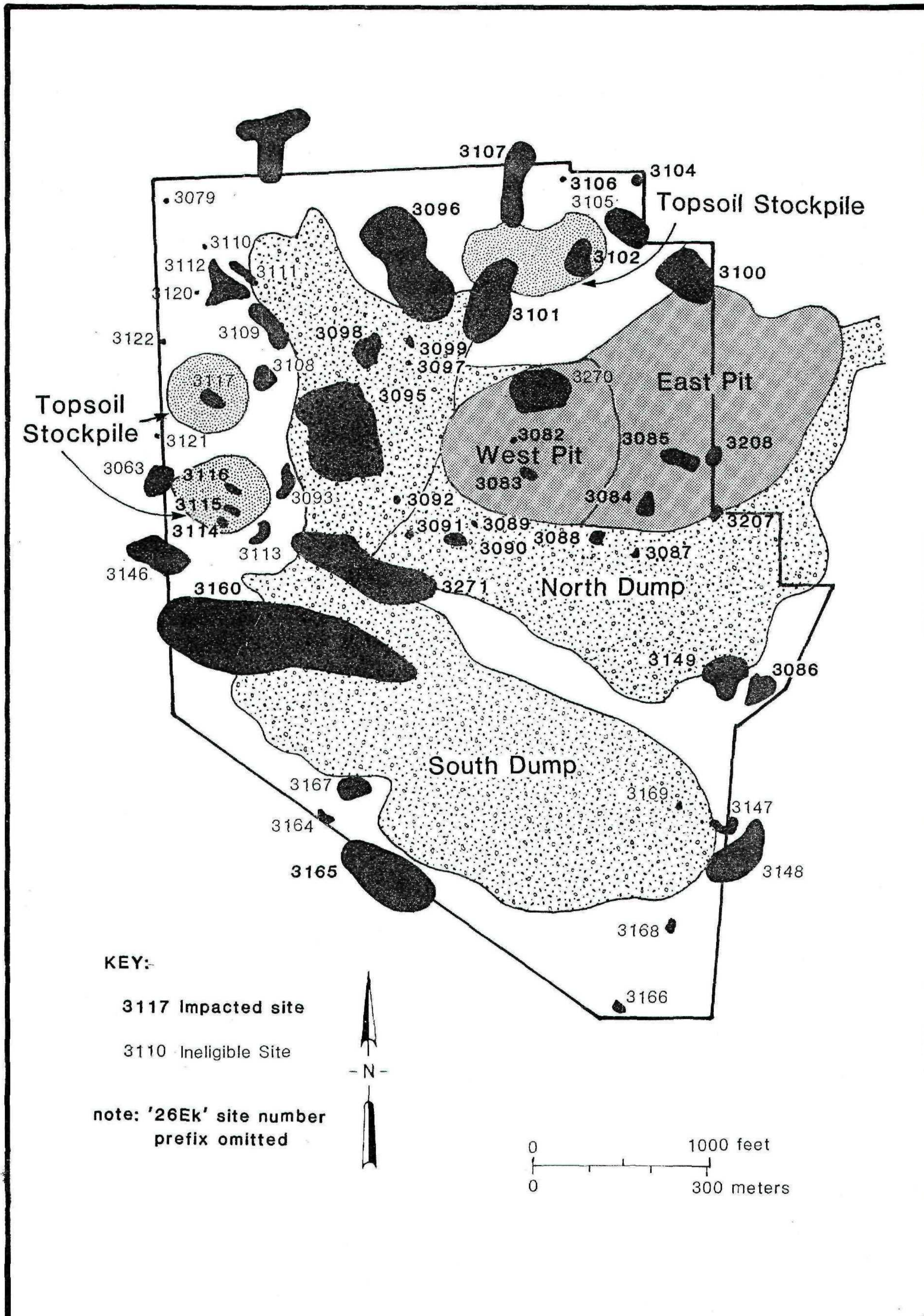
IN NEVADA

Note:

One or more pages have been removed from this part of the report due to sensitivity of specific archaeological site location information. Qualified persons may contact the Nevada Bureau of Land Management, Elko Field Office, to inquire about obtaining additional information.

Figure C. Project Design Elements and Impacted Archaeological Sites, USX-West Study Area.


3107
3104
3106
3105
3079
3096
Topsoil Stockpile
3110
3102
3112
3111
3100
3120
3101
3122
3109
3098
3099
3108
3097
3270
3117
East Pit
3095
Topsoil
Stockpile
3082
3085
3208
3121
West Pit
3063
3116
3083
3093
3092
3084
3115
3207
3091
3089
3114
3088
3090
3087
3113
3146
3160
3271
North Dump
3149
3086
South Dump
3167
3169
3147
3164
3165
3148
3168
KEY:
3117 Impacted site
3110 Ineligible Site
-N-
note: '26Ek' site number
prefix omitted
3166
0
1000 feet
0
300 meters

archaeological sites, of which 35 were determined to lie within zones that would be impacted directly by proposed project elements; 11 of these sites were determined by the survey to be ineligible for National Register consideration. Twenty-four sites subsequently became the target population for archaeological testing and evaluation, together with six additional sites (26Ek3086, 26Ek3104, 26Ek3106, 26Ek3107, 26Ek3149, and 26Ek3167) that, while not within the direct impact zones of proposed design elements, lie in such proximity to them that they seem equally at risk (cf. Table B and Figure B).

Table B
Sites Impacted by Proposed Developments, USX-West.

Design Element	Archaeological Site
East Pit	26Ek3084
	26Ek3085
	26Ek3100
	26Ek3208
West Pit	26Ek3082
	26Ek3083
North Dump	26Ek3086
	26Ek3087
	26Ek3088
	26Ek3090
	26Ek3091
	26Ek3092
	26Ek3093
	26Ek3095
	26Ek3096
	26Ek3097
	26Ek3099
	26Ek3149
	26Ek3207
	26Ek3271
South Dump	26Ek3160
	26Ek3165
Topsoil Stockpiles	26Ek3101
	26Ek3102
	26Ek3104
	26Ek3106
	26Ek3107
	26Ek3114
	26Ek3115
	26Ek3116

USX-East Study Area

Comprising about 160 acres southeast of the Tosawihi Quarries, the USX-East Study Area is proposed as the site of ore processing facilities related to the planned developments in USX-West. Principal elements of the proposal consist of an ore crusher, two leach pads, holding ponds, and a topsoil stockpile, as well as a system of leachate collection ditches and a network of access roads (Figure D). Virtually the entire surface of the study area would experience severe disturbance and, as in the USX-West study area, it is assumed that any archaeological sites lying within the disturbance boundary of the proposed facilities would suffer total destruction.

The USX-East area was surveyed in April, 1988 (Raven 1988). Approximately 160 acres were given intensive scrutiny, resulting in the recording of 37 previously unrecorded prehistoric archaeological sites. Of these, 27 would suffer direct impacts from execution of the proposed design elements. Six of the 27 were determined by survey to be ineligible for National Register consideration; therefore, 21 sites, together with six additional sites (26Ek3177, 26Ek3197, 26Ek3200, 26Ek3202, 26Ek3203, 26Ek3204) lying within 200 feet of proposed developments, constitute the evaluative and sample universe of USX-East (cf. Table C and Figure D).

Table C
Sites Impacted by Proposed Developments, USX-East.

Design Element	Archaeological Site
Crusher and Ponds	26Ek3170
Leach Pad	26Ek3171
	26Ek3172
	26Ek3173
	26Ek3179
	26Ek3181
	26Ek3182
	26Ek3183
	26Ek3184
	26Ek3185
	26Ek3188
	26Ek3189
	26Ek3190
	26Ek3191
	26Ek3192
	26Ek3193

Table C, continued.

Design Element	Archaeological Site
Future Leach Pad	26Ek3177
	26Ek3178
	26Ek3197
	26Ek3198
	26Ek3200
	26Ek3201
	26Ek3202
	26Ek3203
	26Ek3204
Topsoil Stockpiles	26Ek3195
	26Ek3196

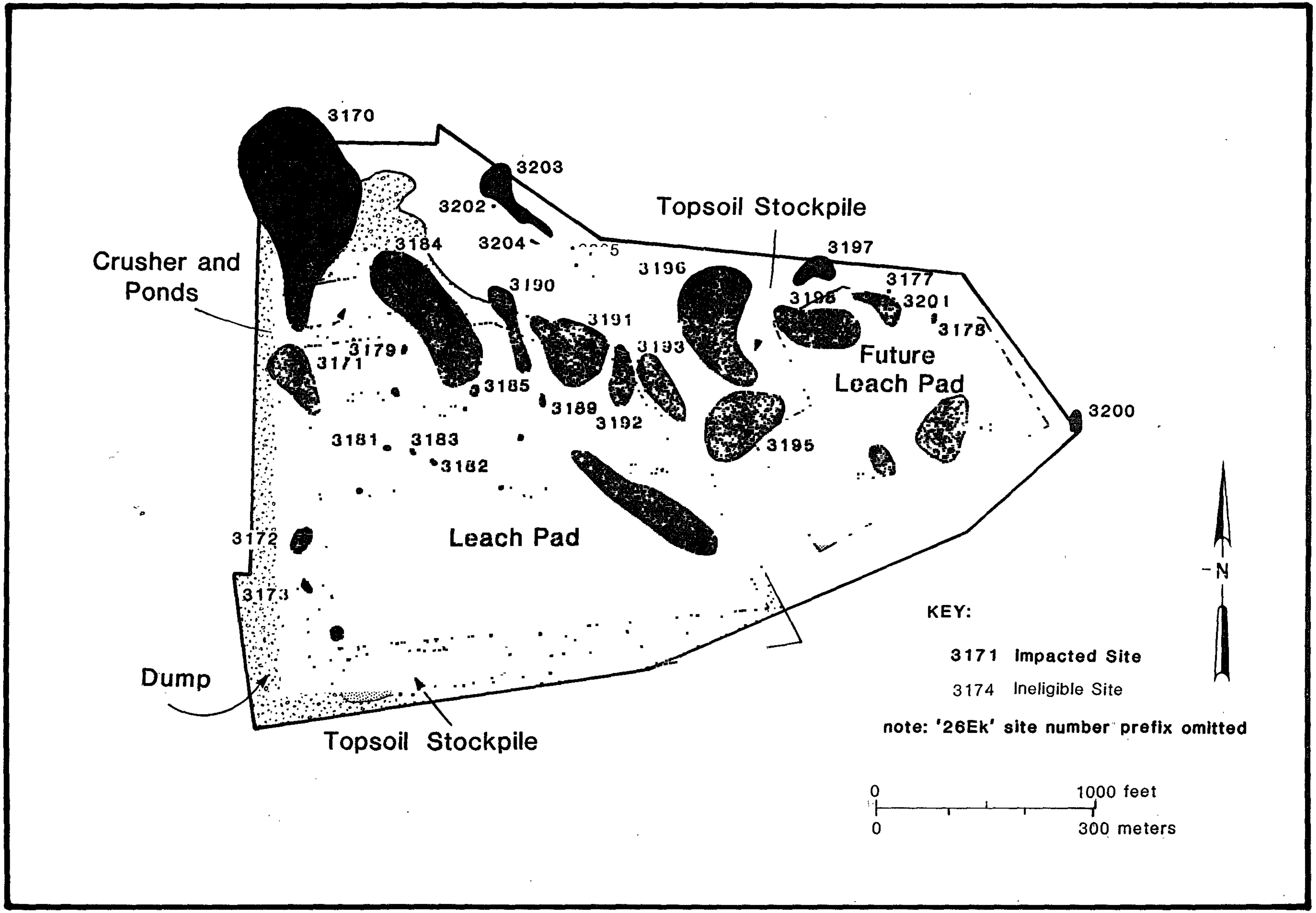
National Register Assessments of Tested Sites

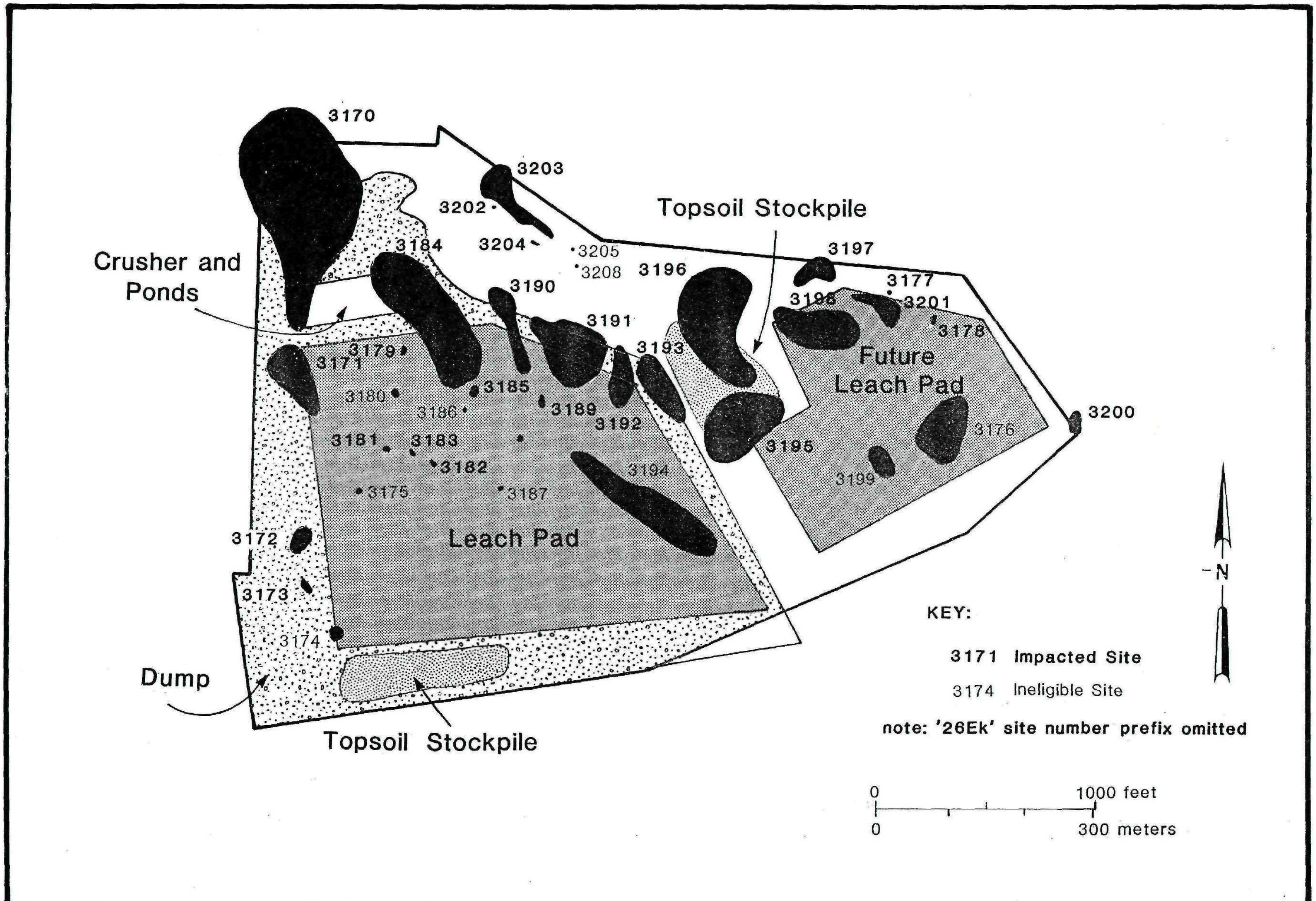
Two evaluative exercises were undertaken in each of the study areas to identify with increasingly refined information those sites most likely to merit nomination to the National Register of Historic Places. In both cases, emphasis was placed on the data content and research potential of the subject sites, on the general premise that National Register eligibility most often is conferred upon prehistoric sites exhibiting significant research potential (NPS 1982).

The first exercise was conducted immediately after the initial surveys, and the results included as components of the various survey reports (Budy 1988:44-62; Drews 1988:12-16; Raven 1988:12-18). To ensure comparability, uniform criteria of integrity and research significance were established and scores were assigned to each site in light of its performance against the criteria.

Integrity was evaluated in terms of degree of existing surface disturbance sustained within site precincts, measured by the standards expressed in Table D. Only the lowest integrity rating (score = 1) dismissed sites from further consideration for National Register eligibility; sites with higher scores were considered potentially eligible pending evaluation of their research significance.

Figure D. Project Design Elements and Impacted Archaeological Sites, USX-East Study Area.


3170
3203
3202
Topsoil Stockpile
3204
3197
Crusher and Ponds
3184
3196
3177
3190
3198
3201
3191
3178
3179
3193
Future Leach Pad
3171
3185
3189
3200
3192
3181
3183
3195
3182
3172
Leach Pad
3173
KEY:
3171 Impacted Site
3174 Ineligible Site
Dump
note: '26Ek' site number prefix omitted
Topsoil Stockpile
0 1000 feet
0 300 meters
N



3170
3203
3202
3204
3205
3208
3196
Topsoil Stockpile
3197
3177
3198
3201
3178
3184
Crusher and Ponds
3190
3191
3193
3179
3171
3180
3185
3189
3186
3192
Future Leach Pad
3200
3176
3181
3183
3182
3195
3194
3199
3175
3187
3172
Leach Pad
3173
3174
Dump
Topsoil Stockpile
N
KEY:
3171 Impacted Site
3174 Ineligible Site
note: '26Ek' site number prefix omitted
0
1000 feet
0
300 meters

Table D. Integrity Rating Scheme.

Score	Scoring Standards
1	Severely disturbed over more than 50% of of site area. Disturbance may be a result of extensive erosion, numerous roads, drill pads, minerals exploration features, bulldozer cuts, or artifact collection.
2	Moderately to heavily disturbed over less than 50 of total site area. Disturbance may be a result of erosion, roads, or minerals exploration, but significant portions of the site remain intact.
3	Discrete, areal disturbance restricted to less than 25% of total site area. Disturbance may include a road or mining exploration feature as well as slopewash and rodent turbation.
4	Essentially undisturbed. Minor disturbance may be a result of slopewash, trampling or bioturbation.

Research significance was assessed in terms of several objective measures identified by Glassow (1977); a cumulative score was tallied for each site on the basis of the quantity of cultural materials discernible, the clarity and complexity of spatial organization, and the diversity of artifact classes identified. Specific score equivalents are given in Table E.

Table E. Research Significance Rating Scheme.

RESEARCH CRITERIA	SCORE
Quantity Measures	
1-10 items/sq. m.	1
>10-100 items/sq. m.	2
>100 items/sq. m.	3
Clarity Measures	
Isolated artifact	1
Undifferentiated spacially	2
Single activity locus	3
Multiple activity loci	4
Multiple activity loci/ Possible residential features	5

Variety Measures	
Quarry Categories	
On-site opalite source	1
Quarry feature	1
Reduction Categories	
Cores	1
Stage I bifaces	1
Stage II bifaces	1
Stage III bifaces	1
Specialized Activity Measures	
Groundstone	1
Hammerstones/cobble spalls	1
Basalt Biface Reduction Debitage	1
Obsidian	1
Specialized Tools	1
	Total Score

The results of these evaluations were translated in expressions of National Register eligibility. In the USX-West and North Access Corridor Study Areas, cumulative research significance scores of 10 or greater were taken to indicate that a site was apparently eligible for nomination to the National Register, and scores of 5-9 to indicate unclear eligibility status; scores of 4 or lower were taken to signal ineligibility. Because mean significance scores for sites in the USX-East Study Area were slightly higher, eligibility standards were adjusted upward; scores of 11 or higher indicated National Register eligibility, scores of 6 or lower, ineligibility, and scores of 7-10, uncertain eligibility.

Subsequently, the selection of sites for testing was guided by the combined criteria of project impact and National Register eligibility; in each study area those sites were tested that 1) would be impacted directly by proposed design elements, and 2) were ranked as clearly eligible, or of uncertain eligibility, for the National Register. Sites lying beyond the compass of project impacts and those judged ineligible for the National Register generally were omitted from the testing program.

Testing served not only as a basis for clarifying issues of National Register eligibility, but also for designing site-specific data recovery plans. Upon the completion of testing, all entailed sites were reevaluated in the light of test data, their significance this time being assessed more specifically by their relative potential to address explicit research issues relevant to the Ivanhoe Project area (IMR 1988a).

North Access Corridor Study Area

Of the 10 affected sites in the North Access Corridor Study Area, testing confirmed the National Register eligibility of two

(26Ek3237 and 26Ek3251); all sites of which eligibility was unclear prior to testing now are regarded ineligible. Table F summarizes pre-testing and post-testing assessments.

Table F
Assessment of Archaeological Significance,
North Road Study Area.

Site	Pre-testing National Register Status	Post-testing National Register Status
26Ek3228	Unclear	Ineligible
26Ek3231	Unclear	Ineligible
26Ek3232	Unclear	Ineligible
26Ek3234	Unclear	Ineligible
26Ek3237	Eligible	Eligible
26Ek3238	Unclear	Ineligible
26Ek3239	Unclear	Ineligible
26Ek3251	Eligible	Eligible

USX-West Study Area

In the USX-West Study Area, two sites originally considered to be of National Register quality (26Ek3093 and 26Ek3271) were demoted from that eminence, the first because it had nothing particular to say about identified research issues, the second because the magnitude of disturbance that it had sustained was found to be greater than first perceived. Further, four sites the National Register eligibility of which was regarded initially to be unclear (26Ek3084, 26Ek3085, 26Ek3092, and 26Ek3208) are now seen to contain data useful for addressing various identified research issues, and thus are considered eligible for National Register consideration. Table G compares pre-testing and post-testing assessments of National Register eligibility of potentially affected sites in the study area.

Table G
Assessment of Archaeological Significance,
USX-West Study Area.

Site	Pre-testing National Register Status	Post-testing National Register Status
26Ek3082	Unclear	Ineligible
26Ek3083	Unclear	Ineligible
26Ek3084	Unclear	Eligible
26Ek3085	Unclear	Eligible
26Ek3086	Unclear	Ineligible
26Ek3087	Unclear	Ineligible
26Ek3088	Unclear	Ineligible
26Ek3090	Unclear	Ineligible
26Ek3091	Unclear	Ineligible
26Ek3092	Unclear	Eligible
26Ek3093	Eligible	Ineligible
26Ek3095	Eligible	Eligible
26Ek3096	Unclear	Ineligible
26Ek3097	Unclear	Ineligible
26Ek3099	Unclear	Ineligible
26Ek3100	Unclear	Ineligible
26Ek3101	Unclear	Ineligible
26Ek3102	Unclear	Ineligible
26Ek3104	Unclear	Ineligible
26Ek3106	Unclear	Ineligible
26Ek3107	Unclear	Ineligible
26Ek3114	Unclear	Ineligible
26Ek3115	Unclear	Ineligible
26Ek3116	Unclear	Ineligible
26Ek3149	Unclear	Ineligible
26Ek3160	Eligible	Eligible
26Ek3165	Eligible	Eligible
26Ek3207	Unclear	Ineligible
26Ek3208	Unclear	Eligible
26Ek3271	Eligible	Ineligible

USX-East Study Area

In the USX-East Study Area, four sites initially regarded to be of National Register quality (26Ek3185, 26Ek3193, 26Ek3196, and 26Ek3201) demonstrated during testing substantially less research potential than believed originally, and now are considered ineligible for National Register consideration. Additionally, 26Ek3182, believed before testing to be of unclear eligibility, was reevaluated (but not tested) in the field and judged ineligible in terms of both research significance and integrity. No sites were found in testing to be eligible for National Register consideration that were not so regarded before testing was undertaken. Table H summarizes pre-testing and post-testing perceptions of National Register eligibility in the study area.

Table H
Assessment of Archaeological Significance,
USX-East Study Area.

Site	Pre-testing National Register Status	Post-testing National Register Status
26Ek3170	Eligible	Eligible
26Ek3171	Eligible	Eligible
26Ek3172	Unclear	Ineligible
26Ek3173	Unclear	Ineligible
26Ek3177	Unclear	Ineligible
26Ek3178	Unclear	Ineligible
26Ek3179	Unclear	Ineligible
26Ek3181	Unclear	Ineligible
26Ek3182	*Unclear*	*Reevaluated ineligible*
26Ek3183	Unclear	Ineligible
26Ek3184	Eligible	Eligible
26Ek3185	Eligible	Ineligible
26Ek3188	Unclear	Ineligible
26Ek3189	Unclear	Ineligible
26Ek3190	Unclear	Ineligible
26Ek3191	Unclear	Ineligible
26Ek3192	Eligible	Eligible
26Ek3193	Eligible	Ineligible
26Ek3195	Eligible	Eligible
26Ek3196	Eligible	Ineligible
26Ek3197	Eligible	Ineligible
26Ek3198	Eligible	Eligible
26Ek3200	Eligible	Eligible
26Ek3201	Eligible	Ineligible
26Ek3202	Unclear	Ineligible
26Ek3203	Unclear	Ineligible
26Ek3204	Eligible	Eligible

Additional to those discussed above, 5 sites (26Ek3174, 26Ek3175, 26Ek3180, 26Ek3186, and 26Ek3187), regarded from the first to be ineligible for National Register consideration, were investigated in the interest of defining the range of variation in the study area. The effort served to aid in assessment of the significance of other sites in the area. Results of the investigations are discussed in the present volume.

Summary

In summary, investigations of 65 sites discussed in this volume found 17 sites, all of them prehistoric, eligible for nomination to the National Register of Historic Places. Of those, all (7 in USX-West, 8 in USX-East, and 2 in the North Access Corridor) would be affected adversely by consummation of the proposed action. Accordingly, impact mitigation in the form of data recovery is recommended for each of them.

ABSTRACT

The Tosawihi Quarries constitute the largest, most intensively exploited, and probably longest-visited prehistoric chert toolstone sources currently known in the Great Basin. Preliminary investigations have involved the archaeological testing of 65 sites peripheral to the heart of the quarries, inquiring about the nature of quarrying, its implications for an archaeological record, and the particular manifestations of that record at Tosawihi. A suite of research questions guided the inquiry, the goal of which was to identify fruitful lines of investigation regarding chronology, paleoenvironmental circumstances, site structure and formation processes, variability in site function and assemblage composition, and the implications of all these for understanding the economic and strategic organization of lithic procurement.

Evidence for clearly reconstructable sequences of environmental change so far remains equivocal, although tephrachronology and faunal assemblages may provide important keys. The broad outlines of a cultural chronology, however, are better understood; time-sensitive artifacts (projectile points and ceramics) suggest that the quarries have been visited repeatedly over the past 8000 years, with an apparent intensification of use during Rosegate and Desert times. Radiocarbon assay of charcoal from quarry pits will allow refinement of the chronology, and will permit finer-grained inquiry into temporal differences in the intensity of quarrying.

Structural observations segregate quarrying features, reduction loci, and residential complexes as distinct classes of site also differentiated by assemblage composition, diversity, and inferred function; assemblage composition, especially, is conditioned strongly by distance from toolstone source. Guided by the results of testing, further inquiry into the spatial, temporal, technological, and functional differences in units of the archaeological record should clarify salient details of the organization of lithic procurement at Tosawihi, and should pose models of more universal applicability.

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This project required the efforts of many. Dr. Robert G. Elston, who served as principal investigator, developed the overall research design for the project. Testing strategies were designed by Dr. Elizabeth E. Budy and Dr. Christopher Raven.

Budy and Raven directed field operations in the USX-West and USX-East project areas, respectively. William Bloomer and Margaret Brown were crew chiefs for the USX-West team and Dave N. Schmitt was crew chief for the USX-East team. Schmitt directed field work at the North Access Road sites and at several sites in USX-West. Trained by Michael P. Drews, Kenneth E. Juell and W. Troy Tucker performed all total station mapping. Major stratigraphic profiles in USX-East and USX-West were drawn by Elston with the assistance of Brown and Susan Stornetta.

The field kitchen was presided over by camp chef Mr. Jimmy Olsen, assisted by Hilliard Ross. Administrative support of the field effort was provided by Roz Works. Field crew members included Meg Burns, Christopher Carembelas, Fred Crisson, Lynn Furnis, Ellen Glassmeyer, Bruce Gothar, Ross Rechiskey, Susan Stornetta, and David Zeanah. Processing and cataloging were performed by Michael Clerico, Bill Germino, Shelly Raven, Susan Stornetta, and Mary Works, under the supervision of Lynn Furnis. Processing was assisted for a time by Burns, Crisson, and Glassmeyer.

Elizabeth Budy authored descriptions of the USX-West project area and sites therein; Dave Schmitt prepared descriptions of the North Access Corridor area and sites within it. Steven G. Botkin undertook authorship of the USX-East area and site descriptions. Hand-drafted and computer-generated maps were produced by Michael Drews. Shelly Raven, assisted by Charles D. Zeier, provided computer data summaries and statistics. Artifact photographs were made by Bill Germino and Elizabeth Budy. Analysis of flaked stone artifacts was performed by Bloomer, Furnis and S. Raven, under the direction of Elston; projectile points were analyzed by Michael Drews. Faunal remains and ground stone were analyzed by Dave Schmitt; Schmitt was assisted by Ken Juell during ceramic analysis. The concluding chapter of the report is the joint effort of Drews, Elston, Schmitt, and Dr. Melinda Leach. Word processing and report production were performed by Katherine Nickerson. The manuscript was edited by Robert Elston and Cashion Callaway, with assistance from C. Raven.

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Special thanks are extended to Jim O'Connell, Duncan Metcalf, Dave Thomas, and Lori Pendleton for taking the time to visit the project.

PREFACE

The present report is the product of archaeological testing at 65 prehistoric sites in the vicinity of the Tosawihi Quarries, Elko County, Nevada. The work followed initial campaigns of archaeological survey, recording, and evaluation, during the course of which a suite of theoretical and regional research issues was developed to guide the conduct of multi-phased research at Tosawihi and its peripheries. These research issues formed the bases for phrasing testing strategies, assessing the research potential of each site, and, ultimately, designing plans for data recovery at a subset of the sites tested.

Intermediate between site recognition and data recovery, archaeological testing is largely an evaluative exercise. In the case of the work reported here, our intent was to weigh the value of each site in terms of its potential clarification of identified research issues, and to provide a framework within which the answers to lingering questions might be sought. Emphatically, our intent was not to resolve research issues and report conclusions, but rather to lay a descriptive foundation upon which, through data recovery, we might build to that goal.

There is, accordingly, much description and analysis of data here, but little synthesis. That is because we believe synthesis to be premature at this stage of reporting, more logically deferred until final results are in hand and we are able to address how well our questions have been answered. And although these pages were still being composed while data recovery was underway, the logic of the later exercise was dictated entirely by what testing had disclosed and what is reported here. Our final synthesis, then, awaits the consummation of data recovery, when we can return, better informed, to the research issues that have motivated our inquiry.

Part I. Introductory Information

Part I is intended to provide the reader with an overview of the natural and cultural settings of the three project areas considered herein, and with the goals and methods of the testing program.

Chapter 1. INTRODUCTION

by Elizabeth E. Budy, Robert G. Elston, and Christopher Raven

Minerals exploration is being conducted and extraction is planned in the Ivanhoe Mining District, Elko County, Nevada (Figure 1), in the vicinity of archaeological site 26Ek3032, the Tosawihi Quarries (Figure 2). In connection with proposed mining development, archaeological site inventories were made in two areas adjacent the Tosawihi Quarries (Budy 1988; Raven 1988) and along a proposed access road corridor extending from the northern boundary of the Quarries to Willow Creek (Drews 1988). These areas are referred to hereafter as USX-West, USX-East, and the North Access Corridor (Figure 3).

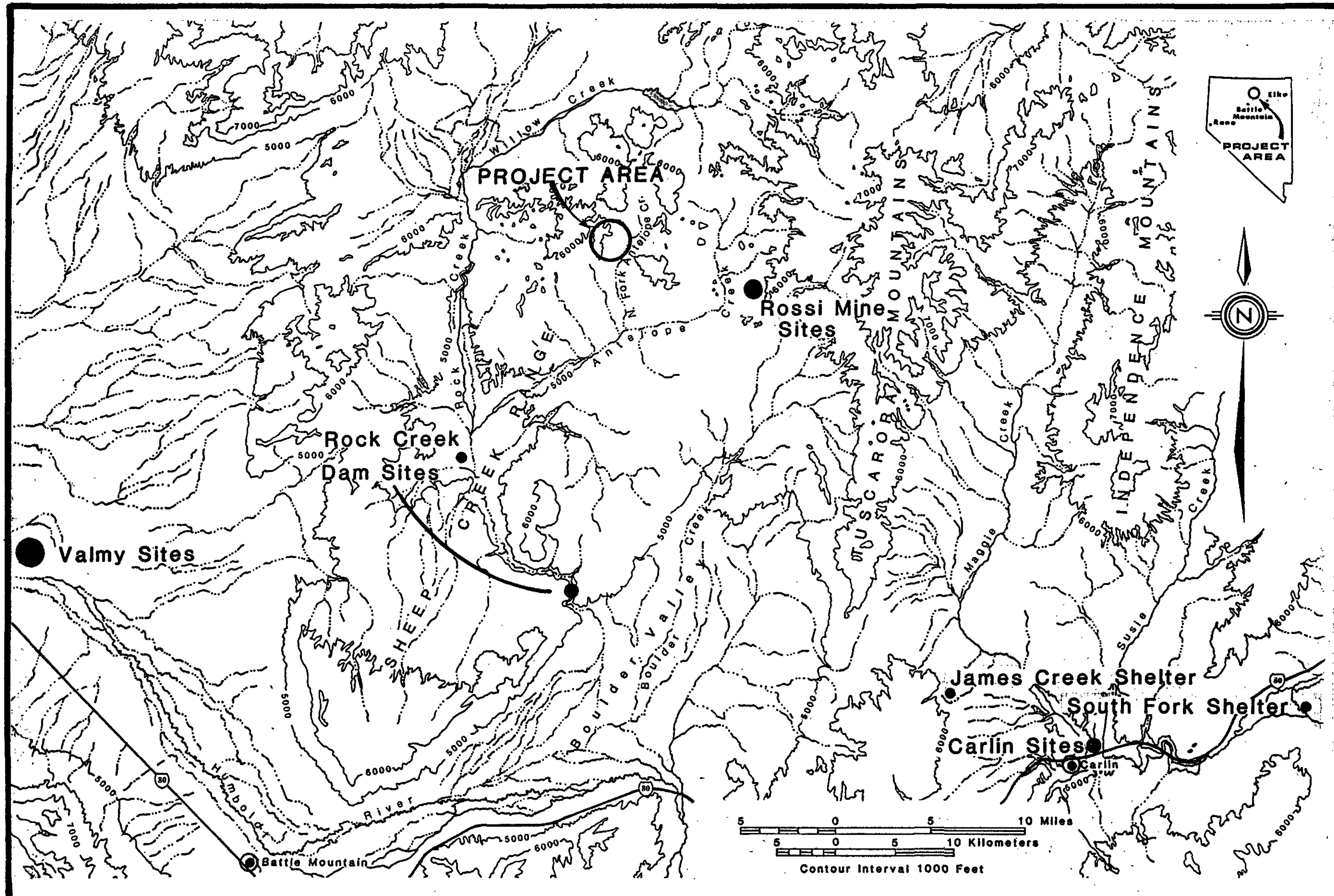
The North Access Corridor covers a linear road alignment extending from the northern boundary of the Tosawihi Quarries Site 26Ek3032, thence along Ivanhoe Creek, to Willow Creek which forms the northern terminus. A total of 28 archaeological sites, 3 of them historic and 25 prehistoric, have been recorded along the route (Drews 1988); 8 of these were the subject of the present testing program. The USX-West project area is adjacent the Tosawihi Quarries on the southwest. A total of 152 prehistoric sites were recorded here during initial survey (Budy 1988), 30 of which were tested and the results reported herein. The USX-East project area lies adjacent the Tosawihi Quarries on the east. Thirty-seven sites were recorded by survey of this area (Raven 1988) and 27 of them were tested.

The present report details the findings of the testing program, and evaluates the research significance of each site. The report is divided into five parts. Part I introduces the project, describes the natural and cultural setting, outlines a theoretical approach, and discusses research methods. Part II describes artifact classes used throughout the report. Parts III, IV, and V describe testing results from the North Access Corridor, USX-West, and USX-East, respectively. Part VI presents conclusions; statements of National Register eligibility and assessments of project effects on tested sites preface this report.

Natural Setting

The project areas occupy a rocky, gently undulating expanse lying at the junction of the Sheep Creek Range and the southwestern foothills of the Tuscarora Mountains. Moderately dissected by currently seasonal drainages, landforms in the area clearly have been considerably eroded since their formation, although there is little evidence of high-energy runoff or deposition. Measured against local vertical relief, the area constitutes a mid-to-upland zone transitional between nearby ecologically distinct milieus; encompassing elevations from 5500

Figure 1. Project vicinity map.



PROJECT AREA
Rossi Mine Sites
Rock Creek Dam Sites
Valmy Sites
James Creek Shelter
South Fork Shelter
Carlin Sites
Carlin
Battle Mountain
Willow Creek
Antelope
N. Fork Antelope Cr.
Rock Creek
SHEEP CREEK RANGE
TUSCARORA MOUNTAINS
INDEPENDENCE MOUNTAINS
Boulder Valley
Boulder Creek
Maggie Creek
Susie Creek
Humboldt River
Elko
Battle Mountain
Reno
PROJECT AREA
5 0 5 10 Miles
5 0 5 10 Kilometers
Contour Interval 1000 Feet

Figure 2. Location of 26Ek3032, the Tosawihi Quarries.

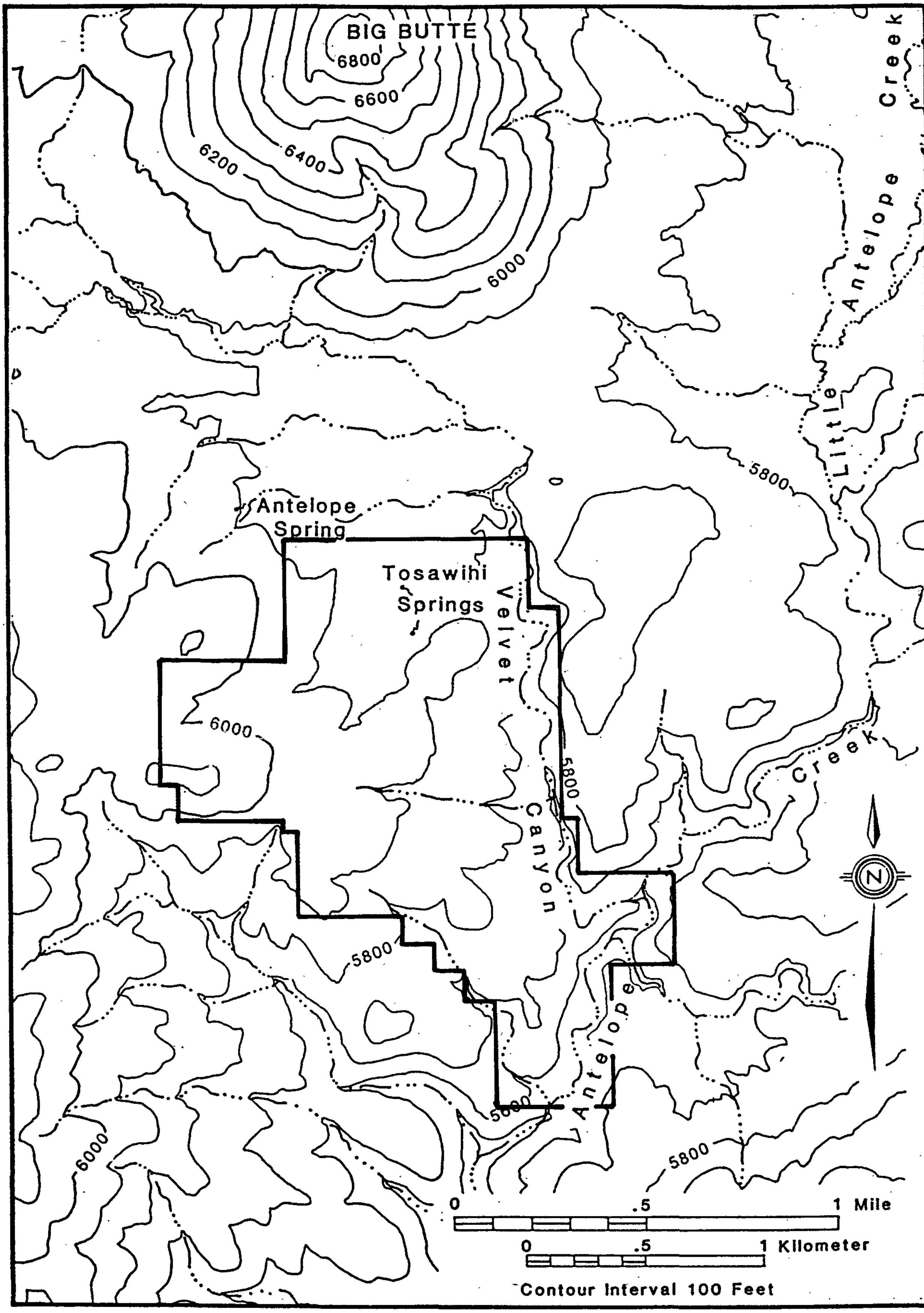
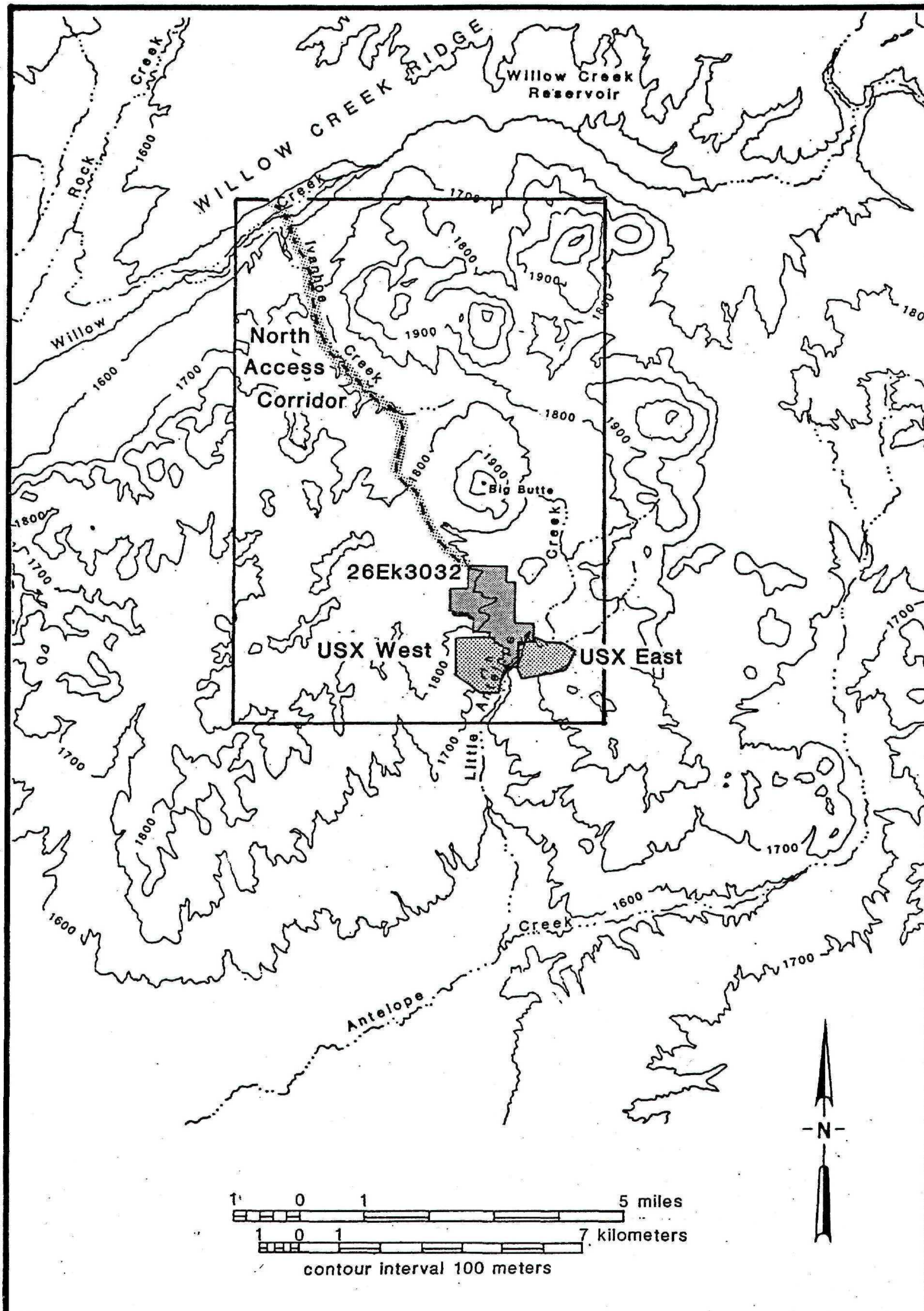

BIG BUTTE
6800
6600
6400
6200
6000
Little Antelope Creek
5800
Antelope Spring
Tosawihi Springs
Velvet Canyon
6000
5800
Creek
N
5800
Antelope
5800
6000
5800
0 .5 1 Mile
0 .5 1 Kilometer
Contour Interval 100 Feet

Figure 3. Study areas relative to site 26Ek3032.



WILLOW CREEK RIDGE
Willow Creek Reservoir
Rock Creek
Willow Creek
Willow
Ivanhoe Creek
North Access Corridor
Big Butte
Creek
26Ek3032
USX West
USX East
Little Antelope
Antelope Creek
1600
1700
1800
1900
N
1 0 1 5 miles
1 0 1 7 kilometers
contour interval 100 meters

to 6100 feet amsl, it stands some 700 feet above the extensive plains that flank it to the west and south, and some 1900 feet below the peaks of the Tuscarora Range 12-15 miles to the east. Intermediate between two more extensive ecozones, the study areas host a biotic mosaic composed largely of communities and species more dominant in neighboring settings.

Geology

The chief component of archaeological concern centers on the extensive opalite formations in the Tosawihi Quarries and which outcrop here and there in each of the three study areas. The opalite, the extraction and reduction of which focuses prehistoric use of the area, is described relative to historic mercury mining in the area (Bailey and Phoenix 1944) and in the context of earlier stages of Tosawihi archaeological investigations (Duffe' 1976a, b). The formation is the product of late Miocene or early Pliocene silicification of volcanic rocks and sediments (rhyolitic ash, tuffs, obsidian, and rhyolite) induced by a series of hydrothermal episodes. Permeation of the matrices by silica-rich solutions along fissures and bedding planes resulted in localized deposits of opalite that subsequent millenia of dehydration and crystallization have transformed into a chert-like group of cryptocrystallines (Bailey and Phoenix 1944:17-21). Minimal internal structure and relative homogeneity lent the material desirability as prehistoric toolstone; the entrapment of cinnabar in its upper members rendered it historically desirable as a source of mineable mercury ore.

The other principal surface geologic unit consists of andesitic basalt that outcrops in the red hills on the southwest. Large basalt cobbles were transported prehistorically from the area to the Tosawihi Quarries where they served as hammerstones and provided raw materials for projectiles and digging tools; tabular pieces provided seed grinding surfaces and abraders for percussion tools.

Hydrology

Surface water is a fugitive resource in the Tosawihi vicinity. Although contributing eventually to the flow of the Humboldt River and flanked at lower elevations on the north and west by major perennial streams, the area experiences rapid runoff and seasonally depleted aquifers. Willow Creek is a perennial stream located at the north end of the North Access Corridor; Ivanhoe Creek, fed by three springs, is an ephemeral tributary to it. On the southwest and southeast, the terrain is severely dissected and narrow ephemeral drainages descend to the canyon of Little Antelope Creek. During storm episodes, the seasonal streams of the canyons probably are fed as much by direct slope-wash as they are by the contribution of the numerous minor tributaries.

Vegetation

Vegetation is an expression of the Artemesian biotic province characteristic of the high desert valleys and lower foothills of the northern Great Basin (Billings 1951:110-113; Cronquist et al. 1972:122-125). Several local communities are found in the area; their distribution is related primarily to variation in soil depth and effective soil moisture. To facilitate reference throughout this report, genus and species are provided here while common names are used elsewhere in the document (Table 1).

Table 1. Key to Scientific Plant Names.

Common Name	Scientific Name
big sagebrush	*Artemisia tridentata*
bitterroot	*Lewisia rediviva*
bitterroot (pygmy)	*L. pygmaea*
buckwheat	*Eriogonum* spp.
cheatgrass	*Bromus Tectorum*
chokecherry	*Prunus virginiana*
death camas	*Zygadensus venenosos*
fiddleneck	*Amsinckia* sp.
gooseberry	*Ribes* sp.
Great Basin wild rye	*Elymus cinereus*
horsebrush	*Tetradymia* sp.
Idaho fescue	*Festuca idahoensis*
larkspur	*Delphinium nuttallianum*
linear-leafed paintbrush	*Castilleya linariaefolia*
locoweed	*Astragalus* spp.
low sage	*Artemisia arbuscula*
nutgrass	*Carex* sp.
onion	*Allium* sp.
phlox	*Phlox* spp.
rabbitbrush	*Chrysothamnus viscidiflorus*
rock basalm	*Balsamorhiza hookeri*
sage (other)	*Artemisia ludoviciana*
scarlet gilia	*Gilia aggregata*
sego lily	*Calochortus nuttallii*
serviceberry	*Amelanchier alnifolia*
silky lupine	*Lupinus sericeus*
squirrel tail grass	*Sitanion hystrix*
tumble mustard	*Brassica nigra*
wheat grass	*Agropyron* spp.
wild rose	*Rosa* sp.
willow	*Salix* sp.
white yarrow	*Achillea millefolium*
wiregrass	*Juncus* sp.

Occupying much of the silty bottomlands and other areas of deeper soils, and semi-shadowed northern exposures, is a community dominated by big sage and rabbitbrush in the shrub component, and by Great Basin wildrye and bluebunch wheatgrass in the grass component. On the other hand, thin-soiled settings such as knoll-tops, cobble fields, and washes where seasonal drainage has continuously inhibited soil development, tend to be occupied by a community composed chiefly of low sage, phlox, and the grasses squirreltail and Idaho fescue. Forbs common to the big sage communities include buckwheats, lupine, onion, balsam, paintbrush, larkspur, and scarlet gilia. Rocky ridgetops host bitterroot, sego lily, and onion; all provide edible tubers.

Microenvironmental anomalies support sporadic appearances of species related to other communities, but their prevalence is always dominated by the area's two principal assemblages. Thus the bottoms of gorges are prone to sparse stands of wild rose; the bases of rims often shadow clumps of gooseberry, chokecherry, or service berry; brief strings of willow, occasionally supporting wiregrass or nutgrass, cluster along the moistest of stream channels. Several other plants are common on disturbed sites, including tumble mustard, thistle, fiddleneck, and cheat grass.

Wildlife

Animals observed in the project areas include coyote, cottontail rabbit, and chipmunk. Big sagebrush thickets, and deeper soils, often contain badger burrows and ground squirrel colonies. Antelope were noted during an earlier survey (Elston et al. 1987:8), and mule deer are likely seasonal visitors. Archaeological sediments have yielded bones from big horn sheep, antelope, and bison. Common names, used throughout this report, are keyed to scientific terms in Table 2.

Except for ground squirrel, animals were not observed in abundance during the field exercise, although those species noted suggest broader patterns characteristic of other settings. Commensurate with other mid-to-upland zones, antelope probably are attracted to the area from the valley bottoms in spring when forbs are most plentiful and water sources most reliable. Mule deer also are likely to be seasonal visitors, their presence in the area limited by the availability of forage and water.

In high valley/foothill settings such as the Tosawihi vicinity, the upper Sonoran life zone (Merriam 1898) hosts as well kit foxes, marmots, jackrabbits, and wood rats. Numerous of the mammalian species listed by Hall (1946) as typical of the zone, particularly several species of rodents, are probably present but went unnoticed.

Species of birds likely to inhabit the area are discussed by Linsdale (1936), reptiles by Stebbins (1966), and fish by LaRivers (1962). None of these phyla was given significant scrutiny during the archaeological investigations.

Table 2. Key to Scientific Names of Animals

Common Name	Scientific Name
antelope	Antilocarpa americana
bighorn sheep	Ovis canadensis
badger	Taxidea taxus
bison	Bison bison
bushy-tailed wood rat	Neotoma cinerea
chipmunk	Eutamias spp.
cottontail rabbit	Sylvilagus nuttallii
coyote	Canis latrans
ground squirrel	Spermophilus cf. richardsonii
jackrabbit	Lepus spp.
kit fox	Vulpes macrotis
marmot	Marmota flaviventris
mule deer	Odocoileus hemionus
pocket gopher	Thomomys spp.
pygmy rabbit	Sylvilagus idahoensis
vole	Microtus sp.

Cultural Setting

A summary of ethnographic patterns, cultural chronology, and previous archaeological research in the region is provided by Elston et al. (1987). The discussions which follow highlight selected cultural background information and guide the reader to relevant literature sources.

Ethnography

The project area constitutes a portion of the foraging territory used by the ethnographic Tosawihi, or "White Knife," Shoshoni whose winter settlements were centered along the Humboldt River in the vicinity of present day Battle Mountain (Steward 1938). The group name refers to a locally available white toolstone (Steward 1938:162), most certainly the Tosawihi Quarries opalite. Ethnographic sources include Steward (1937, 1938, 1939, 1941), Harris (1940), and Powell and Ingalls (1874), but they record little ethnographic data concerning the mechanisms of opalite procurement, transport and trade, or relationships to Shoshoni settlement and subsistence. These questions are the focus of previous archaeological studies in the vicinity, as described below.

Previous Archaeological Research

The archaeology of the project area is tied closely to inquiry into the exploitation and manipulation of opalite toolstone from the Tosawihi Quarries. Though the significance of the Quarries has been known for some time (cf. Steward 1938), research has been limited and present understanding is preliminary.

Investigation of the Tosawihi Quarries was initiated by Mary Rusco in the 1970s. Initial research focused on chemical as well as macroscopic physical characterization of Tosawihi opalites and on the distribution of apparent Tosawihi material in sites outside the quarry source, in light of gravity models and ethnic boundaries (Rusco 1976a, 1976b, 1978, 1979, 1983). X-ray fluorescence methods for chemical characterization so far have proven equivocal (Duffe' 1976a, 1976b), but other approaches are being contemplated (Mary Rusco, personal communication 1987).

Identification of the nature and distribution of lithic materials derived from the Tosawihi Quarries has been addressed by subsequent research at archaeological sites 50 to 90 km east of the quarry source: at South Fork Shelter (Heizer et al. 1968; Spencer et al. 1987:72), at James Creek Shelter (Elston and Budy 1989), and at sites near Carlin (Rusco, Davis, and Jensen 1979) and along Susie Creek (Armentrout and Hanes 1986).

Investigations at five late prehistoric sites at a proposed Rock Creek Dam location, about 30 km southwest of the project area, indicate that reduction of Tosawihi opalite bifaces was a primary activity there; it has been inferred that the material was taken to the sites in the form of Stage II or Stage III bifaces (Clay and Hemphill 1986). Tosawihi opalite was also the dominant toolstone material present at seven sites investigated near the Rossi Mines, located about 10 km east of the Tosawihi Quarries (Rusco 1982); there, projectile points suggest a possible time depth of 8500 years.

The most intensive archaeological investigations to have been undertaken in the region were in connection with development of the Valmy power plant some 50 km southwest of the Tosawihi Quarries; studies included preliminary surveys (Bard 1980; Busby and Bard 1979; Rusco and Seelinger 1974) and intensive surface collections and test excavations at several sites near Treaty Hill (Davis et al. 1976; Rusco and Davis 1979; Elston et al. 1981). These investigations indicate human use of the area over the past 7000 years, with Tosawihi opalite composing the dominant toolstone at the sites studied.

An intensive reconnaissance of the 823 acre Tosawihi Quarries Study Area recently was conducted by Elston et al. (1987). The study recorded 219 prehistoric localities: isolated artifacts, discrete clusters of artifacts, rockshelters, open residential localities, and quarry-related localities (isolated quarry pits, quarry pit complexes, outcrop quarries, adits, and surface cobble quarries). Survey of the USX-West project area is reported by Budy (1988), of USX-East by Raven (1988), and along the North Access Corridor by Drews (1988).

Cultural Chronology

Syntheses of the regional cultural chronology are available in James (1981), Rusco (1982), Smith et al. (1983), and Elston (1986a); Figure 4 compares regional cultural sequences. A sequence proposed for the upper Humboldt, based on recent excavations at James Creek Shelter (Elston and Budy 1990), 50 km southeast of the project area, is outlined below.

Dry Gulch Phase: ? - 6000 B.C.

Diagnostic artifacts for the earliest known phase for the upper Humboldt include large, concave-base projectile points, Great Basin Stemmed points, flaked stone crescents, heavy core tools, scrapers, and choppers. Originally defined as a lacustrine adaptation, or the Western Pluvial Lakes Tradition (Bedwell 1973), presently it is recognized in riparian and upland settings as well. Regarded as Pre-Archaic in the broader sequence of Great Basin adaptations (Elston 1982), the phase is characterized by a distinctive lithic technology, lack of seed grinding implements, and a high degree of residential mobility. Artifacts diagnostic of the phase have been noted at Valmy (Elston et al. 1981), Susie Creek (Armentrout and Hanes 1986), Rye Patch Reservoir (Rusco and Davis 1987), and at the Tosawihi Quarries (Elston et al. 1987).

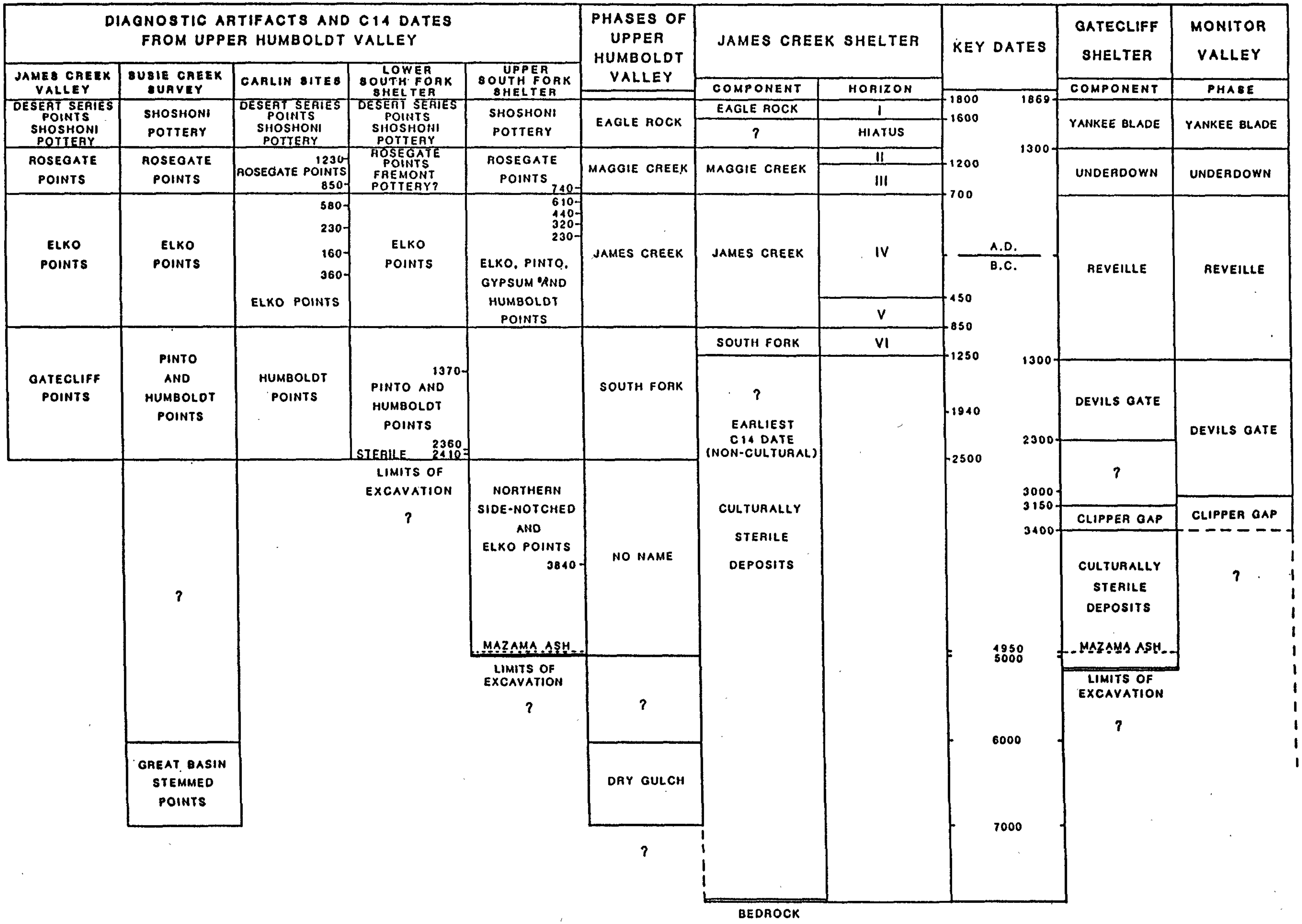
No Name Phase: 5000-2500 B.C.

The emergence of the Early Archaic adaptation in the upper Humboldt River drainage is marked by Northern Side-notched and Humboldt Series projectile points (Heizer and Hester 1973; Thomas 1981, 1983). Elsewhere in the Great Basin, Early Archaic adaptations reflect the inception of intensified seed use, increased locational diversity in land-use patterns, probable increase in breadth of diet, and logistical structuring of subsistence pursuits. In the upper Humboldt, few sites of this time period have been observed (Elston and Budy 1990).

South Fork Phase: 2500-850 B.C.

The Middle Archaic adaptation on the upper Humboldt is not well characterized by existing data; however, Humboldt and Gatecliff Series projectile points are considered diagnostic (Elston and Budy 1990).

Figure 4. Prehistoric chronology for the upper Humboldt Valley, Nevada (after Elston et al. 1987:Figure 2.2).


DIAGNOSTIC ARTIFACTS AND C14 DATES FROM UPPER HUMBOLDT VALLEY
JAMES CREEK VALLEY
SUSIE CREEK SURVEY
CARLIN SITES
LOWER SOUTH FORK SHELTER
UPPER SOUTH FORK SHELTER
PHASES OF UPPER HUMBOLDT VALLEY
JAMES CREEK SHELTER
COMPONENT
HORIZON
KEY DATES
GATECLIFF SHELTER
COMPONENT
MONITOR VALLEY
PHASE
DESERT SERIES POINTS SHOSHONI POTTERY
SHOSHONI POTTERY
DESERT SERIES POINTS SHOSHONI POTTERY
DESERT SERIES POINTS SHOSHONI POTTERY
SHOSHONI POTTERY
EAGLE ROCK
EAGLE ROCK
I
?
HIATUS
1800
1600
1869
1300
YANKEE BLADE
YANKEE BLADE
ROSEGATE POINTS
ROSEGATE POINTS
1230
ROSEGATE POINTS
850
ROSEGATE POINTS FREMONT POTTERY?
ROSEGATE POINTS
740
MAGGIE CREEK
MAGGIE CREEK
II
III
1200
700
UNDERDOWN
UNDERDOWN
580
230
160
360
610
440
320
230
ELKO POINTS
ELKO POINTS
ELKO POINTS
ELKO POINTS
ELKO, PINTO, GYPSUM AND HUMBOLDT POINTS
JAMES CREEK
JAMES CREEK
IV
A.D.
B.C.
REVEILLE
REVEILLE
450
V
850
SOUTH FORK
VI
1250
1300
GATECLIFF POINTS
PINTO AND HUMBOLDT POINTS
HUMBOLDT POINTS
1370
PINTO AND HUMBOLDT POINTS
STERILE
2360
2410
SOUTH FORK
?
EARLIEST C14 DATE (NON-CULTURAL)
1940
2500
DEVILS GATE
DEVILS GATE
2300
LIMITS OF EXCAVATION
?
NORTHERN SIDE-NOTCHED AND ELKO POINTS
3840
NO NAME
CULTURALLY STERILE DEPOSITS
?
3000
3150
CLIPPER GAP
CLIPPER GAP
3400
CULTURALLY STERILE DEPOSITS
?
?
MAZAMA ASH
LIMITS OF EXCAVATION
?
?
4950
5000
MAZAMA ASH
LIMITS OF EXCAVATION
?
6000
GREAT BASIN STEMMED POINTS
DRY GULCH
7000
?
BEDROCK

James Creek Phase: 850 B.C.-A.D. 700

This phase marks the full expression of the Archaic adaptation. Elko Series projectile points are the principal phase-markers, and their distribution indicates the exploitation of an extremely wide range of settings and resources, a marked broadening of the prey-base, and a more eclectic use of the environment.

Maggie Creek Phase: A.D. 700-1300

At James Creek Shelter, this phase is characterized by further intensification of plant exploitation, increased pursuit of small game, and introduction of the bow and arrow. Rosegate Series projectile points (and Fremont Grayware ceramics in the eastern Great Basin) are diagnostic.

Eagle Rock Phase: A.D. 1300 to protohistoric times

The phase apparently represents the archaeological record of the Numic peoples who occupied the area at historic contact. Along the upper Humboldt, the phase is marked by Desert Series projectile points (Desert Side-notched and Cottonwood), and by Shoshone Brownware ceramics (Elston and Budy 1990).

History

The project area is located in the historic Ivanhoe Mining District (Bailey and Phoenix 1944:17-21). Mercury ore was discovered in 1911, but development, north of the project area at the Clementine, Butte, and Velvet workings, dates from about 1929 (Zeier 1987:6). Mining continued intermittently through the 1940s, with most production generated by the Butte Quicksilver Mine. Mercury mining increased with the advent of World War II and lasted, at least intermittently, until 1947. Mining saw a brief resurgence between 1957 and 1962, and again in 1966, most likely in response to increased international mercury prices (Zeier 1987:6). In 1979, exploratory drilling for other mineral resources was initiated in the area. Gold associated with the local opalite formation and deposits at Red Hill motivates the present proposed mining developments.

Chapter 2. RESEARCH APPROACH

by Elizabeth E. Budy, Robert G. Elston, and Christopher Raven

This chapter opens with a discussion of relevant research issues. We first review the literature of prehistoric North American quarries to provide an overall context for the Tosawihi Quarries study, and then outline a theoretical perspective for the archaeological study of Tosawihi Quarries wherein toolstone supply and demand are linked to mobility in settlement and subsistence strategies. Subsequent sections focus more narrowly on particular research topics and appropriate investigative strategies. As well, we identify criteria that measure the potential of a site to inform with regard to the a particular research issue. In the second part of the chapter, field and laboratory methods are described.

Theoretical Concerns

Archaeological research issues relevant to the Tosawihi Quarries and vicinity have been identified by Elston 1988. The ability of any particular site to address any particular issue depends on site function, position in the landscape, access to water, depositional environment, and proximity to sources of toolstone. These factors vary considerably among Tosawihi Quarries and areas peripheral to it. Similarly, there is considerable variation among these factors from one peripheral area to another. Thus, the archaeological records of USX-East, USX-West, and the Access Road Corridor were expected to reflect research domains and topics unequally.

Lithic Quarry Studies

Interest in prehistoric lithic quarries has a long history in North American archaeology (cf. Holmes 1919; Honea 1983 and references; Ahler 1986a:1). In the last decade or so, increased interest in lithic quarries and workshops has resulted from the attention now accorded to adaptive cultural processes, including the procurement and use of toolstone in subsistence systems and in trade (cf. Butler and May 1984; Davis 1978; Ericson and Earle 1982; Ericson and Purdy 1984; Plew et al. 1985; Vehik 1985a; Wright 1977).

Great Basin quarries have long been noted (cf. Botti 1976; Davis 1964; Elston and Turner 1968; Grosscup 1956; Harrington 1951; Meighan 1955; Pippin 1980), but, until recently, little studied. Although analysis of lithic tools and manufacturing waste are increasingly foci of Great Basin archaeological studies (for central Nevada, see Drews and Clerico 1985; Elston et al. 1981; Novick 1987; Rusco and Davis 1987; Stearns and

Matranga 1984; Thomas 1983; Zeier 1985), only a handful of quarries and quarry workshops have been studied in all the western Great Basin (Elston and Zeier 1984; Elston et al. 1987; Elston and Budy 1990; Pedrick 1985; Raymond 1984; Rusco various; Rusco et al. 1982; Singer and Ericson 1977; Toney 1972; Tuohy 1970).

Several obsidian quarries in the Great Basin (Ragier and Lancaster 1966; Lohse 1980; Singer and Ericson 1977; Elston and Zeier 1984), and at least one chert quarry in an adjacent region (cf. Berry 1975), are as large or larger in extent than the Tosawihi Quarries. However, Tosawihi is the single largest known silicified toolstone quarry in the Great Basin proper, and the intensity of prehistoric activity there is unprecedented elsewhere in the region. Time-diagnostic projectile points suggest the quarries have been visited for the last 8,000 to 10,000 years (Elston et al 1987:108). Chert artifacts that appear to have been made from Tosawihi material were found at Gatecliff Shelter, ca. 175 km south of the quarry (Novick 1987), and Tosawihi-like, white chert artifacts are common throughout the western Great Basin, although they tend to decrease in numbers with distance to the west (Stephenson and Wilkenson 1969; Rusco 1978).

White chert toolstone is the most common lithic material type in large sites along the upper Humboldt River (Elston et al. 1981). The Tosawihi Quarries were obviously an important resource for the ethnographic Shoshone of the Humboldt Valley. The group living in the vicinity of Battle Mountain called themselves Tosawihi or White Knife, while other Humboldt River Shoshone groups were identified by food names; i.e., the Tsogwi (a root) yuyugi (shakes like jelly) of the Elko area (Steward 1938:154).

Lithics and Prehistoric Hunter-Gatherer Adaptations

The general significance of prehistoric lithic quarry and workshop studies for understanding hunter-gatherer adaptation can be appreciated by considering that, in prehistoric societies without metal, technology is based on organic materials (shell, bone, sinew, hide, membrane, plant fiber, wood, resin) and on stone. Although many organic materials can be gathered with the hands and used "as is", the procurement and processing of others requires hard and sharp piercing, cutting, and scraping edges. Such implements can be made from shell, hardwood, or bone, but, for sharpness and durability, only metal surpasses stone. Thus, for hunters and gatherers with a stone-based technology, toolstone is an extremely important, possibly limiting, resource.

In order to fully understand the role of lithic technology in prehistoric adaptive strategies, one must examine the technology and economics of toolstone procurement at quarry and workshop sites, in addition to the use and discard of finished stone tools at other sites. The distribution of lithic raw material across the landscape (toolstone availability) and the degree of mobility in settlement and subsistence patterns all affect toolstone supply and demand (Elston and Budy 1987 and references). Hence, analysis of toolstone extraction, processing, manufacturing, utilization, transport, and discard reveal not only the economic value of toolstone resources in ancient societies, but organization of production, patterns of mobility and settlement, subsistence strategies, trade, social structure, and group relationships (Butler and May 1984:xix; Goodyear and Charles 1984:1; Raymond 1984:1; Vehik 1985a:2).

In the Great Basin, piercing, cutting, and scraping tools invariably were made by flaking or knapping. Knapping requires a brittle, isotropic medium (Cotterell and Kamminga 1987) such as obsidian (volcanic glass), cryptocrystalline or microcrystalline silicate rocks including flint, chert, jasper, chalcedony, and opalite, as well as fine-grained basalt and andesite.

Toolstone availability is controlled by geology and geomorphology; in any given region, toolstone abundance and distribution varies widely across the landscape (Gould 1985). Isotropic rocks are relatively uncommon in most regions, but tend to be more abundant in uplands and mountain ranges, and scarce in alluvial valleys. Of course, toolstone quality and abundance may differ considerably among different areas and among different sources in the same area.

Mobility and Toolstone Economics

Binford's (1980) continuum of mobility is a useful means of conceptualizing variability in hunter-gather subsistence and settlement strategies. At one end are highly mobile foragers who tend to operate in a large annual range, frequently moving from camp to camp. At each camp, a particular set of resources is exploited in a relatively small area within the foraging radius (the distance one can walk, do business, and return in a day) until return rates for target resources fall off (a matter of days to a few weeks), at which point the camp is moved to a new area where the resource set may be different. The total area exploited in a given year is the annual foraging range. In the forager strategy, resources are consumed as they are taken, not stored: people move to resources.

The greater the mobility and annual range of a group, the more toolstone sources are likely to be available to them and choices can be made among the highest quality sources. Quantities of toolstone on the surface may be sufficient to meet demands without more intensive procurement techniques. Since considerable time may elapse between visits to the best sources, foraging groups might be expected to "gear up" (Binford 1979) with new tools when a high quality source is encountered. In addition, the lithic tools of mobile foraging groups are likely to be highly symmetrical in form (ease of maintenance) and large in size (mobile storage of toolstone); Paleoindian tools are a case in point (Goodyear 1979). Biface technology, particularly well adapted for use by highly mobile hunter-gathers (Kelly 1988), has been the focus of lithic production in the Great Basin throughout prehistory.

At the other end of the continuum are less mobile collectors, who establish a long term base camp with a view toward a variety of resources or resource sets. In temperate climates, these sites tend to be occupied in the late fall and winter; e.g., the Humboldt River Shoshone winter settlements described by Steward (1938). As in the forager strategy, resources in the vicinity of the base camp (foraging radius) are taken, but a much larger area (defining the logistical radius) is also exploited by means of logistical task groups. These are formed to procure a specific resource or restricted range of resources (i.e., pine nuts or mountain sheep). Such groups may travel a long distance from base camp, establish one or more temporary field camps, obtain the target resource(s), then return to base camp. Logistical field camps are likely to be occupied for a relatively short period of time, perhaps a few days (but see Downs 1966:30). Because transport is limited sharply by human load carrying capacity (Madsen n.d.), resources usually are processed at or near their source to reduce bulk and weight. The collector strategy is designed to deal with seasonal shortages, so storage is an integral part of the collector strategy. Resources can be cached at the field camp, at the main base camp, or at points between the two.

Several factors may increase toolstone demand among collectors. Scheduling conflicts and time limitations with regard to key food resources may increase sharply toolstone demands for limited periods, or prevent collection of sufficient supplies through casual surface collection. Logistically based collectors, or hunter-gatherers practicing a seasonally mixed mode strategy, may operate within a smaller annual range than pure foragers. When this results in limited access to toolstone sources, the importance of any high quality sources within the annual range may increase, along with the intensity of their use. Intensity of exploitation at a source can also be expected to increase with duration of occupation in its vicinity, as people exhaust supplies of toolstone brought to the place and turn to local sources for replenishment. In terms of the functional site types discussed above, the highest intensity of exploitation (including quarry pitting) is expected at lithic sources within the foraging radius of long term, winter base camps and, in decreasing order, short term foraging base camps, and logistical field camps.

Thus, the different toolstone supply and demand problems faced by foragers and collectors are likely to be solved in different ways. The extremes of surface collection and quarry pit excavation do not exhaust the strategies for toolstone exploitation, but do suggest several important archaeological questions with regard to Tosawihi Quarries. The quarries are in a hinterland far from any known ethnographic or prehistoric winter base camps, yet hundreds of quarry pits and vast quantities of processing debris suggest very intense exploitation. Why is this so? Was use of other toolstone sources constrained by shifting settlement patterns, changing trade networks, or increased population? How much time and effort does intense exploitation through quarry pitting consume? Could this level of activity possibly be accomplished through an "embedded" strategy of exploitation, or would logistical organization and special task groups be required? If logistical organization was required, how could task groups be supported while at the quarries? Would visiting the quarries be more advantageous during a particular time of the year? Could the archaeological record at Tosawihi Quarries be the cumulative result of relatively infrequent episodes of toolstone procurement over the last 10,000 years, or is it due to one or more sharp, temporally bounded peaks in toolstone production? How far did people travel to obtain Tosawihi chert, and how far did it travel through transportation and trade?

As it happens, the present phase of investigation involves numerous archaeological sites adjacent the quarries, but relatively few of them are quarry sites. Most are lithic workshops and/or residential sites apparently occupied by people who were procuring and processing toolstone from the quarries. Investigation of such sites presents an opportunity to address many of the questions posed above.

The Nature of the Resource

The nature of the toolstone at Tosawihi Quarries is the aspect of the resource least controlled by prehistoric miners and knappers. Geological forces created Tosawihi opalite and have determined where it is exposed and accessible for extraction by means available to prehistoric people. We assume that toolstone quality was a major factor guiding prehistoric choices among toolstone sources. Moreover, we believe it likely that the standard of acceptable quality may have varied according to toolstone supply and demand. Thus, understanding the geology of Tosawihi opalite, its range of quality throughout the Quarries, and its chemical identification, are essential to understanding the economics and strategy of prehistoric extraction-production.

Geologic Context of Tosawihi Toolstone

Tosawihi "chert" is amorphous cryptocrystalline rock formed by silicification of Tertiary rhyolite tuff through subsurface hydrothermal action, as well as deposits of chalcedontic sinter formed at the surface by active hot springs (Bailey and Phoenix 1944:19-20). Erosion has removed overlying strata and cut into the beds of opalite and sinter. The silicified bedrock now lies near the surface, thinly mantled with colluvium and exposed in stream cuts.

Potential toolstone sources include bedrock outcrops, thinly mantled bedrock, opalite talus deposits, and colluvium containing opalite clasts, each of which may vary through a particular range of quality and require different methods of extraction and processing (Elston, Raven and Budy 1987:77-19). The geologic context of Tosawihi "chert" thus determined its accessibility to prehistoric people and no doubt strongly influenced the choice of strategies for its extraction.

Possible variables affecting the choice of toolstone sources are toolstone quality, depth of colluvium, and the proportion of high quality toolstone to waste rock. Size and abundance of chert clasts in colluvium may be important also (Elston, Raven and Budy 1987:77).

Criteria for Research Potential

Virtually any site with unambiguous evidence of toolstone extraction can inform regarding the nature of the source exploited. Particularly important are quarry pits or adits that provide "windows" into the local geology.

Investigative Strategies

Backhoe and hand-dug trenches sampled quarry pits, and depth of colluvium was measured directly. Stratigraphic documentation of trench profiles and column sampling were employed to investigate variation with depth in size and abundance of colluvial chert clasts and proportion of waste rock.

Variability in Toolstone Quality

All three study areas contained too few quarry features to provide a representative sample of variability in toolstone quality. However, toolstone quality was monitored in notes and samples of tools and cores.

Chemical Identification of Tosawihi Toolstone

The question of chemical identification of Tosawihi chert in sites outside the quarries is a pressing issue, inhibiting all attempts at a broader view of Tosawihi; a realistic evaluation of the importance of the place depends upon an ability to determine how far and in what volumes Tosawihi chert actually travelled.

In addition, the chemical identification of different chert sources within the quarry would make it possible to monitor the distance toolstone was transported from source to workshop/field camp to see if particular sources and/or particular camp sites were favored, and to inform regarding such questions as how many sources were exploited during a given visit to the quarry. By identifying different sources smong a sample of debitage from winter base camps along the Humboldt River, one might come to know if different groups traditionally exploited different parts of the quarry.

The large scale spatial distribution of Tosawihi chert can tell much about trade, toolstone economics, settlement, and subsistence throughout a large portion of the western Great Basin. For instance, critical to the issue of embeddedness in lithic procurement, is the structure of commodity distribution and resource access across the western Great Basin. If Tosawihi cherts are as widely distributed in the archaeological record as they have seemed to be, the probability that they were acquired by trade increases with distance, and this conditions any cost/benefit model that might be applied to primary procurement.

By the same token, the presence and identification of toolstone exotic to the quarries informs as to the distance and direction of travel and/or trade. Obsidian is the best toolstone for this kind of study because many sources have been identified throughout western North America (Hughes 1983, 1984).

Investigative Strategies

Renfrew's (1977) decay, or inverse gravity model, is a descriptive statement of toolstone fall-off rates (both in terms of volume and reduction state) with increasing distance from a source. This model already has been applied tentatively to lithics from Rossi Mine sites (Rusco et al. 1982), Valmy sites (Elston et al. 1981), and James Creek Shelter (Elston and Budy 1990). However, Duncan Metcalf (personal communication) has suggested ways in which marginal utility (Earle 1980), or marginal value (Charnov 1976) can be combined with the transport cost model recently developed by Madsen (1988) to actually predict raw material fall-off rates, tool size, and degree of reduction. Although a full scale study of these relationships will require the investigation of many points (sites) radiating from the quarries, a start in this direction can be made with data from the Access Road Corridor.

Samples taken from selected toolstone sources within the project area, together with samples from the Tosawihi Quarries, form part of a pilot study of source identification through trace elements identified by neutron activation analysis. The findings of this study are to be presented in a subsequent data recovery report.

Chemical source identification of obsidian is now routine and inexpensive (Hughes 1983, 1984). Obsidian artifacts from sites in the three study areas were collected. Source identification and analysis of a sample will be undertaken in planned data recovery efforts.

Criteria for Research Potential

Any site associated with a discrete toolstone source or any site that contains demonstrably exotic toolstone has potential for investigating the chemical identity of toolstone.

Economics of Toolstone Procurement

Resource procurement has been viewed increasingly in archaeology as a problem of economics (Ericson and Purdy 1984); the expenditure of effort in acquiring resources reflects values measurable in terms of their relative benefits and costs. Tosawihi opalites apparently played a role, not only in the technological systems of the peoples exploiting the quarries directly, but also in long-distance trade networks. Thus, the value of the resource was enhanced not only by its immediate abundance and utility, but was well by its function as a commodity.

Since at least the recent past, the quarries appear to have been exploited by groups not living nearby. Exploitation required time and effort for travel and search, extraction, processing and manufacturing; all of which are problems affecting the economics of subsistence strategies, settlement structure, time allocation, and, perhaps, social networks. Several research issues relating to these economics factors merit particular scrutiny.

Toolstone Cost/Benefit Currency

Comparison of the costs and benefits of toolstone procurement and use requires a currency. People do not derive energy directly from toolstone; rather, organic resources that do produce energy are captured and processed more efficiently through the use of stone tools (Elston and Budy 1990). Since stone tools generate benefits only during the time they are used, the greatest benefit will accrue from tools with the longest service life. Service life is partly a function of mass, but mass alone is not a sufficient currency, because toolstones differ in hardness, isotropy, durability, and workability. Other factors that influence service life are tool design, the technology of maintenance, and the material of the workpiece. Under average technological constraints, user skills and work conditions prevailing in a particular cultural system, toolstone currency is average weight of toolstone consumed per service time (weight/ST). Thus, a 1000 gram tool made of toolstone with a service life of 810 minutes has a utility of 0.81 *minutes per gram.*

Toolstone Return Rates

The procurement costs of toolstone, as any other resource, can be thought of in terms of search time and handling time. Searching entails time spent traveling to the toolstone source or patch, finding toolstone items in the patch, as well as visual inspection and assaying likely toolstone items. Handling time includes both extraction and processing. Extraction varies from simply plucking an item from the surface, through recovery of toolstone clasts by excavation of soil, to excavation of toolstone in beds and outcrops. Processing includes those tasks necessary to render the toolstone into usable form (decortication, core preparation, flake blake production, initial biface reduction, heat treatment). The point at which processing ends and tool manufacturing/maintenance begins is contingent on constraints of time and task. When comparing costs and benefits of two different toolstones, return rates should be calculated (using toolstone utility) as the total service life of the toolstone procured, minus handling time and search time. If looking at the costs and benefits of different strategies for exploiting a single toolstone, utility can be ignored, using weight procured per handling and search time.

Toolstone Procurement Strategies

There are two basic strategies for toolstone procurement: surface collection and quarrying. The collection of surface material has the advantage of low initial search time; everything present is visible. Moreover, this strategy is embedded easily in hunting, gathering, and traveling. However, the disadvantages of surface materials are several. Surface material is often dispersed so that there is a significant time gap between encounters. In addition, surface items occur within a narrow size range constrained by local geology. Surface toolstone is usually weathered (checked, dehydrated); most pieces have to be assayed, and many pieces will be rejected because of stresses and flaws that would increase processing tome and decrease use-life. The average return rate for a particular surface toolstone patch is the weight of potential toolstone items encountered, minus the weight of items rejected, per unit of time. For most surface patches, the dispersion of items, high ratio of unsuitable material, and constrained size range will keep average return rates relatively low.

Procurement of toolstone through quarrying also has disadvantages. Finding buried toolstone requires a visual search of the ground surface, assaying likely pieces, and a certain amount of prospecting or test pitting (Binford and O'Connell 1984). This must be followed by quarry pitting, the creation of an excavation of sufficient size and depth to reach toolstone clasts in a soil matrix and/or toolstone bedrock. If bedrock is to be quarried, it must be broken up into manageable pieces with hammers and wedges, and possibly with fire. After all the toolstone has been recovered from the bottom of the original excavation, a new excavation must be created to obtain additional material. All this requires the application of considerable time and energy that must influence the size and composition of the group employed in the enterprise.

However, buried toolstone has several advantages. Less subject to weathering and thermal stress, need for assay is minimized. Localities can be selected to ensure uniformity of quality, maximizing processing and ratios of toolstone to waste rock. With exploitation of bedrock, the size of cores and flake blanks is limited only by technology and human physical characteristics. Moreover, the moisture content of buried toolstone increases its workability, also decreasing waste. All these factors can increase return rates for buried toolstone far beyond what can ordinarily be achieved by exploitation of surface material.

As discussed previously, time spent at Tosawihi figures in a number of research domains. Available time in the toolstone source area might be limited by a variety of factors, including weather, availability of food and water, or conflicts with critical food resources in other areas. It is assumed that time required for quarry pitting was considerable and it must have been planned carefully to take such constraints into consideration.

Quantity of Toolstone Processed and Removed From Tosawihi

In conjunction with studies of chronology, settlement, and subsistence, estimates of the quantity of toolstone processed and removed from Tosawihi, if possible, can allow assessment of the importance of that toolstone resource and the total human investment of time and energy devoted to obtaining it (Ahler

1986a:18). This question cannot be addressed fully at this time, given the small number of quarry features in the present study areas. However, data collected during the present study will contribute useful information toward that end.

Investigative Strategies

The amounts of toolstone extracted in single episodes at individual quarry features will be estimated through documentation of stratigraphic detail. Volume of material in quarry pits, berms, and colluvium will be estimated directly from column samples taken from excavations in quarry pits, pit vicinities, and cobble fields. This will in turn allow the estimation of time and energy invested in extraction and processing at individual localities (cf. Ahler 1986a:18), useful in calculating rough estimates of extraction for the entire quarry.

Criteria for Research Potential

Any quarry feature with well preserved, stratified deposits, contains data that ultimately can bear on the problem.

Level of Effort Expended at Tosawihi Quarries

The total manpower invested in extraction, processing, and manufacturing at Tosawihi bears on a variety of archaeological problems including the organization of these activities, the structure of groups visiting the quarries, the place of the quarries in regional subsistence strategies, and trade. For instance, assuming that the source was exploited for as long as the few known time markers suggest, could the archaeological record have accumulated as the product of 10,000 (or so) short seasonal visits by small groups engaged principally in other activities? What were annual rates of production? Did these vary through time?

Investigative Strategies

Although volumetric studies of quarry pit waste can contribute to calculating the time and energy required to extract raw material from various kinds of pits or outcrop sources, other data not present in the archaeological record can be obtained from ethnoarchaeological models and actualistic experiments. Ahler (1986a) based his level of effort estimates for the Knife River Flint quarry site 32DU508 on the excavation rate of the 1982 archaeological crew using modern picks and shovels. However, actualistic experiments, using materials and tools available prehistorically (digging sticks, wedges, hammerstones, bone and stone scoops, and baskets), will provide more reliable data regarding the amount of useable material removed as toolstone, the amount dispersed in the vicinity as waste (both debitage and rejects), and the amount of person-time sufficient to accomplish these tasks. Knapping experiments can provide time estimates for processing and manufacturing. These data can be checked against the ethnoarchaeological record documenting quarry behavior among Australian Aborigines (Binford and O'Connell 1984; O'Connell n.d.; Gould 1977:163-164; Gould 1980:124-127).

Criteria for Research Potential

Any quarry feature with stratified, datable deposits contains data that ultimately can bear on the problem.

Place of the Quarries in the Regional Economy

The ethnographic Shoshone groups of the Humboldt River, like most Great Basin Indians, employed a mixed mode settlement/subsistence strategy; a sedentary, logistical collecting mode from winter base camps on the Humboldt River and a highly mobile foraging mode throughout the annual range for the remainder of the year. Territory in the Humboldt River valley was divided loosely into "districts" (Steward 1938:153-154) containing from one to several "semipermanent" base camps (often clustered into villages) considered home by certain families who returned there when they could do so. The only winter base camp sites recorded by Steward (1938) in the country between the Humboldt River and the Snake River in Idaho were those on the Upper Humboldt River, on Maggie Creek, and on the south fork of the Owyhee River, all major corridors for north-south travel. It is possible that people occasionally wintered on Rock Creek or Willow Creek in favorable years, although there is no ethnographic evidence for this.

However, it appears that uplands such as the Tosawihi Quarries vicinity were hinterlands visited mostly by foraging and logistical groups. During all but a few weeks in spring, the upland steppe seems too cold, too dry, and too unproductive to have supported very many people for any length of time. Thus, long-term residential occupation of Tosawihi Quarries is considered unlikely.

How then, were the quarries exploited? We have proposed that the settlement/subsistence strategy of a given population determines encounter rates for toolstone sources and duration of occupation in their vicinity. Most of the time, hunter-gatherers position themselves with regard to sources of food, water, and shelter, rather than to toolstone. Binford (1979, 1985; Binford and Stone 1985) maintains that toolstone procurement by hunter-gatherers is always "embedded" in food-getting activities, occupies slack time, or is pursued when primary target food resources fail to materialize. However, when demand is high because of critical task requirements, or religious and trade incentives (Gould 1980, 1985; Gould and Saggers 1985; Hughes and Bettinger 1984), hunter-gatherers may employ a more direct strategy, making forays targeted specially at toolstone, where procurement of other resources is of secondary importance.

Gould's Australian data (1977, 1980) suggest that procurement strategies and use of toolstones may vary with the type of lithic source. Low to medium quality toolstone is distributed widely across the Australian landscape. This material is obtained through an embedded strategy on an encounter basis, used for expedient tasks "more or less on the spot", and discarded after completion of the task. The archaeological "signature" of this strategy comprises isolated tools and small scatters of flakes.

Higher quality toolstone (such as that available at Tosawihi Quarries) was procured directly at quarries, often by logistical groups, "small parties of men who made a special effort to visit the quarry site, sometimes detouring from some other route for that purpose or else making an expedition from their habitation camp primarily to procure isotropic stone" (Gould 1980:124). Gould maintains that such toolstone procurement was the most time-consuming and laborious part of stone tool manufacture, requiring trips over distances of 10 to 30 kilometers with overnight or longer stays at the quarry. Even travelling by automobile, toolstone procurement by one group of Alyawara Aborigines took most of a day (Binford and O'Connell 1984); prior to historic times, overnight stays at quarries very distant from residential camps must have been the rule.

Data in Steward (1938:162) suggest the usual logistical radius for Humboldt River groups was 50 or 60 km, and longer trips (up to 100 km one way) made to the vicinity of Austin for pine nuts, and to the headwaters of the Owyhee River and other tributaries of the Snake River for salmon, suggest the extent of the maximum annual range. The Tosawihi quarries are well within the logistical and summer foraging ranges of Humboldt River people and probably within the extended range of many Owyhee-Snake River groups as well. Since people lacked the concept of land ownership and food surpluses commonly were shared by several different groups, it seems likely that everyone had equal access to Tosawihi toolstone.

An embedded strategy of toolstone procurement (obtaining toolstone while pursuing other resources) is most likely to be employed by people traveling light and moving frequently through a landscape in which toolstone is relatively abundant. Tools can be replenished as required, and since there is no need to procure large amounts of toolstone, there is little payoff for using intensive extraction methods (Elston and Budy 1990). The embedded strategy would fit well with the ethnographic pattern of summer foraging in small, extended family groups. It might also be employed by task groups on long range forays passing through Tosawihi Quarries to target resources elsewhere.

Yet, the hundreds of quarry pits and great quantities of waste rock and debitage at Tosawihi bespeak an intensity of exploitation that seems too great for highly mobile people pursuing an embedded strategy of toolstone procurement. The lithic procurement activities of the Alyawara, probably carried out on logistical trips, created lithic debris and shallow pit features very similar to those observed at Tosawihi Quarries, although on a smaller scale (Binford and O'Connell 1984; James O'Connell, personal communication).

At Tosawihi Quarries, then, it must have taken people at least a couple of days to excavate pits, manufacture large bifaces, transport those to near-by field camps, heat-treat the bifaces, and then reduce them further prior to their transport out of the area. Similar reasoning, and time-effort estimates, for the creation of certain quarry features at the Knife River Flint Quarry led Ahler to believe (1986a:106) that special task groups were involved in their creation. The intensive exploitation of Tosawihi Quarries through a logistical strategy is most likely for collectors, who may be able to target more routinely a particular lithic source than could foragers; in fact, they are more likely to do so if their access to other toolstone sources is restricted or their annual range is constrained. In any case, collectors can organize the time and effort required for intensive exploitation as a logistical task.

Perhaps the possibility of extended visits to Tosawihi Quarries was resource limited. If the availability of food and water limited the size of the group that could be supported for the amount of time they could spend there, certain seasons may have been favored for visits to Tosawihi Quarries. It may be that extended visits were possible only once in a run of years. While water is abundant in winter, and pronghorn antelope (present at Tosawihi Quarries today) congregate in the largest groups then (Hall 1946:629), winter at Tosawihi Quarries is harsh; the ground freezes, snow drifts deep, and it is very cold. In spring, though, plants (bitterroot) and small mammals (particularly burrowing rodents) are most abundant, there is plenty of water, and the weather is more hospitable. These conditions prevail into early summer.

The foregoing observations notwithstanding, logistical and embedded procurement do not always employ mutually exclusive technological approaches: members of foraging groups could have excavated quarry pits; logistical groups may have taken meat or roots as well as toolstone. We suspect that people probably made every effort to lower the cost of toolstone procurement at Tosawihi, embedding as much travel time as possible in the pursuit of other resources, either at Tosawihi Quarries or in the vicinity. The presence of a particularly good bitterroot crop, a herd of antelope, or a periodic population explosion of rabbits or ground squirrels might have made it possible to spend more time at Tosawihi Quarries than usual. But whether people went to Tosawihi to get toolstone, obtained toolstone while they were there doing something else, or employed some combination of procurement strategies, probably has to do most with the overall structure of the settlement and subsistence system, and the seasonal position of people vis a vis the Quarries.

Investigative Strategies

As outlined above, the estimation of level of effort per quarry episode will provide data concerning minimum occupational duration. If the average episode of quarrying and processing consumed only a few hours, people well may have pursued these activities as they passed through on their way elsewhere. If, on the other hand, quarrying and processing were more time consuming, people, of necessity, may have stayed at the Quarries longer.

Identifying the diet people consumed at Tosawihi will provide information concerning seasonality and the possibility of provisioning from the resources in the vicinity of the Quarries. Direct evidence of local subsistence may be obtained from excavation at sites where faunal and floral remains are preserved, especially rockshelters with dry deposits.

Whether or not field camps of logistically organized task groups can be distinguished from the short term camp sites of foraging groups is a particularly thorny problem (Thomas 1983a, 1988; Elston and Budy 1990). If structures are present, do they suggest short term occupation (brush windbreaks, pit shelters) or longer term occupation (wickiups, flattened surfaces); were fires built in simple surface hearths or in lined pits; was toolstone heat treated; are "domestic" artifacts in evidence?

Indirect evidence of group size, composition, and duration of occupation may be revealed by analysis of site structure and artifact variability, as outlined below, especially at small camp sites recorded on the periphery of the Quarries (Budy 1988; Raven 1988).

In order to know whether assemblages representing non-quarrying activities at Tosawihi are unique or similar to assemblages from non-quarry sites elsewhere, comparative data must be gathered from sites in the surrounding region. Samples from sites on Willow Creek and Ivanhoe Creek should be particularly interesting in this regard.

Criteria for Research Potential

Sites bearing evidence of diet, seasonality, shelter, hearths, heat treating, exotic toolstone and/or stratified quarry deposits have potential for addressing questions of regional economy.

Site Function, Structure, and Distribution

Questions of site function are concerned with why particular sites were occupied, and what activities occurred there. Site structure involves the use and organization of site space, and its study must consider the ways archaeological sites were formed and how they since have been transformed. Site distribution, on the other hand, reflects the overall organization of lithic extraction and processing, and the tasks of daily life, and their distribution in the Tosawihi landscape.

Site Function

Archaeological localities in the Tosawihi Quarries site (26Ek3032) have been classified tentatively on the basis of surface evidence (Elston, Raven and Budy 1987), and a similar classification system was applied to sites recorded on the Quarries periphery (Budy 1988; Raven 1988). The functional distinctions implied by these classes remains to be demonstrated. For instance, what were the functions of "Reduction Stations", the small, discrete lithic scatters found usually on ridges or in small rockshelters? Do they represent hunting stations, or procurement of lithic material by groups just passing through on their way elsewhere, or places where specialized reduction tasks were carried out? Another example is the set of sites judged to be "Residential" by the presence of ground stone and "finished" tools. Some of these are represented by open lithic scatters and others by rockshelters. Do these two situations imply a basic functional difference? Are shelters somehow more or less residential than open sites? We have observed considerable structural complexity in several of the open sites. Are more complex sites functionally different from less complex sites?

Investigative Strategies

Site function can be addressed by assessment of variability in the content of individual localities and by comparing the relative variability among assemblages (Thomas 1983; Elston and Juell 1987; Elston and Budy 1990). Functional tool classes and relative frequencies of distinct artifact types (numbers of bifaces vs. flake tools; projectile points, drills and scrapers vs. groundstone) will signal the range of activities as well as their intensity. The presence or absence of residential features (hearths, storage pits, and house pits or other structures) indicate duration of occupation and the functional range of a site.

Criteria for Research Potential

Virtually any site with formed artifacts can contribute to the study of site function, but sites with discrete features and faunal or floral remains are particularly significant in this regard.

Site Structure

Structure of a site often suggests the size, social structure, and duration of occupation of groups occupying it (Binford 1978; 1983a; O'Connell 1986; Zeier and Elston 1986; Novick 1987; Thomas 1983b, 1988; Elston and Budy 1990). Obviously, quarry localities, workshops, rockshelters, and open habitation sites all may exhibit different structures because each presented a different set of spatial constraints and each may have been occupied by different sized groups for different sets of activities over different periods of time.

Whether or not the organization of field camps is highly structured probably has a great deal to do with length of occupation. If archaeologically visible, sites occupied for a very short duration usually will have a correspondingly simple structure, consisting of a discrete scatter of debris. Conversely, the structure of sites occupied over longer periods, and those consistently reoccupied, often are blurred accumulated debris: subsequent occupants may find it advantageous to clear certain space and keep it clean, to empty hearths, and otherwise organize and reorganize work areas and places of debris disposal. Moreover, non-cultural processes such as slope wash and bioturbation bury and move cultural remains.

The ethnoarchaeological literature, particularly that of Australia, provides some insight into what we might expect of the site structure of lithic quarries and workshops (Binford and O'Connell 1984, 1986; Gould 1977, 1980:124-125; Hayden 1979:51; O'Connell 1974, n.d.; Tindale 1965:140). Toolstone materials assay is expected to generate a distribution of assayed cobbles and debitage, often correlated only with the geology of toolstone. In areas where surface toolstone is abundant, but of poor quality, assaying could generate relatively dense scatters of assayed cobbles and debitage but have no quarry pits. Such places should have a distinctive debitage profile and artifact assemblage: assayed cobbles and primary debitage will dominate; exotic hammerstones, later stage cores, and bifaces will be rare; quarry pits will be absent for the most part, or small and shallow when present; the scatter of surface artifacts will lack structure, appearing essentially random. Toolstone extraction and processing generates distinctive kinds of features and debris, including quarry pits and berms, adits, cobble concentrations, and dense flake scatters. Some O'Connell (personal communication) photographs document the creation of such features by Alyawara in Australia.

Quarry pitting occurs when the quality of subsurface toolstone is higher than that of surface material. Gould (1980:125), O'Connell (personal communication), and Binford and O'Connell (1984) report that Australian Aborigines at a quarry of high quality material would excavate one to two feet below the surface to secure unweathered toolstone.

Quarry pitting progresses through several stages. First, surface rocks are assayed to locate likely subsurface stone. The archaeological consequences include primary flakes and assayed cobbles. Once a partially buried boulder or outcrop is located, minimal excavation is conducted in order to expose enough of the subsurface rock to assay it. This creates a small, shallow pit around the margins of the buried rock, a slight berm of soil and waste rock (tailings) along the edge of the pit, and primary and secondary debitage, mostly in the bottom of the pit. If assaying shows satisfactory results, further excavation exposes and removes the buried rock. Larger rocks may be moved with a lever, or they may be broken up using block on block or fire techniques. The archaeological consequences are expected to be a large pit and berm, large pieces of waste rock and chunks of shattered toolstone in the berm, exhausted extraction tools (hammer stones, picks, and shovels) and spall from their use, charcoal, and fire-altered toolstone in the pit and berm.

The objective of Tosawihi quarrying was large bifaces and so the pattern of reduction should be somewhat different from that exhibited by the Alyawara. Judging from the numbers of bifaces in quarry pits and on pit berms, flake blank production and initial bifacial reduction often took place at the quarry pit. Alyawara sometimes cleaned surfaces of debris and vegetation to provide clear areas in which to reduce cores. Cleared spaces have not been observed at Tosawihi Quarries, and discrete lithic scatters are usually found only some distance from quarry pits; those on slopes tend to be fan shaped as a result of slope movement.

Investigative Strategies

Site structure will be monitored through description and systematic collection of feature and non-feature areas, detailed mapping, tests for size-grading of artifacts, and plots of tool distributions. These data will be compared with ethnographic models.

Criteria for Research Potential

Sites with potential for the study of site structure have well preserved, discrete cultural features, as well as patterned distributions of artifacts and features.

Site Formation Processes

Interpretation of the archaeological record at Tosawihi will be enhanced by an understanding of how archaeological sites there were formed and how they have been transformed in the interval since (Binford 1979, 1980; Schiffer 1976). People create archaeological sites by living and working in them. Use of space is differentiated as people sleep in one place, work in another, and dispose of refuse in yet another. Erosion, deposition, soil formation, bioturbation, chemical change, and human activity all affect archaeological deposits as they are created and for as long as they exist thereafter. Several models of site formation processes derived from ethnographic data (Binford 1977, 1978; Binford and O'Connell 1984, 1986; Yellen 1977; Gould 1977; 1980) are applicable at Tosawihi and vicinity.

Activities at residential sites also can be expected to create cultural features and transform archaeological sites; for example, excavation and cleaning of hearths and heat treating ovens, creation of debitage scatters, disposal of lithic and other waste, clearing of work spaces, and shelter construction. In caves and rockshelters, the latter may effect massive transformations of archaeological deposits (Elston and Budy 1990).

Geological and biological processes begin to transform archaeological sites as soon as they are created. In the present project areas, the notable agencies of non-cultural site transformation are slope movement, eolian and alluvial deposition, and bioturbation by burrowing animals. Most slopes show evidence of soil movement through solifluction and slope wash; discrete lithic scatters on slopes are typically fan shaped, with the apex of the fan upslope. Eolian and alluvial deposition has buried archaeological deposits, now visible on the surface only in tailings of animal burrows. Some open sites have been churned thoroughly by burrowing animals. Coverage of site surfaces by annual tailings where burrowing animals are active appears to range between five and twenty percent per annum, suggesting the entire site is turned over every decade or so. Pack rats (Neotoma sp.), mammalian predators, and raptors all contribute to the faunal content of caves and rock shelters; the former two may cause extensive disturbance of archaeological deposits through burrowing (Elston and Budy 1990).

Investigative Strategies

Investigation of site formation processes requires careful analysis of sediments in context, and understanding site-transforming cultural and natural features. An integrated interpretation of site formation will be derived from feature mapping, trench profiling, and geomorphic studies. Where applicable, analysis of faunal remains can reveal the proportion of naturally and culturally introduced bone (Schmitt 1990).

Criteria for Research Potential

Site formation processes are best studied in sites containing discrete cultural features and/or strata, along with chronological indicators such as carbon or obsidian.

The Organization of Lithic Production

One tentative scenario for the organization of lithic production at Tosawihi has been sketched (Elston, Raven, and Budy 1987): chert was extracted, processed, and transformed into early stage bifaces at the place of extraction, transported to a habitation site where it was reduced further, heat treated, reduced yet again, and then transported elsewhere. This model seems most suited to a logistical strategy of lithic procurement and production; foragers probably used a different strategy.

Investigative Strategies

The organization of lithic production can be studied in several ways. Using a gravity model, hammerstone size already has been shown to be an inverse function of distance from basalt source (Elston, Raven and Budy 1987). The same approach might work with debitage volume vs. distance from field camp; the principle of least effort suggests that intense exploitation should occur at the nearest available source, other things (such as stone quality) being equal. The actual distribution, then, would test the model and suggest where other things are not equal (i.e., where quality of toolstone or its near-surface accessibility have conditioned less than the most efficient extraction). In fact, the gravity model can be used for all kinds of predictions; for instance, hammerstone size also may have a direct relationship to distance from habitation. If we can rank toolstone quality and accessibility, those variables could be added.

A strong formal characterization of the differences in debitage (stage, size, raw material type, presence or absence of heat treatment) observable at quarry pits and at habitation sites will help evaluate whether reduction carried on there was simply pre-transport lightening of the load or whether folks were remaining in place long enough to make the production of finished tools worthwhile.

Criteria for Research Potential

Most sites in the study areas are expected to contain evidence of lithic extraction and/or processing that will be useful in the reconstruction of the organization of production.

Chronology and Paleoenvironments

All the research domains discussed above entail significant temporal dimensions. As a consequence, control of chronological sequences and variation becomes a research issue critical to the understanding of all other data categories, and must be an element in the investigation of each. Four lines of chronological inquiry especially pertinent to research in the Tosawihi Quarries are discussed below, with the understanding that, in fact, all other research issues must address chronology to greater or lesser degrees.

Cultural Chronology

A cultural chronology describes the dates and sequence of phases in the culture history of a locality or region (Willey and Phillips 1958:22). Cultural phase boundaries mark changes in technology, style, subsistence, or other cultural attributes. A fairly detailed cultural chronology exists for the last 3200 years in the upper Humboldt River region (Elston and Budy 1990), although prior to that, the record becomes progressively sketchy with time. The oldest radiocarbon date in the Upper Humboldt region is 5790 B.P. from Upper South Fork Shelter (Spencer et al. 1987), although diagnostic projectile points suggest people were operating in the region (including Tosawihi) by at least 8000 B.P. (Spencer et al. 1987).

Local chronological questions consider the earliest use of Tosawihi chert, the inception of quarry pitting, outcrop quarrying, and other intensive extraction techniques, and when occupation of rockshelters and open sites began.

Investigative Strategies

Construction of a local cultural chronology for Tosawihi that can be fitted into, or even expand, the regional sequence, requires a series of radiocarbon dates from stratified or otherwise discrete cultural deposits. The most likely places in the present study areas are sites in alluvial situations, such as stream terraces. However, small hearths with dateable charcoal, expected to be present at short term camps, certainly can contribute (Budy 1988; Raven 1988).

It is possible that dateable, stratified deposits exist in the Quarries; over two meters of stratified quarry debris were observed in historic trenches at locality 44 (Elston, Raven and Budy 1987), and similar deposits may exist in other places as well. If fire was used in the quarrying process, datable charcoal may be present in quarry pits or in waste dumps at outcrop quarries. Moreover, hearths may have been used for warming and/or cooking in quarry areas, and hearths may also be present in some of the small, discrete surface lithic scatters designated Reduction Stations (Elston, Raven and Budy 1987:61).

Tephrachronology provides another precise dating method (Bradley 1985:110-112). Tephra, or ash deposited from volcanic eruptions, can travel thousands of kilometers from the source and become incorporated in cultural and geological deposits. Tephras from different eruptions are chemically distinct, and most major Holocene eruptions in the western United States have been well dated. The most widespread tephra in Nevada is ash from the Mt. Mazama eruption (which formed Crater Lake) of about 7,000 years ago (Davis 1978). Mazama ash has been found in several localities in the Upper Humboldt region, including Valmy on the Humboldt River (Elston et al. 1981), in the James Creek drainage (Elston and Budy 1990), at Upper South Fork Shelter (Spencer et al. 1987), and on Mahala Creek in North Fork Valley (Madsen 1985), and there is every reason to expect Mazama ash at Tosawihi.

Stratigraphic superposition will allow the relative dating of artifacts within stratified alluvial deposits, as well as determination of the relative ages of adjacent quarry pits in pit complexes.

Temporally diagnostic artifacts, such as projectile points, shell beads, and pottery, help constrain the age of the deposits in which they are found within certain limits (between several hundred and several thousand years, depending on the artifact class). Other dating methods, such as obsidian hydration, may be applicable to establishing a chronology at Tosawihi. Though obsidian hydration lacks the precision of the radiocarbon method, careful considerations of soil temperature and chemical composition can be used to develop a local hydration rate appropriate for dating obsidian artifacts at Tosawihi and its vicinity (Zeier 1987). Obsidian is present in small amounts at numerous sites on the Quarry periphery (Budy 1988; Raven 1988), and is expected to be present in rockshelter deposits; combined with radiocarbon dating, obsidian hydration may provide a useful chronology for the area.

Criteria for Research Potential

Sites with datable, well-stratified deposits and/or discrete cultural features and quantities of temporally diagnostic artifacts are well suited to the study of cultural chronology.

Temporal Variation in Quarry Use

Assuming chronological control at the Quarries and means to measure the intensity of quarry use and occupation there, variation in use of the quarry through time can be investigated. Such variation may be influenced by a variety of factors, including climatic change, shifts in trade networks, and overall technological change, or may occur as annual ranges and base camp locations shift through time (Binford 1983b). When it can be monitored, the latter kind of change often has a cyclical pattern. For instance, use of James Creek Shelter, about 50 km southeast of Tosawihi Quarries, was at first slight, grew more intense, and then waned over a 3200 year period (Elston and Budy 1990).

Change in the intensity of use also may have occurred at a different scale. Present evidence suggests that the adaptive strategies of Pre-Archaic groups of the Pleistocene-Holocene Transition (12,000 - 8,000 B.P.) were different from those of the later Archaic (Elston 1982, 1986a). The Pre-Archaic strategy seems to have been based on highly mobile foraging, while the Archaic marks the inception of mixed-mode foraging and collecting known in ethnographic times.

Thus, the quarries are likely to have played different roles in the economies and subsistence patterns of Pre-Archaic and Archaic people. In the Pre-Archaic, the Quarries may have been visited infrequently. Sufficient high quality toolstone may have been available on the surface, so that excavation of quarry pits was unnecessary. Under these circumstances, the archaeological visibility of Pre-Archaic toolstone procurement and subsistence may be low, perhaps preserved only in deeper deposits of habitation sites.

In the Archaic, the Quarries may have been visited much more frequently, both by summer foraging groups and by logistical groups operating out of Humboldt valley base camps. Under these conditions, one might expect a temporal vector to technological change in the extraction and processing of raw material from particular kinds of sources (surface cobbles, colluvium, bedrock outcrops) that require different levels of effort for exploitation and that yield different cost-benefit ratios. It may be that, while some sources at Tosawihi were exhausted, others continued to be worked through increased level of effort, change in technological efficiency, or acceptance of poorer quality raw material.

Investigative Strategies

Temporal change in the use of Tosawihi Quarries is likely to be signaled by variations in proportions of diagnostic artifacts and number of features dated through radiocarbon or obsidian hydrations.

Criteria for Research Potential

Any dated site, component, or discrete feature provides important data relevant to the problem of temporal variation in the use of Tosawihi Quarries.

Temporal Variation in Knapping Technology

Differences in the technology of stone tool manufacture are expected between the Pre-Archaic and Archaic (Elston 1982, 1986a). Pre-Archaic tools are large; bifacial implements are broad, thin, and carefully flaked. In the Archaic, tools are smaller and less consistent in attention to symmetry, relative thinness, and other details. There is a tendency for Archaic tools to decrease in size through time, but, at present, there is little evidence for change in the basic technology of biface manufacture during the Archaic of the western Great Basin (Elston and Budy 1990; Novick 1987). However, local changes in intensity of use, site function, and organization of production may have incorporated technological changes at Tosawihi that would not be evident elsewhere.

Investigative Strategies

Temporal variation in knapping technology may be evident upon analysis of assemblages from distinct stratigraphic components at habitation sites or in technological comparisons between quarry and reduction localities.

Criteria for Research Potential

As with temporal variation in quarry use, any dated site, component, or discrete feature provides important data relevant to the problem of temporal variation in knapping technology.

Paleoenvironmental Reconstruction

Considerable climatic and environmental variation has occurred in the Great Basin since the end of the Pleistocene (Wells 1983; Mehringer 1986). Whether or not these changes were of sufficient magnitude to effect the density and distribution of non-lithic resources at Tosawihi and vicinity through time adds a temporal dimension to questions regarding prehistoric economy.

Investigative Strategies

Paleoenvironmental reconstruction is a complex issue that can be approached through numerous lines of evidence (Bradley 1985). Aside from basic stratigraphy and sedimentology, the approach with most promise for the present work is recovery and analysis of faunal remains from alluvial sites and discrete features.

Criteria for Research Significance

Any site which contains dated paleoenvironmental evidence (faunal remains, pollen, or plant macrofossils) has the potential to inform regarding paleoenvironments at Tosawihi Quarries.

Research Methods

The following section describes field and laboratory methods employed in the collection and analysis of cultural remains and other information.

Field Methods

Field methods were designed to recover data appropriate to identified research problems. As sites vary in the abundance, kind, and distribution of data categories, so field methods varied depending upon whether the site contained a primary toolstone source or whether it served as a secondary reduction and/or residential locus.

The initial assessment of sites involved intensive surface reconnaissance, mapping, and systematic collection. First, formed artifacts and features were located by close interval (two meter) transect survey; precise site boundaries were established and mapped. Formed artifacts (i.e., obviously modified tools, bifaces, and cores) not part of a defined feature locus were assigned specimen numbers, mapped, and collected; obsidian flakes of a size suitable for sourcing were collected similarly.

A datum was established at each site, each artifact and feature located, and a contour map prepared using a theodolite and electronic distance measuring device. Transit data and mapping notes were recorded in an HP 71 computer; files were transferred to floppy disc and printed daily. Later, mapping data were entered into a data base on a Kaypro 286i computer and contour maps were generated using the SURFER mapping program driving an HP 7475A plotter.

Features, defined as patterned arrangements of artifacts and human modifications of the landscape, commonly consist of debitage concentrations, tool clusters, and quarry pits; less frequent features include hearths, adits, rockshelters, and living surfaces. As each feature was located, a central datum was set and its location recorded using the total station. Artifactual arrangements were drawn in plan view and described. Formed artifacts were plotted on the plan, assigned specimen numbers, and collected.

A sample of the features then was selected judgmentally for more intensive study; the sample drawn reflects the full range of discernible surface variability exhibited by the features recorded at the site. Sample features are the foci of systematic collection. In most cases, the entire surface assemblage was collected, using a 1 m grid system. Collection was conducted by skim shoveling the upper 2 cm below surface and passing the sediment through 1/4 in. screen. Where the abundance of surface materials precludes total recovery, certain features were sampled systematically, with smaller units arranged along a transect.

During assessment, sites with accumulations of alluvial or eolian sediments were tested with one or more backhoe trenches. Trench profiles were cleaned and scraped and the presence of artifacts and cultural features noted. Profiles demonstrating significant buried cultural materials were photographed, profiled, and described in detail.

Controlled excavation sampled both feature and nonfeature contexts; units of variable size (but usually 1 by 1 m or 50 cm by 1 m) were excavated to bedrock or to an appropriate depth devoid of artifacts. Where backhoe trenches resulted in the identification of cultural layers or features, excavation units were placed adjacent the trench in order to further explore the feature. Materials were segregated by 10 cm arbitrary levels and sorted through either 1/8 in. or 1/4 in. screen. Excavation unit size and screen mesh used are reported for each site in subsequent chapters.

Strategies for assessing quarry sites varied somewhat from those used at secondary reduction, residential, and other open sites. Survey methods remain consistent: isolated artifacts and obsidian were located and collected, and features mapped and recorded formally. Sample quarry features, however, received special treatment to extract data on their structure, the quality of toolstone present, and the kinds and intensity of activities carried out. Owing to the great volume of material (both cultural and non-cultural) present at quarry features, a systematic sample usually was collected from the surface in several standardized contexts (interior, berm, exterior). Both cultural and non-cultural materials were recovered from sample units to allow assessment in the laboratory of the volumetric relationships of debitage to shatter and naturally weathered opalite. Subsequent to collection, the feature was trenched, either by hand or backhoe, in order to expose its internal structure. Profiles were drawn and sediment samples collected from each discernible layer, as feasible.

Bulk samples were returned to the laboratory for processing and constituent analysis. These samples were used to calculate volumes of waste rock removed versus volume of toolstone extracted. Cultural materials also were used for mass debitage analysis.

Cultural materials at outcrop quarries often are scattered along several hundred feet of rimrock. Debitage was sampled with a combination of systematic feature collections and discretionary collection units, and limited excavation. Cobble quarries, which tend to lack concentrations of cultural material, were sampled variously with discretionary collection units. Samples of unmodified toolstone were collected from all quarry sites for chemical identification and quality assessments.

Intact rockshelters with vertical cultural deposits hold tremendous potential for supplying data relative to several research problems. Assessment of rockshelters tested the abundance and spatial patterning of cultural materials, depth and integrity of deposits, degree of preservation of organic remains, and the presence of plant macrofossils and dateable charcoal. Strategies varied depending on the size and apparent depth of deposits, but in all cases entailed detailed mapping, recording, and collecting of surface artifacts. Subsurface testing included controlled excavation and cross sectional exposure using hand-excavated trenches, as appropriate.

The recovery of radiocarbon samples from all appropriate charcoal deposits was emphasized. Charcoal concentrations were exposed, cleaned, and sampled when first encountered. Charcoal was collected with a clean trowel and wrapped in aluminum foil. Then, the context was exposed fully and evaluated for contamination by roots, krotovina, or recent human intrusion. This procedure insured recovery of charcoal from thin, ephemeral cultural lenses which might be destroyed or contaminated in the course of excavation.

Field Documentation

Records documenting the progress of excavation, methods used, and findings were maintained on a daily basis. Mapping notes were recorded as previously described. Soils and geomorphology notes were recorded in concert with stratigraphic drawings. Excavation unit/level records, completed for every excavated level, include horizontal plan views, description of findings, a list of samples collected, and general soil descriptions.

A reference number system is employed to retain control over samples, artifacts, and recording forms. In this system, each completed form is assigned a unique reference number maintained in a reference number log. The latter documents the unit to which each number is assigned and other pertinent data. Each assigned reference number then was included on associated field records and artifact bags.

Collected materials were placed in bags marked with site number, excavation unit, level, date, collection personnel, reference number, and bag number. Color and black and white 35 mm photographs document all phases of the field work. Photo record forms were maintained for each roll and exposure. Slides, prints, and negatives were indexed and stored in plastic sleeves.

Laboratory Procedures

Once transported to the laboratory, collections were cleaned, sorted, labeled, and cataloged. Each distinctive artifact or artifact lot was assigned a catalog number comprised of site number, reference number, and specimen number. When possible and prudent, the number was applied directly to the artifact using indelible white or black ink covered with clear lacquer. Debitage, bone fragments, and other bulk sample items were cataloged in lots. All non-organic materials were placed in clean plastic bags identified with provenience tags that identifies catalog number, artifact class, excavation unit and level, date of recovery, collector, and cataloger.

As materials were logged in at the lab, personnel sorted special samples from more typical level and surface collection bags. Radiocarbon, flotation, soil, and bulk sediment samples were held out for special handling. Radiocarbon samples, some of which were derived from floated sediment samples, were cleaned manually of soil, air-dried, and weighed. They were repackaged in clean aluminum foil, then placed in plastic bags and shipped to Beta Analytic, Inc., for dating.

Flotation samples were weighed and processed by means of an agitated water system which segregates light organic material from heavy soil matrix, each of which is collected, dried and rebagged separately, ready for analysis.

Analytic Methods

Certain standard analytical methods are applied consistently throughout the Great Basin for describing and classifying particular artifact classes and for identifying faunal remains. Our analysis follows procedures developed by Thomas (1981) for projectile points, by Juell (1990) for ground stone, by Madsen (1977) for ceramics, and by Lyman (1979) for faunal materials. All analytical data were coded and entered into a computer data base. Several data categories, recorded and entered in anticipation of detailed analysis in the data recovery phase, are not analyzed here.

Technological Analysis of Flaked Stone Artifacts

Basic data gathered for all tool categories include specimen measurements (length, width, thickness, and weight), material type, color, and quality, presence or absence of cortex, presence of thermal alteration (if any), and evidence of utilization.

Length, width, and thickness of each piece was measured to the nearest tenth of a millimeter with the aid of calipers. Determining longitudinal axis differed slightly among tool types, as illustrated in Figure 5. In the case of cores, choppers, and battered stones, observers oriented each specimen relative to its observed (when whole) or imagined (when fragmentary) longitudinal axis. After length was established, width and thickness were measured relative to it, for all tools. Width is the longest axis perpendicular to the length; thickness is the maximum distance between faces.

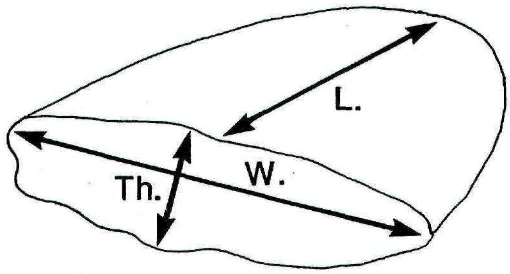
Orienting a biface for measurement requires identifying proximal and distal ends of a complete piece, or recognizing the fragment according to its proximal, distal, medial, or lateral position on a once-complete biface. In most cases, biface length is greater than width, but occasionally the converse is true.

For flake tools, the observer first distinguished proximal (bulbar) and distal (feathered, hinged, or stepped) ends of the original flake (tool blank). The line between them forms the longitudinal axis of the piece; width and thickness are as above. Very commonly, flake length is less than flake width, as shown in Figure 5.

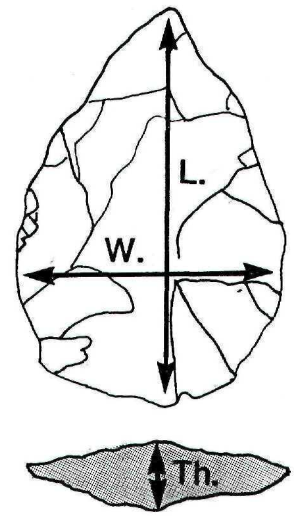
Each tool or tool fragment was weighed to the nearest tenth of a gram on an OHAUS Brainweigh B1500 electronic scale.

Bifaces and flake tools were assigned to one of five material type categories: cryptocrystalline silicate, (hereafter CCS), CCS with quartz, obsidian, basalt, and other. Virtually all CCS and CCS with quartz appearing in the collection is

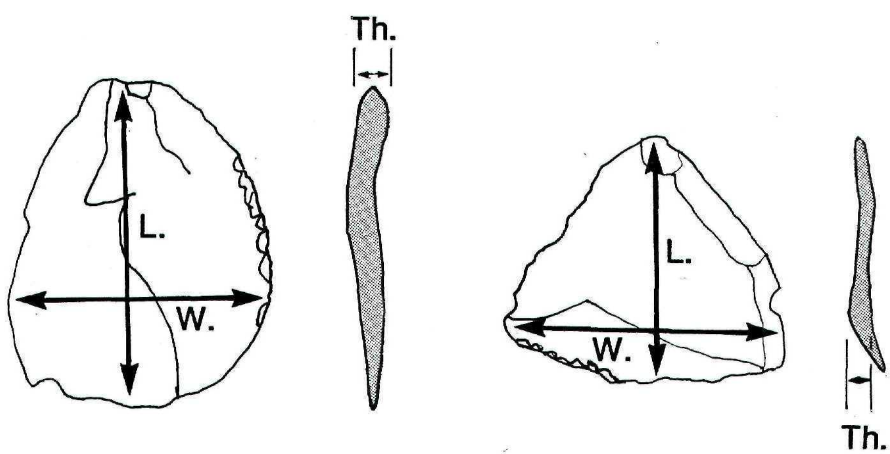
Figure 5. Measurement axes for three tool types.



Hammerstone



Biface



Flake Tools

Tosawihi opalite and jasper. For cores and percussion tools, the list of categories was expanded to include sandstone, quartzite, rhyolite, and tabular versus massive basalt.

Tosawihi opalite occurs in an array of colors and color may represent a key to particular quarry sources, to toolstone quality, and/or to prehistoric cultural preference. Observers recorded the color of each tool, regardless of material type, comparing the piece viewed under 60 watt incandescent lighting to color chips in the GSA Rock-Color Chart (1984 edition).

For cryptocrystalline artifacts, observers determined stone quality by degree of "flawedness" observed. "Excellent" toolstone has no observable flaws (i.e., vugs, cracks, or internal stress lines). "Good" material has few faults, none of which has proven fatal to tool completion. A piece with fatal flaws is graded "poor". Large vugs, unsilicified bands, fracture planes, and extreme potlidding and crenation from heat treatment are observed fatal flaws. The "degree of siliceousness" was also estimated for opalite tools. Tosawihi opalite grades from very white, shiny, hydated material, which is brittle and poorly silicified, to a more dense, resilient stone with grainy to waxy textures, found in numerous colors. The former is a poor opalite, the latter a good to excellent grade.

Observers noted presence or absence of heat treatment on cryptocrystalline specimens and identified obvious traits of thermal alteration such as crenation or pot-lidding, and suspiciously shiny versus dull surfaces on truncations and flake scars. We recognize that thermal alteration is not always detectable.

Additional data specific to the particular tool type under study were gathered. For example, special biface considerations included trajectory, reduction stage (Callahan 1979), fragment type, manufacture failure, and evidence of redirection/ reworking.

Areas of overlap in tool type assignments are recognized among Tosawihi specimens. For example, a bifacially reduced artifact exhibits the obvious attributes of an end scraper. In these preliminary analyses, this tool is not categorized as a biface but as a flake tool, functional class "end scraper". Conversely, a complete or partial biface may have utilized edges, created by cutting actions; it is categorized as a utilized biface.

A gray area exists between chunky Stage II quarry bifaces and spheroid cores. On many nodules, only recognized opposing faces determine that a piece is a biface, not a core. At the other extreme, a crude biface might be considered a stylized core; indeed, the reduction of a quarry trajectory biface produced a large number of useful flakes. Too, the Tosawihi preform category is awkward in that it includes projectile point preforms as well as very small biface forms, the function of which is not known. For purposes of this report, preforms are discussed with projectile points (see Chapter 3), but are analyzed with biface forms.

Attributes important to flake tool analysis include blank type (i.e., flake type), fragment type, functional class, number and type of edge unit (eus), technological approach (unmodified, uniface, biface, etc.), and evidence of redirection/reworking. For purposes of analysis, the flake tool category includes scrapers, knives, drills and other perforators, gravers, spokeshaves, and multi-purpose cutting and scraping tools.

The term "edge unit" refers to any edge, or portion thereof, which has been modified through casual use, purposeful flaking (retouch), and/or resharpening. It is discussed in greater detail in Chapter 3.

Cores and assayed pieces are considered together, classified into six categories based on Callahan (1979): assayed piece, block core, spheroid core, split nodule core, core fragment, and other. Each is discussed in greater detail in Chapter 3.

Percussion tools include hammerstones and choppers. Attributes observed for the form were blank type, degree of use, and functional type. Degree of use (light, moderate, or heavy) is determined by extent of battering. A tool with light use has small, discontinuous areas of battering on edges and ends. A heavily-used hammerstone or chopper exhibits extensive and continuous battering and/or flaking sufficient to modify the overall shape of the tool.

Debitage

Debitage, the by-product of lithic reduction, includes shatter, flakes, and cores. These items are distinguished from non-debitage by the presence of attributes of positive or negative flake scars.

Herein, debitage refers to unmodified flakes and shatter; cores were isolated from debitage and cataloged as individual artifacts, along with modified and utilized flakes, as previously described. Debitage analysis employs two basic approaches: mass analysis and attribute analysis; each provides information different from the other about lithic reduction technology. Mass debitage analysis, following the methods described below, was initiated on behalf the present project and pursued through the data collection phase.

Mass Debitage Analysis

Mass analysis assumes that different reduction technologies produce debitage with different size distributions, and that these can be recognized in archaeological assemblages. Ahler (1988; Ahler and Christensen 1983), after discriminant analysis of 652 debitage assemblages generated by experimental replication, found significant differences in debitage size distribution among the following technologies: raw material testing, freehand core reduction, bipolar core reduction, large biface production, biface finishing/resharpening, flake tool production/resharpening, and small biface (pressure) reduction.

Samples of screened debitage from surface collections and excavations, and bulk samples from quarry features, were prepared for mass analysis in subsequent phases of study, generally following the methods of Ahler (1972, 1975a, 1986a, 1987) developed for his study of the Knife River Flint Quarries of North Dakota and related sites.

Selected debitage samples and bulk sediment samples containing debitage, were weighed and then sorted into as many as six size grades (1.0, 0.5, 0.25, 0.11, 0.046, and < 0.046 in.) each of which then was weighed, counted, and observed as described below. The data thus obtained were used to estimate the parameters of the total sample. Sorting was accomplished by pouring each sample through chicken wire to remove particles larger than 1.25 in., and thence into a stack of U. S. Standard sieves for 30 seconds of agitation in a mechanical shaker. Samples too large to be sorted in their entirety were poured through chicken wire and thence through a 16 chute box splitter to obtain randomly smaller fractions; the sample fraction then was run through the sieves, and material from each size grade combined.

Statistical Methods

For the present testing phase of work at Tosawihi, statistical manipulations remained largely descriptive, and analysis focused upon the biface collection.

Summary statistics (mean, range, sum, standard error, kurtosis, minimum, maximum, standard deviation, and skewedness) were used to analyze bifaces along a number of parameters. Length, width, thickness, and weight were described in this manner for the total population of bifaces and for the subpopulations of the three study areas. These data were obtained for all bifaces, and for the subgroups defined by stages. Biface caches were isolated and analyzed as well.

Width-thickness ratios were calculated by stage for the total population of bifaces and for each of the separate areas.

T-test and chi square statistics (Blalock 1979) were employed to evaluate differences between various samples of artifacts. The t-test statistic sought significant differences in the mean length of biface populations recovered from USX-East and USX-West areas, and for contrasting mean lengths between the quarry and small biface trajectories. The chi square statistic inquired whether or not quarry and small biface populations were composed differently in terms of stages.

Analysis of other tool types was more straightforward, crosstabulating the distribution of tools and assayed pieces across areas, sites, and features. Functional classes also were analyzed in terms of heat treatment, blank type, and other variables.

Counts and weights of debitage were summed for each size grade as well as totalled by reference number; flakes and shatter were treated separately. Average weight per individual was calculated. The results were displayed by site, feature, and material type to aid comparison.

Part II. Artifact Descriptions

In the following four chapters, artifacts are described according to their technofunctional classes. Chapter 3 deals with cores, bifaces, and flaked stone fabrication tools such as scrapers and perforators. Projectile point styles and chronology, are described in Chapter 4. Ground, battered, and scratched stone tools include plant processing tools, abraders, hammerstones, and tools used for platform preparation in lithic reduction; these are described in Chapter 5. Pottery, described in Chapter 6, includes both Fremont Grayware and Shoshone Brownware ceramics.

Chapter 3. CORES, BIFACES, AND FLAKE TOOLS

by C. Lynn Furnis, Margaret C. Brown, and Robert G. Elston

Most flaked stone tools in the present collection fall into one of three general categories: cores, bifaces, and flake tools. Each of these broad categories is in turn divided into classes. In the case of cores and bifaces, classes are thought to reflect technological approaches to procurement and reduction. In contrast, flake tool classes are based on morphological and functional distinctions. These classes are devised for the purposes of evaluating testing results; all such classes are tentative and subject to revision during more detailed analysis anticipated in connection with data recovery.

Cores

Two hundred thirty-one cores were collected, but many more were observed at the sites tested. The modus operandi was to collect all cores found within features, excavation units, and surface collection units; those located elsewhere on the sites were noted but left in situ. However, exceptional pieces were recovered regardless of location. The core assemblage, then, is limited intentionally.

Cores were recovered from 40 sites: 17 in USX-West, 3 in the North Access Corridor, and 20 in USX-East. Most cores are from USX-East (n=135), compared to 87 from USX-West and 9 from the North Access Corridor. Nearly all recovered cores are opalite, though a few specimens (n=18) are basalt, obsidian, rhyolite tuff, quartzite, and siltstone. For analytical purposes, we distinguish six core types: assayed piece, spheroid core, block core, split nodule, core fragment, and "other". The following text is organized according to these categories.

As pointed out by Callahan and others (Callahan 1979: 41-65; Zerga and Elston 1989), numerous quarry bifaces may actually be cores. We have chosen to categorize all tools with biface morphology as bifaces, recognizing the probable flake production function of large bifaces.

Core types and frequencies are arrayed in Table 3, below.

Table 3. Tosawihi Core Types Arrayed by Geographical Area.

CORE TYPE

Area	Assay No.	Assay %	Spheroid No.	Spheroid %	Block No.	Block %	Split Nodule No.	Split Nodule %	Core Fragment No.	Core Fragment %	Other No.	Other %	Total
East	15	11	67	50	23	17	3	2	27	20	0	0	135
West	3	3	56	64	16	18	1	1	10	12	1	1	87
North	1	11	2	22	4	44	0	0	2	22	0	0	9
Total	19	8	125	54	43	19	4	2	39	17	1	0	231

Assayed Pieces

Testing a cobble or nodule by removal of a few flakes allows the knapper to examine the fresh, unweathered toolstone. If the stone is found unsuitable, the piece is rejected. The result is an assayed piece.

Nineteen assayed pieces are identified, composing 8.0% of cores. Toolstone sources are most abundant in USX-East of the three areas tested. We thus expected that area to yield an abundance of assayed pieces and, indeed, 79% of recovered assayed pieces are from USX-East. Approximately half all assayed pieces are weathered cobbles with a few flakes snapped from the surface, or are split cobbles with a few flakes removed from interior faces. The other half are "chunks", i.e., large angular pieces of shatter which have been tested.

All the assayed pieces are white or light-colored opalite, except for one of basalt (26Ek3271-1044-7) and another of buff-colored, poorly silicified tuff (26Ek3196-2003-1). Rhyolite tuff is a local material, interbedded with Tosawihi opalite. Assayed pieces measure between 75 mm and 185 mm maximum dimension, and weigh between 227 gm and 1602 gm. Only two specimens appear heat-treated; one is from the west (26Ek3104-500-4), the other from the north (26Ek3237-500-70).

Spheroid Cores

Definitions for spheroid and block cores are after Callahan (1979:41-63). Spheroid cores are very irregular polyhedral in shape. Flakes have been removed in a seemingly random pattern because the knapper has made use of all likely platform areas, removing flakes from numerous directions on one core. This is in contrast to block core appearance which is characterized by systematic, patterned flake removal. Spheroid core reduction requires a complex flint-knapping strategy which results in very little flaking waste according to Callahan (1979: 63, 65).

Spheroid cores account for 54% (n=125) of the collection. Proportionately, they are more abundant in USX-West (comprising 64% of cores there) than in the east, where they account for 50% of cores (cf. Table 3). These trends may reflect a greater need to consume raw material in the USX-West area which has relatively few toolstone sources.

Spheroid cores range from 43 mm to 238 mm maximum dimension, weighing from 63 gm to 1913 gm. Most are blocky, oblong, opalite chunks. They vary considerably in size, but not in overall morphology. None of the core blanks is a flake, and only a very few were made on weathered cobbles.

Four material types are represented among the spheroid cores: light (n=115) and dark (n=5) opalites, jasper (n=2), basalt (n=2), and siltstone (n=1). "Dark" opalite has a chromatic value between 1 and 6, while "light" opalite has values of 7, 8, or 9 in the GSA Rock-Color Chart (1984). All are local toolstones, with the exception of dark blue-gray siltstone. The latter resembles material observed near James Creek Shelter, in northern Eureka County (Robert Elston, personal communication), but it probably occurs closer to Tosawihi Quarries as well.

Of 125 spheroid cores, 17 (14%) appear thermally altered; 12 of these are from the west, accounting for 21% of spheroid cores there. Five are from the east, comprising 7% of eastern spheroid cores. Three utilized cores (26Ek3170-2023-3, 26Ek3185-1004-1, and 26Ek3204-500-2), all from the east, exhibit minimal scraping use wear on very steep edges. A fourth core, of basalt (26Ek3271-519-3), is from the west; moderate battering is apparent on two edges, perhaps the result of chopping or hammering action.

Block Cores

Block core reduction is characterized by systematic removal of blade-like flakes. As Callahan illustrates them, block cores have broad flat "tops" and bodies which either narrow to a point at the bottom (i.e., funnel-shaped) or are parallel-sided (Callahan 1979: 41-63). The Tosawihi specimens include block, funnel, and semi-domed shapes, always with broad, flat tops. The top is the flaking platform; parallel flakes are systematically struck from its perimeter down the sides of the bodies. Both long, parallel-sided flakes (blades) and broad, short flakes might be created from such a core. In the case of Tosawihi blocks, several examples have two opposing "tops" or platforms, with a series of parallel flake scars associated with each.

There are 43 Tosawihi block cores, accounting for 17% and 18% in east and west areas, respectively, and 44% (n=4) in north road sites, as shown in Table 3.

Block cores are made from four local toolstones, but most (n=34) are light-colored opalites. Two dark-colored opalites, five basalt, one jasper, and one quartzite core were also recovered. Quartzite cobbles are abundant in USX-East drainages. Basalt and quartzite cores retain large cortex surfaces, usually on the broad platform tops; all apparently were made from large weathered cobbles. Block core maximum dimensions range from 47 mm to 162 mm, and weigh from 52 gm to 1414 gm.

Split Nodules

This core type is made on a small, rounded pebble which has been split in half and then flaked. Four split nodules were recovered, all of them waterworn obsidian pebbles. One (26Ek3095-1045-1) is from USX-West, the remainder from USX-East sites. The obsidian is from an unknown source, but is black and translucent with a rough, pitted cortex that is present on all four nodules. The four cores are similar in size, ranging from 28 mm to 45 mm maximum dimension, weighing from 7 gm to 41 gm. They comprise 2% of all cores.

Core Fragments

This category includes 39 fragments of block and spheroid cores which are too small or too deficient in salient attributes to classify with confidence. All are light-colored opalite pieces of angular shape, measuring between 20mm and 125mm in length, and between 13gm and 543gm in weight. They account for 17% of the total collection.

Other Cores

One piece which does not fit any of the five categories described above is labeled "other". The specimen (26Ek3160-500-275) is a tabular piece of pale blue opalite, sandwiched between tuff strata which form the opposing faces. A few large flakes have been removed from each end. It measures 95.5 mm long, 64.0 mm wide, 27.9 mm thick, and 125.4 gm in weight.

Summary

Discounting assayed pieces, we know that four core types occur in the study areas: biface, spheroid, block, and split nodule. Bifacial cores are certainly most numerous, and are discussed later. About half of all remaining cores are spheroid. They may represent the second core type of choice for a couple of reasons. Initial chunk or nodule form is not strictly constrained; almost any opalite chunk with reasonable striking edge and flake area will suffice. Callahan found during his Clovis biface experiments that less waste material is produced in spheroid core reduction (20-30%) than in block core flaking (40-60%) (Callahan 1979:65). While the Tosawihi Quarries are extensive, with a seemingly endless supply of opalite, individual knappers apparently chose to conserve their quality toolstone as much as possible.

The advantage of block cores over spheroids is that they produce lots of blade-like flakes. Since spheroid cores comprise 54% of the collection, and block cores account for only 19% of the total, production of blade-like flakes from block cores may have been a secondary goal.

Finally, there are split nodules, of which there are few specimens (n=4). All are obsidian pebbles with cortex. We do not know where they originated, though they all appear waterworn, as if gathered in drainages. There are no known obsidian sources in the vicinity of Tosawihi.

Bifaces

Biface implements constitute the largest category of tools (n=2509) collected from the 67 tested sites. As used here, "bifaces" include all bifacially worked tools, from large, chunky core-like nodules to small, very thin projectile point preforms. Functionally specific bifaces, such as projectile points and drills, are excluded from the biface category, though they are desired end products of biface reduction.

We imposed a "trajectory" system to handle the variety of observed form and size trends within the biface population. First organizing the specimens by trajectory, we hoped to isolate groups significantly different in size range and probable end product. The bifaces are organized into three trajectories for purposes of discussion. "Quarry" or "large" bifaces are treated first, then "Small" bifaces, "Preforms", and "Indeterminate" bifaces. In the present analysis, trajectory is based on the relative size of the original flake or nodule from which a tool has been fashioned.

Different trajectories have different end products (Muto 1971) and trajectories are organized by general size range; reduction stage defines the degree of reduction within each size group. Trajectories are more or less arbitrarily divided into one of five lithic reduction stages, based on Errett Callahan's "stages of manufacture for Clovis-like biface artifacts" (1979:9, 35-37). Callahan defines nine stages for the complete reduction of a blank to a finished, fluted and retouched Clovis projectile point, ready for hafting. While devised for Clovis tools, the first five reduction stages are applicable to biface reduction in general, covering the sequence from blank acquisition to biface shaping stage. Thus, the same stage sequence is applied to all three trajectories described here even though blanks and end products are of different sizes in each.

Some discussion of the term preform is in order. For purposes of this report, "preform" refers to the smallest biface forms. Most are regarded as projectile point preforms, and others as small tools of unknown purpose. Callahan employs the term differently, using "rough preform" and "refined preform" to describe large Stage II, III, and IV bifaces equivalent in size to those in our quarry trajectory. He prefers "to call a biface a preform if it is at that stage of manufacture just preceding final specification of shape" (Callahan 1979: 36).

In the case of small bifaces and preforms, numerous Stage II artifacts have a flattened cross-section (i.e., plano-convex or flat with bevelled edges) even when only edge preparation has been completed. This occurs because the tool blank is a thin flake, requiring little or no thinning. Elston noted the same phenomenon among medium and small-sized bifaces from the Vista site; it "represents a special reduction technique...in which the tool is finished, but one (usually the ventral) or both faces are only marginally or partially reduced"(Zeier and Elston 1986: 141).

Our five reduction stages are defined as follow (after Callahan 1979: 36-37):

Stage I: Obtaining the blank. Blanks are simply nodules or flake forms of suitable size and form for large biface manufacture. Stage I pieces were not identified systematically and segregated as such in the field or in the lab. Hence, few are counted in our collection, though more may lay hidden in the recovered debitage.

Stage II: Initial edging. A blank is considered a Stage II biface when it has been edged, but neither face has been thoroughly flaked. Prepared edges are bevelled by percussion removal of relatively short, thick flakes from one or both faces. Such removal effectively prepares the edges for removal of well-formed thinning flakes in the Stage III sequence. With small bifaces, and especially preforms, the bevel is often created by "scrubbing" the margin of the flake blank with an abrader (Elston 1986b:148). When viewed edge-on, the edge line of a Stage II biface is irregular and sinuous, the length of flake scars on either face are generally less than half the width of the piece. Bevels created on small bifaces and preforms by abrasion may be only a few millimeters wide. In addition, the biface cross-section is a flattened hexagon or thick lenticular shape.

Stage III: Primary Thinning. This stage involves the removal of flakes which extend to, or slightly beyond, the center of the biface, producing a lenticular in cross-section. In plan view, the outline of Stage III biface is often irregular, with spurs between flake scars. At this stage, thinning of the biface body is most important. The edge line remains sinuous, though dips between arrises are less severe than with Stage II bifaces. The successful biface is reduced in thickness more than it is reduced in width or length at this point.

Stage IV: Secondary Thinning. A Stage IV biface is characterized by flake scars which cross the midline and considerably undercut those originating from the opposite edge of the same face. A successful piece is devoid of large humps, step-fractures and hinges, and its cross-section has a flattened biconvex shape. The outline is more regular, as most knobs and spurs have been removed. A side view reveals a much more regular, straighter edge line.

Stage V: Shaping. A Stage V biface is not only thin and thoroughly reduced on both faces, but the edges are manicured with fine flaking, giving a specified shape to the piece. In other words, by Stage V, the knapper has focused his attention on the biface outline. Thinning of the body is complete, so that refining of the tool perimeter to a desired shape is the primary focus.

Nearly all Tosawihi bifaces have been keyed to one of these five "stages of manufacture". Those which cannot be keyed are labeled "Indeterminate".

Quarry Bifaces

The single largest tool class from Tosawihi are quarry bifaces, consisting of 1632 items. The production of large bifaces appears to have been the major focus of prehistoric toolstone extraction and processing at Tosawihi Quarries. Bill Bloomer (personal communication) suggested that the size of these objects, and the reduction technology employed in their processing, set them apart from other bifacial tools found at Tosawihi. Quarry bifaces are large enough to have functioned as both tools and as cores for the production of flake blanks suitable for flake tools, small bifaces, and projectile points. As shown in Table 4, 298 specimens (18%) are complete, while 1334 range from exceedingly fragmentary to nearly complete; minimum, maximum, and mean dimensions of the group are given.

Summarizing the size range information provided in Table 4, we can say that quarry bifaces measure between 223.00 mm and

61.0mm in length, between 145.0mm and 34.0mm in width, and between 93.0mm and 11.0mm in thickness. Generally, they are made from blanks about the size of an extended hand and larger.

Some Stage II quarry bifaces are much like spheroid cores, except that they have two opposing faces, (i.e., a rough biface configuration) but great thickness in proportion to other dimensions.

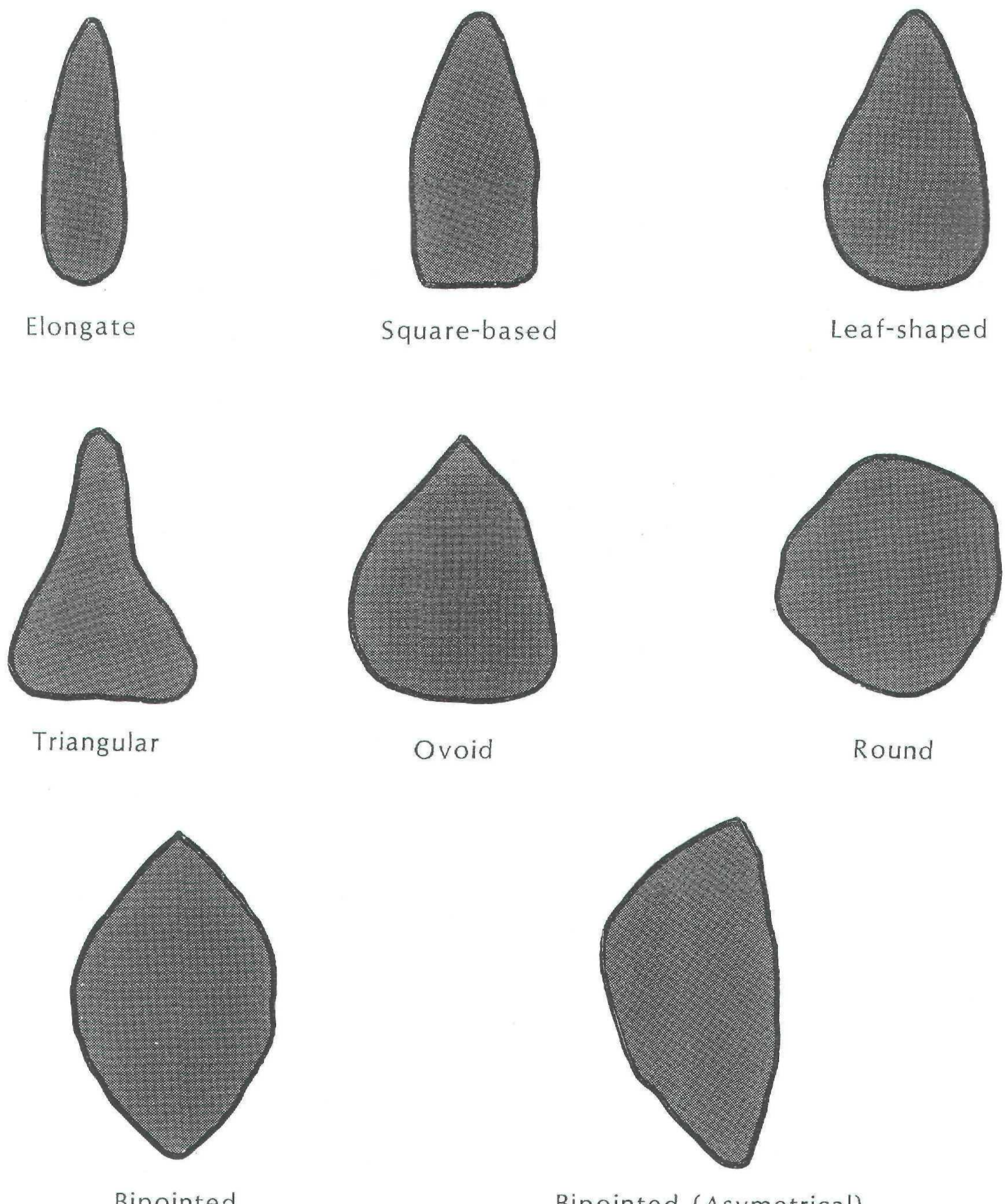
Table 4. Minimum, Maximum, and Mean Dimensions for Quarry Trajectory Bifaces.

Dimensions	Complete n=298	Fragmentary n=1334
Length		
maximum	223.00 mm	160.00 mm
minimum	61.70 mm	8.10 mm
mean	116.12 mm	67.83 mm
Width		
maximum	135.50 mm	145.00 mm
minimum	34.50 mm	5.20 mm
mean	71.31 mm	57.97 mm
Thickness		
maximum	93.00 mm	67.00 mm
minimum	11.00 mm	4.80 mm
mean	28.73 mm	19.23 mm
Weight		
maximum	1409.80 gm	1071.90 gm
minimum	39.50 gm	1.50 gm
mean	246.80 gm	88.09 gm

T-tests were performed on the mean lengths of bifaces to compare quarry biface and small biface trajectories within study areas, and to contrast biface dimensions of the same trajectory across areas. At the .01 level, quarry bifaces and small bifaces differ significantly from each other in both areas (west t-score 7.255 > 2.62, east 13.8 > 2.58). Quarry bifaces from USX-East, closer to quarry sources, were also significantly larger than quarry bifaces from USX-West at the .01 level (3.57 > 2.58). Small bifaces from the two areas were not found to be significantly different.

We have observed a variety of quarry biface shapes (cf. Figure 6). Although this variation suggests a continuum, wide bipointed and leaf-shaped bifaces appear to be the most common forms.

Figure 6. Observed shapes of quarry bifaces.


Elongate
Square-based
Leaf-shaped
Triangular
Ovoid
Round
Bipointed
Bipointed (Asymetrical)

Some trends are apparent in the data provided in Table 5. Grouped by reduction stage, most quarry bifaces fall into Stage II and Stage III categories. Together, the two groups account for 81% of all quarry bifaces in the collection. The next largest category is Stage IV, comprising 9.4% of all bifaces. Only six individuals of the 1632 recovered are Stage I or Stage V quarry bifaces, representing the extremes of the reduction spectrum. Although the dearth of Stage I quarry blanks may be due, in part, to a failure to seek them out systematically, few really large well-formed flakes were recovered. Consider that such items were the object of the quarrying effort. Since any modification to a blank immediately qualifies it as a Stage II biface, few blanks are expected. The two Stage V quarry bifaces recovered are broken. The data suggest that quarry bifaces usually were transported from Tosawihi Quarries in Stage III or IV. Thus, any further reduction must have taken place during the time the biface was used to produce flake tool blanks and to perform various tasks. The few broken bifaces at the quarries probably represent tools used up elsewhere and discarded as new tools were procured.

Table 5. Selected Attributes of Quarry Trajectory Bifaces.

	Reduction Stage						
Dimensions in mm.	I	II	III	IV	V	Indeterm.	Total
Mean length (c)	120.53	116.55	115.62	125.50	0	0	116.13
Mean length (f)	74.40	76.08	66.75	62.26	56.95	53.37	67.84
Mean width (c)	83.13	72.15	69.68	47.30	0	0	71.31
Mean width (f)	94.75	63.73	57.58	52.75	43.95	47.40	57.92
Mean thickness (c)	32.96	31.12	24.62	12.60	0	0	28.73
Mean thickness (f)	34.05	24.92	17.35	11.11	8.30	18.11	19.23
Mean weight (c) (in grams)	299.57	270.10	207.41	81.20	0	0	246.80
Mean weight (f)	274.05	133.05	76.77	42.13	23.50	45.19	87.89
Heat treated specimens	n % 2 50	n % 306 49	n % 388 55	n % 104 68	n % 2 100	n % 88 59	n % 888 54
Whole specimens	3 75	187 30	107 15	1 >1	0 0	0 0	298 18
Total No.	4 0.2	626 38.3	697 42.7	154 9.4	2 0.1	149 9.1	1632 99.8

(c) = complete specimens
(f) = incomplete specimens

The two Stage V quarry bifaces were recovered from Bitterroot Ridge in USX-West, some distance from the main quarrying area. Both bifaces are broken. The first (26Ek3160-2001-3) had been heat-treated and thoroughly flaked after heating. Still, an internal material flaw caused it to fail during reduction. The second piece (26Ek3095-500-40) was broken much sooner after heat-treatment, as the only shiny surface resulting from heat-treatment occurs on the mechanical truncation, created by end shock. No flakes were removed from the extant biface half (proximal) after heating.

Intentional thermal alteration is a significant variable in the reduction of opalite bifaces. As shown in Table 5, more than half the total assemblage (54%) has been heat-treated. Approximately 50% of the quarry bifaces in Stages I through III are thermally altered, with increasingly higher proportions in Stages IV and V. This is reasonable since pieces that survive intentional heating will be reduced further and refined.

Only 18% (n=298) of quarry bifaces are complete. Tracking the ratio of complete versus incomplete specimens from early to late stages, we observe that nearly all complete bifaces are contained within the early stages; only one is recorded for the Stage IV group and there are none in Stage V. Many Stage II and Stage III artifacts are quite thick in proportion to their lengths and widths, and probably rejected because they could not be thinned sufficiently. The lack of complete late stage bifaces also supports the notion that the thinner a biface becomes, the more likely it is to break during manufacture.

Overall size reduction occurs throughout the 5-stage biface manufacturing sequence. Table 5 indicates that mean length of whole and fragmentary bifaces tends to diminish with greater stage reduction. Mean width, thickness, and weight steadily decrease from Stage II to Stage IV. The large mean length for Stage V quarry bifaces is due to the presence of a single large individual. Too few Stage I and Stage V quarry bifaces exist for comparison. Although there are staged, incomplete bifaces reflect similar trends, but with more modest differences between stages, as shown in Table 6.

Table 6. Relative Mean Size Change from Stage II to Stage IV Quarry Bifaces.

	% Change	
Dimensions	Complete	Incomplete
Width	34 decrease	17 decrease
Thickness	60 decrease	55 decrease
Weight	70 decrease	68 decrease

Table 6 also shows that Tosawihi bifaces are thinned at nearly twice the rate than they are narrowed.

Callahan (1979:35) discusses his long-time struggle to advance his own flint-knapping skills, finding at last the key to successful biface reduction by controlling the rate of thinning and reducing biface thickness at a faster rate than width. With regard to Tosawihi bifaces, we assume that prehistorically desirable biface forms have greater width/ thickness ratios than rejected implements. In other words, substantial body thinning is a primary goal of prehistoric quarriers who intend to transport, trade, and further reduce large numbers of bifaces.

Four biface caches were discovered in the course of fieldwork. Together, they yielded 83 quarry bifaces and one small biface, comprising 5% of the total quarry biface collection. Since 63 of the 83 specimens are complete, the whole specimens account for a disproportionate fraction (21%) of all complete quarry bifaces (n=298). Unlike those in the other caches, opalite bifaces in the 26Ek3184 cache are all fragments, seemingly selected for similarity in size and shape. The one intact specimen is a chunky obsidian biface. Assuming the cached tools are prized, curated examples and most other quarry bifaces are rejected pieces, we should observe differences in width/thickness ratios between the two populations. In Table 7, we compare the mean w/t ratios of the total biface population from tested sites, the population in each cache, and the total biface population from all sites, excluding cached bifaces. The mean W/T values by stage for Tosawihi cached bifaces are essentially the same as those derived by Callahan (1979) in his experiments. With the exception of the obsidian specimen in the cache from site 26Ek3184, all cached bifaces have greater mean w/t ratios than do Tosawihi bifaces in general, intact or not. In fact, the fragmentary specimens in 26Ek3184 have the greatest mean w/t ratio of all, suggesting purposeful selection of items with a high potential for reworking.

Material Types

Of the 1612 opalite specimens, most are white, gray, or grayish blue opalite, but pink, pale purple, salmon pink, and yellow opalites appear as well. These are "light" opalites, with chroma values of 7, 8, or 9 on the GSA Rock-Color Chart (1984). Eight opalite bifaces are fashioned from very dark purplish red to golden brown varieties of Tosawihi stone, with chromatic values of 1 through 6 on the same Color Chart.

Tosawihi opalite varies considerably in quality and texture, as well as in color. The most common variety encountered during 1988 fieldwork is a massive, yellowish-white to grayish-white material. In quality, it grades from good, or nearly flawless, to extremely "vuggy"; in many USX-East quarry pit sites, this type of opalite is riddled with vugs 5 mm to 50 mm in diameter. Its texture ranges from smooth and waxy to matte and grainy.

Table 7. Mean Width/Thickness Ratios of Selected Quarry Biface Populations, by Reduction Stage.

Biface Population		Reduction Stage I n	%	II n	%	III n	%	IV n	%	V n	%	Indeterm. n	%	Total Mean	
All Quarry Bifaces	(c)	2.60	(3)	2.50	(187)	3.00	(107)	3.90	(1)	0	(0)	0	(0)	2.68	(298)
(n=1632)	(f)	3.39	(1)	2.81	(439)	3.62	(590)	4.94	(153)	5.34	(2)	2.93	(149)	3.43	(1334)
26Ek3095 cache	(c)	0	(0)	1.82	(1)	3.18	(7)	3.90	(1)	0	(0)	0	(0)	3.11	(9)
(n=11)	(f)	0	(0)	0	(0)	4.66	(1)	0	(0)	0	(0)	1.59	(1)	3.13	(2)
26Ek3184 cache	(c)	0	(0)	2.20	(1)	0	(0)	0	(0)	0	(0)	0	(0)	2.20	(1)
(n=14)	(f)	0	(0)	3.59	(1)	3.94	(10)	5.02	(2)	0	(0)	0	(0)	4.08	(13)
26Ek3192 cache	(c)	4.56	(1)	3.34	(9)	3.48	(28)	0	(0)	0	(0)	0	(0)	3.48	(38)
(n=41)	(f)	0	(0)	2.95	(1)	2.96	(2)	0	(0)	0	(0)	0	(0)	2.96	(3)
26Ek3197 cache	(c)	0	(0)	2.65	(11)	2.36	(3)	0	(0)	0	(0)	0	(0)	2.59	(14)
(n=17)	(f)	0	(0)	2.50	(2)	3.35	(1)	0	(0)	0	(0)	0	(0)	2.78	(3)
All Tosawihi Bifaces not	(c)	2.65	(2)	2.40	(165)	2.85	(69)	0	(0)	0	(0)	0	(0)	2.54	(236)
in Caches (n=1549)	(f)	3.39	(1)	2.81	(435)	3.60	(576)	4.95	(151)	5.34	(2)	2.93	(148)	3.43	(1313)
Callahan's (1979) W/T (c) Ratio, derived from experimental replication		0	(0)	2.00-3.00		3.00-4.00		4.00-5.00		4.00-6.00		N/A		N/A	

(c) = complete specimens
(f) = incomplete specimens

Resembling concrete, many specimens of gray brecciated opalite contain small to large gray, angular opalite inclusions. Bifaces of this material dominate the caches from sites 26Ek3095, 26Ek3192, and 26Ek3197. Most are complete and few have been heat-treated. This toolstone is generally high-quality. In texture, it varies from waxy and smooth to grainy and rough.

Another toolstone remarkable for its rarity and high quality has a bluish-gray, translucent matrix with opaque white blotches and smooth waxy to grainy texture. The few implements manufactured from this material are eye-catching.

Opalites of pink, purple, and red hue tend to be shiny and smooth in texture, and very limited in distribution at Tosawihi. Few quarry bifaces are made of these materials, which commonly are used for flake tools, preforms, and small bifaces.

Eleven bifaces are made of jasper, another local material quarried at site 26Ek3084. Five are leaf-shaped, three are ovoid, and three are indeterminate in shape. Seven implements, five of them complete, were retrieved from USX-West sites (26Ek3092 and 26Ek3271); one is from USX-East (26Ek3185), and two are from a North Road Corridor site (26Ek3238). Complete specimens vary in length from 61.0 mm to 103.0 mm.

During survey of USX-West (Budy 1988), a Stage II jasper biface (26Ek3084-38-1) was collected from a pile of quarry waste at site 26Ek3084. Shown in Figure 7, the specimen, is a quite large, leaf-shaped artifact measuring 225.0 mm long, 107.0 mm wide, 40.7 mm thick, and 1206.6 g in weight. However, it is longitudinally curved, like a banana, probably the cause of its discard. A very large flake scar on one face is evidence that flake blanks of sufficient size for small quarry bifaces or larger small bifaces could have been struck from bifacial cores of this size.

One basalt biface (26Ek3095-515-1) occurs in the collection, a complete Stage II biface of roughly lanceolate shape, measuring 160.0 mm long, 74.7 mm wide, and 30.7 mm thick. Basalt is a local Tosawihi toolstone, from which numerous other large tools are made, such as planers, scrapers, cores, choppers, and hammerstones.

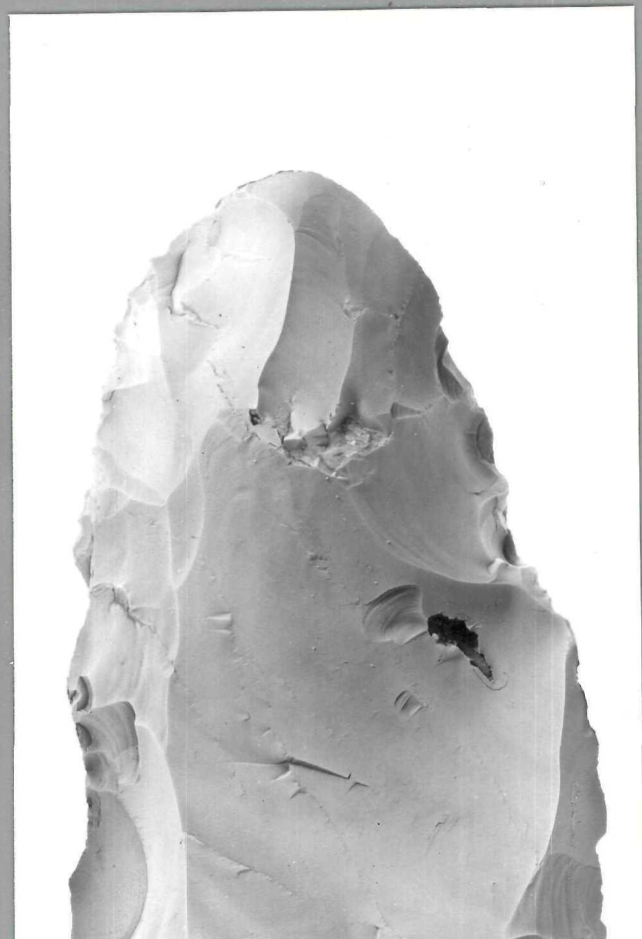
Evidence of Utilization

During biface analysis, utilized edges were observed and noted. Only 19 quarry bifaces are recorded as utilized. One (26Ek3170-502-3) has a scraper edge, three others have perforating features (26Ek3115-501-1, -1004-1, and -1008-1). The remainder have more generalized utilized edges.

Biface Caches

Four biface caches were discovered in the course of fieldwork. One from site 26Ek3095 is the only cache from USX-West. The others are from USX-East sites, 26Ek3184 and 26Ek3192 in the Hole Plug region, and 26Ek3197 in the Undine region. Each cache is discussed below, and within its site context in later chapters.

Figure 7. Large jasper biface from 26Ek3084, specimen 38-1.


0
5
cm

Site 26Ek3095, Feature 24

The smallest biface cache was recovered from site 26Ek3095. Eleven specimens were collected from the test excavation, but excavators suspect, from probing the outlying area, that more bifaces are buried at Feature 24. All specimens were discovered from 2 to 12 cm below ground surface. Three specimens from the cache are shown in Figure 8.

Table 8 summarizes various attributes of cache implements. Three toolstone varieties are present in the Feature 24 cache. The first nine bifaces listed are made of Type #1 opalite, matte opaque, yellowish white to light gray groundmass speckled with darker gray angular inclusions. None appears to have been thermally altered. The first seven on the list are complete specimens, comprising a graduated "set" of wide, bipointed bifaces. Alike in shape, material, and reduction stage, they regularly decrease in size. Their shared traits, particularly material type, suggest a single reducing event for this group. Specimen 26Ek3095-2081-3 (Figure 8a) is in the small biface size range, apparently made on a biface thinning flake, removed, perhaps, from one of the larger bifaces in the cache at an earlier stage of reduction.

One anomalous biface (26Ek3095-1081-7), an odd-shaped Stage II, was found in the cache, made of the same speckled gray opalite. In plan view, it is leaf-shaped, rather than bipointed. Viewed from the side, the distal portion is at a 45 degree angle to the proximal half. It apparently is a rejected failure, bearing a band of unsilicified tuff. At mid-point, a protruding edge was prepared for removal of the proximal half.

The final two bifaces listed in Table 8 are small implements, different from the rest in terms of material and shape. One (26Ek3095-2081-5) is a small, leaf-shaped jasper implement (Type 3). The other (26Ek3095-2081-2 and 6) the only Stage IV in the cache, is an elongate biface fashioned from pale bluish-gray opalite (Type 2).

Site 26Ek3192, Feature 1

The largest biface cache recovered consists of 41 quarry trajectory bifaces. All are considered complete, although seven specimens are missing small lateral portions the absence of which would not impede further reduction (Figures 9 and 10). Four shapes are represented in the cache: leaf-shaped (n=19), wide bipointed (n=11), square-based (n=7), and ovoid (n=4). Feature 1 specimens are all fashioned from one of four varieties of opalite. As all biface shapes are found in nearly all material variations, we can see no correlation or special preference for a particular shape in a particular opalite. Pertinent data are offered in Table 9.

Figure 8. Selected quarry bifaces from the Feature 24 cache, 26Ek3095.

a. specimen 2081-3
b. specimen 1081-1
c. specimen 2082-2

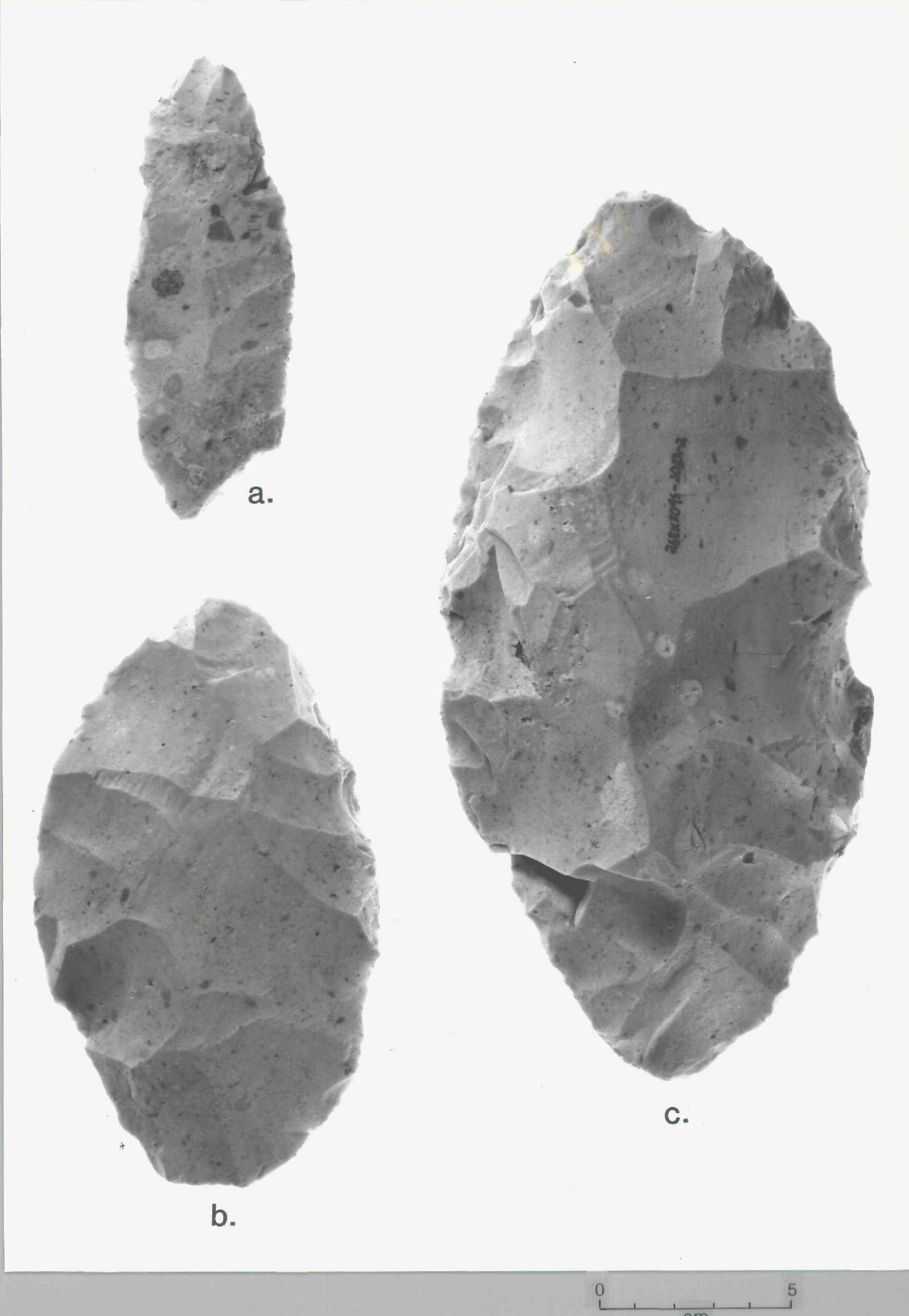
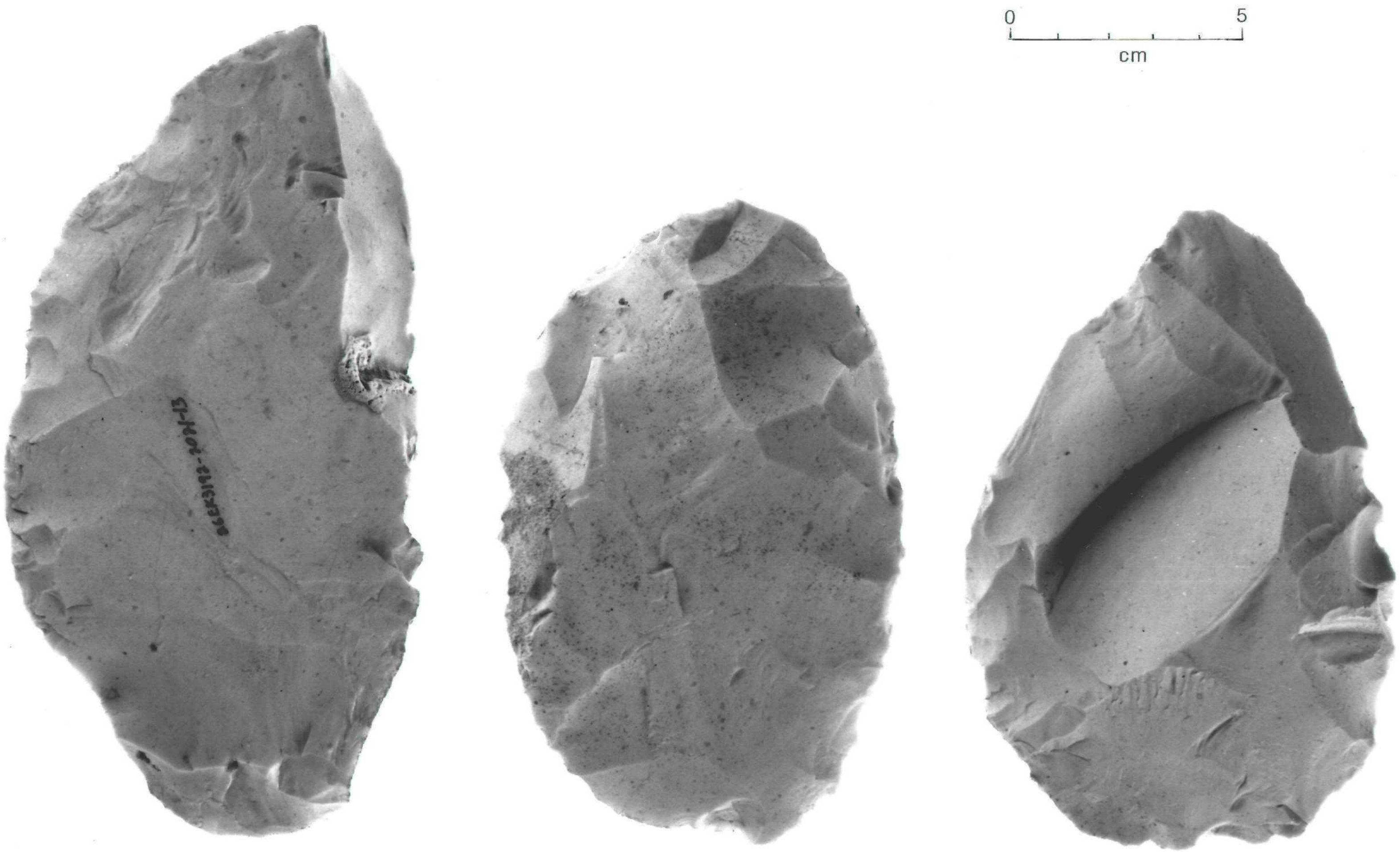

a.
b.
c.
0
5
cm

Figure 9. Selected quarry bifaces from the Feature 1 cache, 26Ek3192.

a. specimen 2021-13
b. specimen 2021-1
c. specimen 1012-2



a. b. c.

Figure 10. Selected quarry bifaces from the Feature 1 cache, 26Ek3192.

a. specimen 2022-23
b. specimen 2022-20
c. specimen 1010-9
d. specimen 2022-2

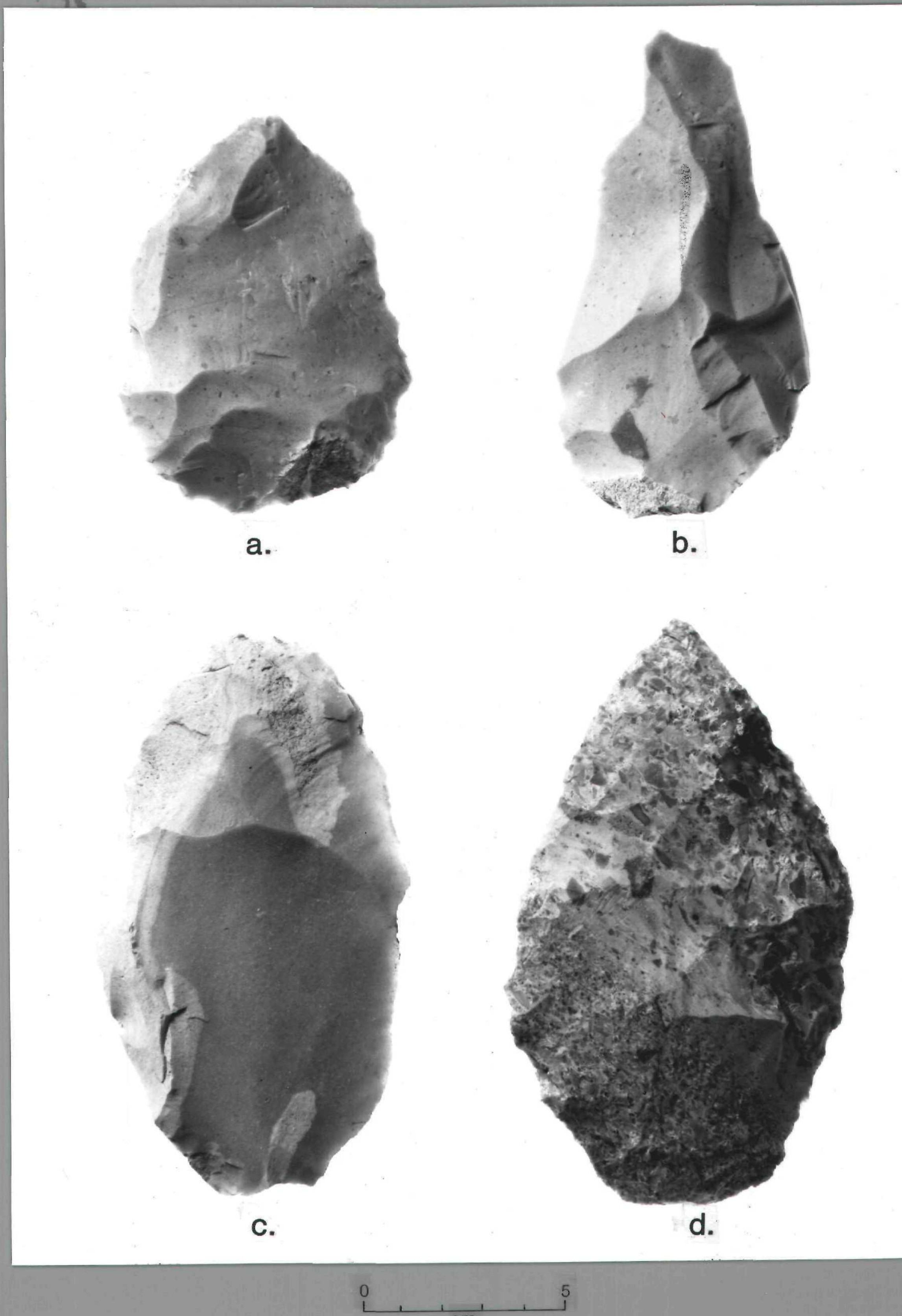

a.
b.
c.
d.
0
5
cm

Table 8. Selected Attributes of Eleven Bifaces from Site 26Ek3095, Feature 24 Cache.

Reference Number	Shape	Material Type/Color	Reduction Stage	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
2082-2	bipointed	#1 opalite - 5Y9/1	III	223.0	111.0	44.3	941.0
2081-1	bipointed	#1 opalite - 5Y9/1	III	205.0	97.7	34.4	701.2
2082-1	asymmetrical bipointed	#1 opalite - N8	III	174.0	96.3	25.1	451.3
2081-4	asymmetrical bipointed	#1 opalite - 5Y9/1	III	168.0	90.0	30.2	427.4
1081-1	asymmetrical bipointed	#1 opalite - 5Y9/1	III	151.0	89.0	26.1	353.8
2082-3	asymmetrical bipointed	#1 opalite - 5Y9/1	III	147.0	78.8	28.4	300.0
2081-3	bipointed	#1 opalite - 5Y9/1	III	118.2	44.4	11.2	59.8
2081-9*	indeterminate	#1 opalite - N8	Indeterminate	104.9	52.6	32.9	117.3
1081-7	leaf-shaped	#1 opalite - 5Y9/1	II	140.4	63.7	35.0	278.4
2081-5*	leaf-shaped	#3 jasper - 5R2/6	III	41.5	42.0	9.0	18.6
2081-6}			IV				
2081-2}	elongate	#2 opalite - 5B8/1	crossmend	126.7	48.4	12.4	81.3

* = incomplete specimen
#1 = Type 1 opalite
#2 = Type 2 opalite

Color Designations from GSA Rock-Color Chart (1984)
5Y9/1 = yellowish-white   5B8/1 = very light bluish-gray
N8 = very light gray   5R2/6 = very dark red

Only one specimen had been heat-treated. One-fourth (n=10) of the tools are Stage IIs; one is Stage I, a biface blank. The remainder are Stage III bifaces. As with the caches from 26Ek3095 and 26Ek3197, this assemblage may have been prepared and stored in anticipation of heat-treatment en masse. All are thin in relation to their width, even at Stage III reduction, suggesting they are choice specimens.

Of the four opalite varieties present in the cache, two are very similar to Types 1 and 2 from the 26Ek3095 cache. Colors range from white, yellowish-white, and gray, to light bluish gray.

Opalite Type 1 is very light gray, opaque, matte, grainy textured, with many small quartz crystal inclusions, occasional vugs of 1.0 mm to 6.0 mm diameter, and speckled throughout with darker gray, angular splotches of 1.0 mm to 4.0 mm length. Twenty bifaces are composed of the material; two are exceptional pieces because of their coloring. The first (26Ek3192-2022-1) is the basic opalite described here, with the addition of a secondary coloring of grayish pink (5YR 8/4). The other (26Ek3192-2022-2) consists of banded stone, each band of which contains a different size grade of dark gray angular inclusion, ranging from 1.0 mm to 3.0 mm diameter in one band, and from 2.0 mm to 11.0 mm in another.

Table 9. Selected Attributes of Forty-One Quarry Bifaces from Site 26Ek3192, Feature 1 Cache.

Reference Number	Shape	Material Type/Color	Reduction Stage	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
1012-2	leaf-shaped	#1 opalite - N9	II	146.0	97.5	28.0	361.5
1010-6	leaf-shaped	#1 opalite - 5Y9/1	IIh	137.0	90.3	27.8	324.8
2022-2	leaf-shaped	#1 opalite - N7	III	141.4	82.2	19.5	219.6
2021-14	leaf-shaped	#2 opalite - N8	III	136.7	85.2	20.6	268.8
2022-1	leaf-shaped	#1 opalite - N8 pink	II	132.0	86.2	28.2	327.7
2021-5	leaf-shaped	#1 opalite - N8	III	127.5	87.6	24.1	261.0
1010-4	leaf-shaped	#3 opalite - 5Y9/1	III	132.4	76.9	25.4	238.2
2022-8	leaf-shaped	#3 opalite - N8	II	131.3	77.6	22.0	289.0
1010-5	leaf-shaped	#1 opalite - N8	III	122.9	77.3	25.5	266.0
2021-8	leaf-shaped	#3 opalite - N8	II	121.5	88.1	22.1	226.0
2021-6	leaf-shaped	#3 opalite - N8	II	122.6	80.5	25.5	241.0
1010-3	leaf-shaped	#1 opalite - 5Y9/1	III	126.9	81.2	28.3	239.0
1010-8	leaf-shaped	#3 opalite - 5Y9/1	III	129.1	76.6	28.0	291.2
2021-2	leaf-shaped	#1 opalite - N8	II	121.2	82.6	28.0	234.0
2022-16	leaf-shaped	#3 opalite - N8	III	115.7	65.1	23.4	183.8
2022-18	leaf-shaped	#1 opalite - N8	III	112.0	70.3	18.8	152.6
2022-12	leaf-shaped	#3 opalite - N8	III	113.8	76.9	17.0	157.0
2022-7	leaf-shaped	#3 opalite - N8	III	104.3	72.5	21.1	173.7
2022-20	leaf-shaped	#1 opalite - N8	II	117.0	62.1	19.1	122.2
2021-13	bipointed	#1 opalite - N8	III	186.0	92.2	28.2	582.4
2021-12	bipointed	#2 opalite - N7	III	153.0	88.1	19.8	264.1
2021-11	bipointed	#1 opalite - N8	III	146.0	96.0	24.5	361.3
1010-7	bipointed	#3 opalite - N8	III	136.4	81.0	28.3	270.6
2022-5	bipointed	#4 opalite - N8	III	132.9	70.1	24.2	233.7
2022-9	bipointed	#3 opalite - N8	III	114.5	77.0	24.4	239.4
2021-15	bipointed	#3 opalite - N8	III	120.5	74.0	21.8	205.3
2021-7	bipointed	#3 opalite - N8	III	126.6	70.5	20.1	173.2
2022-21	bipointed	#1 opalite - N8	III	116.8	73.1	18.0	159.2
2022-22	bipointed	#1 opalite - N8	III	119.1	63.8	19.5	180.6
2022-14	bipointed	#1 opalite - 5B8/1	II	129.2	72.9	24.7	188.0
2021-1	square-base	# opalite - N8	III	149.0	92.8	32.2	430.0
2021-10	square-base	#1 opalite - N8	III	116.9	88.7	28.7	310.0
2021-4	square-base	#3 opalite - N8	III	118.3	74.7	20.5	210.2
2022-19	square-base	#1 opalite - N8	III	128.6	77.3	24.2	253.9
2022-10	square-base	#3 opalite - N8	III	120.1	68.8	21.7	168.5
2021-3	square-base	#2 opalite - N8	III	111.9	75.5	23.9	180.4
2022-13	square-base	#1 opalite - N8	II	108.4	79.5	21.4	221.9
2021-9	ovoid	#1 opalite - N8	III	110.6	85.2	29.1	291.7
2022-15	ovoid	#3 opalite - N8	III	106.2	78.9	17.2	160.0
2022-23	ovoid	#1 opalite - N8	II	96.2	71.9	19.0	127.4
1010-9	ovoid	#4 opalite - N7	I	134.5	74.8	16.4	177.4

Color Designations from GSA Rock-Color Chart (1984)
N9 = white
N8 = very light gray
N7 = light gray
5B8/1 = very light bluish-gray
5Y9/1 = yellowish-white

h = heat-treated

Opalite Type 2 is translucent, very light gray to light gray, with a waxy texture, occasional blotches and swirls of white, and occasional small vugs. Three implements in the cache are fashioned from it.

Type 3 is very light gray to yellowish-white opalite, opaque, with a grainy texture. It includes a high proportion of small quartz crystals (1.0 mm to 2.0 mm diameter) and varying amounts of tiny (ca 1.0 mm diameter) vugs. Sixteen bifaces are made from this material.

Material Type 4 is also light gray in color, with large swirls of white. It is translucent and has a sugary or grainy texture. It is high in quartz crystal inclusions, as with the first two types described. Two specimens, a bipointed biface (26Ek3192-2022-5) and an ovoid Stage I biface (26Ek3192-1010-9), are composed of the light gray translucent toolstone.

Site 26Ek3197, Feature 5

The third biface cache consists of 17 Stage II and Stage III bifaces, presented in Table 10; representative specimens are shown in Figure 11. Three shapes are represented: leaf-shaped (n=6), bipointed (n=9), and square-based (n=1). All are complete or nearly so, with three missing only small lateral pieces. In each case, the truncation has been partially flaked (i.e., repaired).

Two opalite types appear in the cache, one of which composes 15 of the 17 artifacts. The predominating Type 5 opalite resembles cement. It is very light gray in color, opaque, smooth (waxy) to very grainy in texture. Small vugs, tiny quartz crystals (1.0 mm in diameter), and dark gray angular specks are numerous. This toolstone does not resemble closely the toolstones from any of the other caches. While it shares color and inclusion types with Types 1 and 3 from 26Ek3095 and 26Ek3192, it has different proportions of the same ingredients.

The second stone type (Type 1 in all caches) is a gray to gray with pink opalite, opaque, with smooth texture, matte surface, occasional quartz crystals, and large angular dark gray blotches (4mm to 25mm long). Two leaf-shaped bifaces (26Ek3197-2001-2 and 26Ek3197-2001-13) are made of this material.

Table 10. Selected Attributes of Seventeen Bifaces from Site 26Ek3197, Feature 5 Cache.

Reference Number	Shape	Material Type/Color	Reduction Stage	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
505-1	leaf-shaped	#5 opalite - N8	II (f)	150.0	80.5	38.1	375.2
2001-3	leaf-shaped	#5 opalite - 5B7/1	III	141.8	71.5	31.6	297.3
2001-4	leaf-shaped	#5 opalite - N8	II	138.2	71.7	34.2	334.3
2001-13	leaf-shaped	#1 opalite - N8	II	135.0	81.9	26.7	246.3
2001-6	leaf-shaped	#5 opalite - 5B7/1	II	122.1	76.1	37.6	289.4
2001-2	leaf-shaped	#1 opalite - 5R8/2	III (f)	115.9	71.8	21.4	202.7
2001-5	bipointed	#5 opalite - N8	II	148.6	71.5	29.4	269.7
505-4	bipointed	#5 opalite - N8	II	140.4	70.0	16.7	227.4
505-3	bipointed	#5 opalite - N8	II (f)	133.5	74.0	25.5	295.7
2001-11	bipointed	#5 opalite - N8	II	137.2	74.2	28.5	285.2
2001-10	bipointed	#5 opalite - 5B7/1	II h?	131.4	76.2	27.1	282.5
505-2	bipointed	#5 opalite - 5YR8/1	III	127.9	79.8	31.1	285.5
2001-12	bipointed	#5 opalite - N8	II	136.2	88.1	33.6	313.8
2001-1	bipointed	#5 opalite - N8	II	135.2	75.0	32.5	290.9
2001-7	bipointed	#5 opalite - 5B7/1	III	122.6	73.0	31.9	273.4
2001-8	bipointed	#5 opalite - N8	II	143.3	72.5	32.5	295.9
2001-9	square-base	#5 opalite - N8	II	130.8	74.3	26.4	293.7

(f) = incomplete specimen
h = heat-treated

Color Designations from GSA Rock-Color Chart (1984)
N8 = very light gray
5B7/1 = light bluish gray
5YR8/2 = pale grayish orange pink
5YR8/1 = pinkish gray

Site 26Ek3184, Feature 1

A cache consisting of 15 bifaces was recovered from site 26Ek3184, Feature 1. Differing from all others, the cache consists of mostly incomplete bifaces (n=13), includes one obsidian small biface, and contains nine (60%) heat-treated implements. Pertinent data on the group are compiled in Table 11. Each fragment is an "end", representing approximately half a biface. Because of their very high W/T ratios, it is conceivable they were salvaged items for which further working was planned. On the other hand, the feature was very close to a road, and the cache may represent a pothunter's cache.

As shown in Table 11, the majority of bifaces in Feature 1 (n=11) are wide, with pointed ends. We cannot determine if they are proximal or distal fragments, or a mix of both. They may have been wide bipointed bifaces similar to the complete specimens from the 26Ek3095 cache. Six of the eleven "ends" are heat-treated; two are Stage IVs, and nine are Stage III artifacts. Four specimens are complete elongate, ovoid, round, and leaf-shaped tools.

Figure 11. Selected quarry bifaces from the Feature 5 cache, 26Ek3197.

a. specimen 2001-8
b. specimen 2001-1
c. specimen 2001-6
d. specimen 2001-11

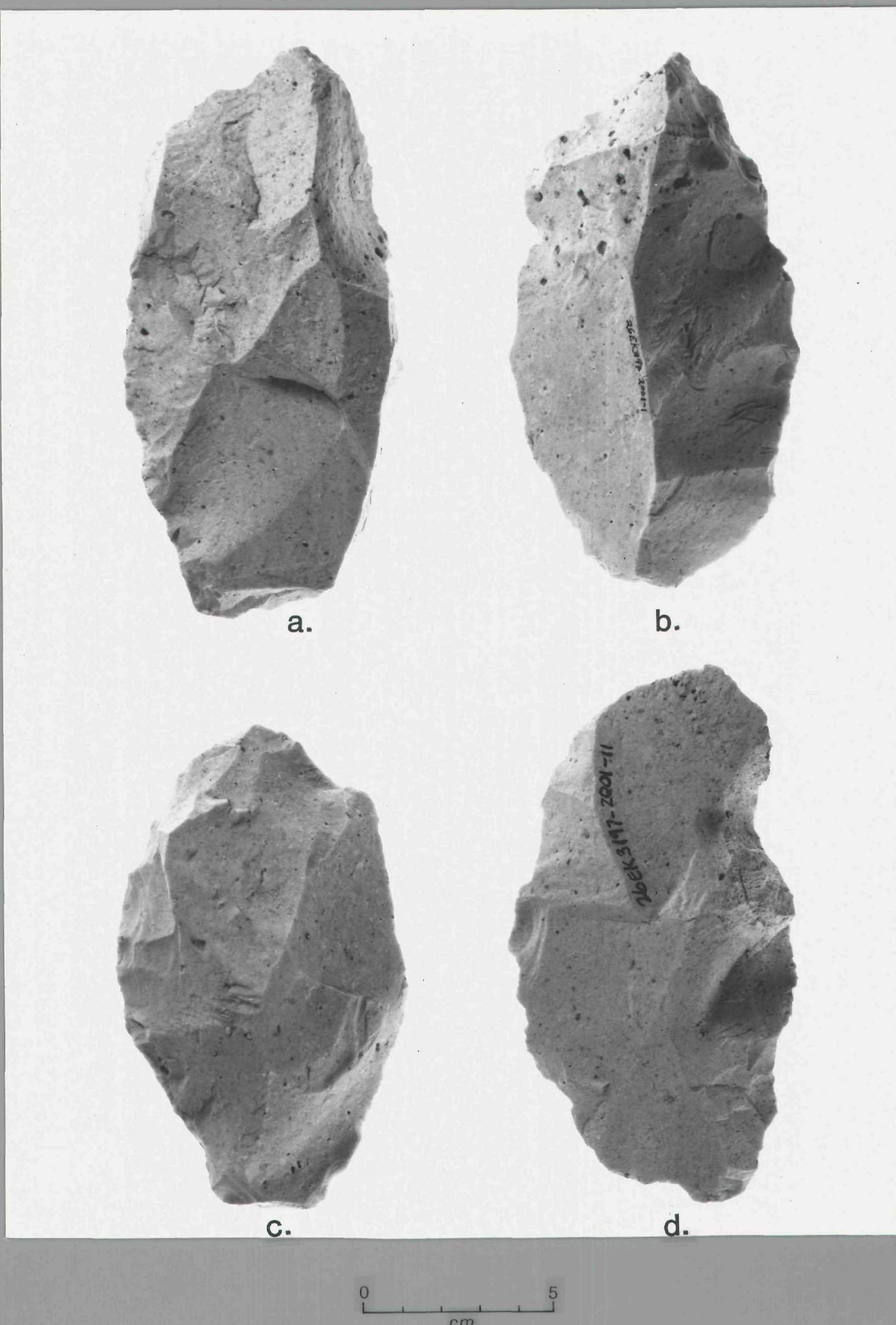

a.
b.
26EK3197-2001-11
c.
d.
0
5
cm

Table 11. Selected Attributes of Fifteen Bifaces from Site 26Ek3184, Feature 1.

Reference Number	Shape	Material Type/Color	Reduction Stage	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
1001-6*	pointed end	#4 opalite - 5B9/1	III h	133.5	71.7	17.1	141.8
1001-3*	pointed end	#4 opalite - 5B8/1	III h	112.0	55.9	16.9	94.8
1001-2*	pointed end	#2 opalite - N8	III h	67.1	70.5	13.8	76.2
1001-8*	pointed end	#2 opalite - 5B9/1	III h	60.8	71.8	14.5	58.2
1001-11*	pointed end	#2 opalite - 5B9/1	III h	59.3	77.8	22.3	79.6
1001-4*	pointed end	#1 opalite - 5Y8/1	III	56.6	58.4	13.5	40.3
1001-10*	pointed end	#1 opalite - 5Y9/1	IV	70.5	56.1	12.9	51.3
1001-12*	ovoid	#1 opalite - N8	II h	77.5	57.5	16.0	74.2
1001-14*	elongate	#1 opalite - N8	III h	85.8	46.5	18.5	67.5
1001-7*	pointed end	#3 opalite - 5GY8/1	III	71.8	62.5	17.0	75.9
1001-15*	pointed end	#3 opalite - 5R8/2	III h	80.0	65.0	16.2	82.2
1002-1	leaf-shaped	#3 opalite - 5Y8/1	II h	89.4	48.0	21.8	95.2
1001-5*	pointed end	#4 opalite - 5B9/1	III	62.4	76.8	19.5	107.7
1001-13*	pointed end	#6 opalite - N8	IV	62.5	57.6	10.1	38.8
1001-9	round	obsidian - N1	III s	59.3	53.0	14.7	39.1

* = incomplete specimen
h = heat-treated
s = small biface vs. quarry biface

Color Designations from GSA Rock-Color Chart (1984)
5B9/1 = bluish-white
5B8/1 = very light bluish-gray
N1 = black
N8 = very light gray
5Y8/1 = yellowish-gray
5GY8/1 = light greenish-gray
5R8/2 = grayish-pink

Five varieties of opalite are distinguished in this cache. Types 1, 2, 3, and 4 as described in the previous cache sections are present. One specimen (26Ek3184-1001-13) is made of a bluish-gray, translucent stone, with a smooth matte texture, occasional large white blotches and innumerable white specks, called Type 6 opalite. It resembles quartzite in appearance, but not in texture. The small, complete round biface is made of obsidian, a transparent black glass devoid of swirls, bands, or phenocrysts. As seen in Table 11, no one opalite variety predominates in the 26Ek3184 biface cache.

Summary

To summarize our general observations about quarry trajectory bifaces, virtually all (99%) the implements are composed of Tosawihi opalite. Most (82%) large bifaces are broken, slightly more than half are thermally-altered, and 81% are reduced to Stage II (edge preparation) and Stage III (primary thinning) levels. Apart from those in caches, most recovered bifaces are incomplete rejects representing manufacturing failures left at the quarry. Most successful, complete tools were probably carried away from Tosawihi.

The frequent incidence of heat-treating among early stage bifaces means that much intentional heating occurred at the quarry or its immediate vicinity. This may have been done to enhance workability for subsequent biface reduction as well as for production of usable flakes from bifacial cores. The low incidence of thermal alteration among the cache population, considered prize bifaces by us, is puzzling when contrasted to heat treatment for the total population. Perhaps cache bifaces from sites 26Ek3095, 26Ek3192, and 26Ek3197 have been heated, but never were flaked afterwards, making thermal alteration difficult to detect now. If they were not heated prior to being cached, then what lay in store for them? Did they await thermal alteration in a batch? Were people reluctant to invest the time in heat-treating a group of objects that might not be retrieved? Are they made of opalite varieties which do not require heating for successful reduction? Since most recovered bifaces from all sites are not composed of the speckled gray opalite that dominates the caches, perhaps frequency of heating correlates in some way with toolstone quality.

The bulk of quarry trajectory bifaces are Stage II or Stage III tools. The absence of Stage I bifaces (large blanks) suggests that blanks were not stockpiled for later knapping. Rather, shortly after being created, they were reduced to at least a Stage II state. The dearth of Stage IV implements in general, and the recovery of only one complete (in 2 pieces) Stage IV biface, suggests that most bifaces were not reduced beyond Stage IV before transportation. In other words, some secondary thinning work took place at Tosawihi, but virtually all successful Stage IV bifaces were taken elsewhere.

Other observations stem from internal differences in the collection as a whole. In Table 12, complete bifaces are compared by geographical area; these data can be compared to those for bifaces in caches presented in Table 7.

The comparisons are useful, pointing out some trends we expected to see. The greater the distance from the quarry, the smaller the biface. The biface cache implements (excepting 26Ek3184 which is mostly incomplete "ends") are generally longer, wider, and heavier than area and total population bifaces.

Table 12. Comparison of Complete Quarry Biface Dimensions by Geographical Area.

Area	No. of Items	Length (mm) mean / st.dev.	Width (mm) mean / st.dev.	Thickness (mm) mean / st.dev.	Weight (gm) mean / st.dev.
East	196	119.46 / 18.84	74.02 / 13.52	29.26 / 11.09	265.28 / 158.36
West	100	110.25 / 28.64	66.30 / 16.34	27.92 / 8.35	213.08 / 146.58
North Road	2	83.50 / 13.86	56.10 / 28.85	17.70 / 6.08	121.90 / 116.53
Total *	298	116.13 / 23.09	71.31 / 15.06	28.73 / 10.26	246.80 / 156.16

Small Bifaces

Small bifaces are artifacts made on relatively small flake blanks produced during the reduction of quarry bifaces and small cores. The smaller size of small bifaces means that, in contrast to quarry bifaces, their reduction produces few, if any, flakes suitable for use as flake tools. Aside from a generally small size range, small bifaces are also contrasted with quarry bifaces by a greater range of morphological variability.

Such artifacts are often referred to as knives in the Great Basin literature (Fowler and Matley 1979; Thomas 1983b; Zeier and Elston 1986). A photograph of 19 hafted stone knives from Southern Paiute (Southern Utah) ethnographic collection (Fowler and Matley 1979: Fig. 3, p. 156), as well as a photograph of two Northern Paiute stone knives (one hafted) collected from Pyramid Lake (Fowler and Liljeblad 1986: Fig. 3, p. 439), appear to contain examples of analogous artifacts, although the haft elements on most are obscured by the hafts themselves. Leaf-shaped, triangular and elongate small biface forms similar to those in the present collection have been recovered from James Creek Shelter (Elston and Budy 1990), and South Fork Shelter (Heizer et al. 1968; Spencer et al. 1987); both are stratified sites within 50 km of the Tosawihi Quarries.

We do not automatically assume that small bifaces were intended for use as knives, since many specimens could have served as preforms for dart points, and several used specimens exhibit scraper-like wear. Teasing apart the significance of the considerable morphological and functional variability in this artifact class is a task which will be left to analysis during data recovery.

Small bifaces were divided into reduction stages according to Callahan's (1979) scheme. Mean dimensions, weights and certain other attributes for each stage are presented in Table 13.

Most (96.8%) small bifaces are made of opalite. Obsidian artifacts make up the remainder (N=18) with no jasper, basalt or exotic chert small bifaces present. As expected, the proportion of thermally altered pieces (possible heat treatment) increases with stage. Relatively few pieces (N=18) show unambiguous signs of utilization.

Morphological variants among small bifaces include lanceolate, leaf-shaped, elongate, triangular, square based, ovoid/round. and constricting end, as described below. Two miscellaneous bifaces do not conform to these classes. Both specimens are irregular early reduction stage pieces. In addition, small biface fragments (N=338) are not assignable to any morphological class due to their small size.

Table 13. Selected Attributes of Small Bifaces.

Dimensions in mm	Reduction Stage I	II	III	IV	V	Indeterm.	Total
Mean Length (c)	-	72.3	66.4	56.6	93.8	29.8	
Mean Length (f)		44.5	42.3	40.6	51.53	30.2	
Mean Width (c)		52.3	42.4	40.3	33.6	21.4	
Mean Width (f)		37.9	33.2	32.7	32.2	31.2	
Mean thickness (c)		16.9	14.5	8.1	8.0	8.9	
Mean thickness (f)		9.8	8.6	7.1	6.2	7.8	
Mean weight (c)		66.4	46.2	21.4	26.8	5.7	
Mean weight (f)		19.6	13.4	10.5	12.4	6.8	
heat treated specimens		23	334	36	18	24	435
utilized specimens		3	14	1	-	-	
whole specimens		7	37	4	1	1	50
TOTAL No.		37	426	42	20	33	558

Lanceolate bifaces (n=3, 0.5 %) are either bipointed or have one end slightly larger than the other. One highly stylized Stage V specimen (26Ek3237-500-42, Figure 12e) is made on a flake blank with a large potlid on the dorsal and ventral surfaces. Fine oblique collateral flake patterning is evident on both faces, with unifacial edge wear perpendicular to the edge, indicating the tool was used as a scraper. All three lanceolate biface specimens are complete.

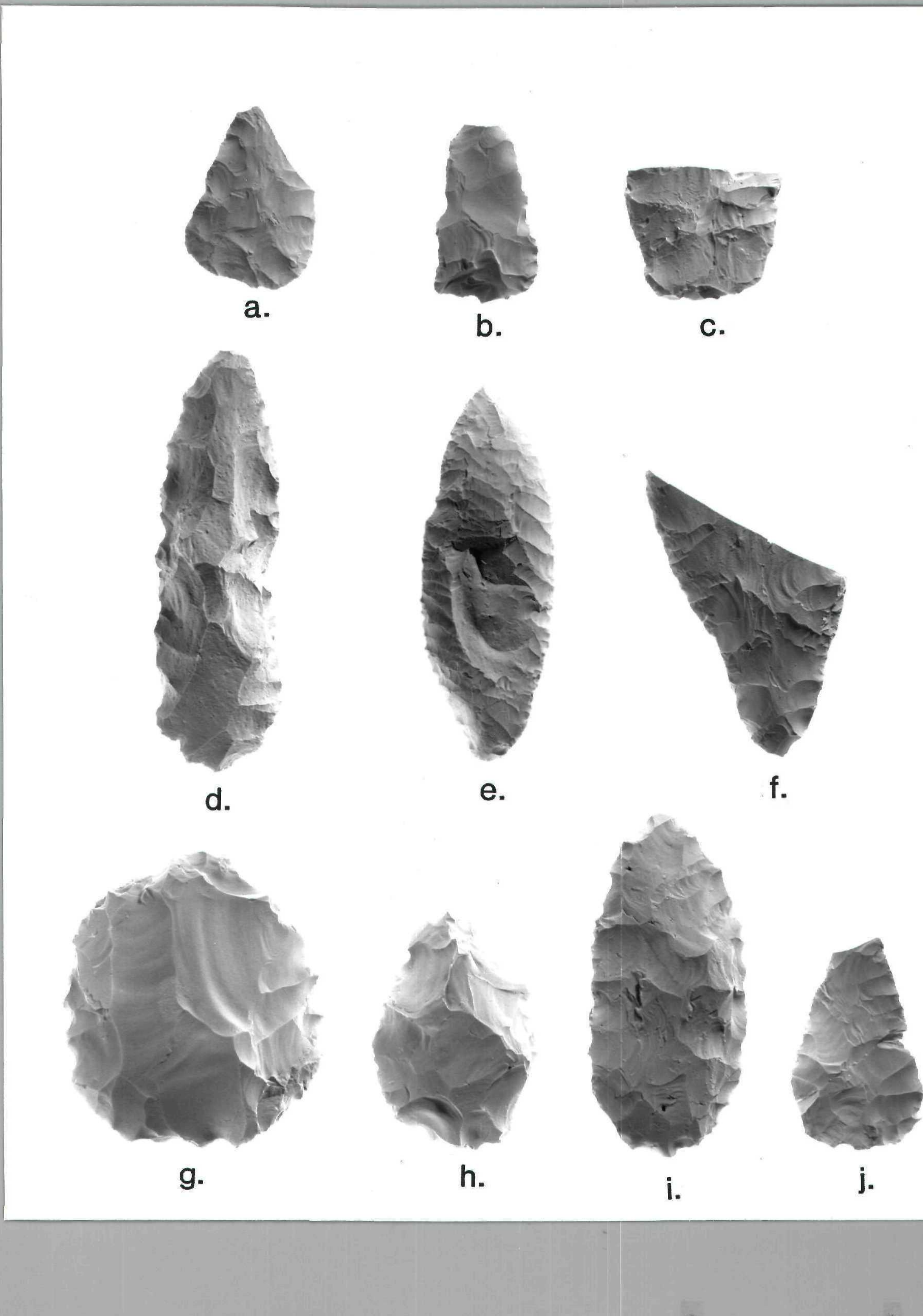
Leaf-shaped bifaces (n=82, 14.6%) are defined by a wide round base with a pointed to blunt distal end. The lateral margins are straight to slightly convex (Figure 12i, j). One late stage specimen (26Ek3190-505-1) is pressure retouched and has been utilized intensively on the proximal end, which exhibits unifacial edge wear, rounding, and polish. It strongly resembles an end scraper.

Elongate bifaces (n=46, 8.2%) have round bases with parallel lateral margins. These tend to be at least twice as long as they are wide, are thick in cross section, and, as a result, may represent thinning failures (Figure 12d).

Triangular bifaces (n=31, 5.5%) grade into leaf-shaped bifaces, although they are characterized by square bases rather than round ones. Distal ends are pointed to blunt, with straight, convex, or slightly concave lateral margins (Figure 12a, b). One highly stylized Stage II specimen (3102-500-5) is made on a wide, very thin flake blank, with fine pressure flake

Figure 12. Selected small bifaces; Triangular (a-b), Square-based (c), Elongate (d), Lanceolate (e), Constricting End (f), Ovoid (g-h), and Leaf-shaped (i-j).

a. 26Ek3160, specimen 523-1
b. 26Ek3160, specimen 500-161
c. 26Ek3160, specimen 500-226
d. 26Ek3160, specimen 517-11 and 12 (refitted)
e. 26Ek3237, specimen 500-42
f. 26Ek3095, specimen 500-14
g. 26Ek3204, specimen 500-63
h. 26Ek3271, specimen 500-131
i. 26Ek3271, specimen 1021-3
j. 26Ek3160, specimens 500-137 and 140 (refitted)


a.
b.
c.
d.
e.
f.
g.
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0
5
cm

scars along both lateral margins. The proximal end, though partially obscured by a break, has been modified to create a concave base.

Square based bifaces (n=9, 1.6%) are a slight variation of triangular bifaces. They exhibit flat bases with expanding lateral margins. All specimens are proximal fragments (Figure 12c).

Ovoid/round (n=33, 5.9%) specimens are primarily early stage bifaces and may be reduced cores or have been discarded as failures as they tend to be thick in cross-section (Figure 12g, h). Most have percussion flake scars ending in hinge fractures and have been utilized as scrapers, as demonstrated by unifacial edge wear on a strong, steep edge. One late stage specimen (26Ek3184-500-7) is thin in cross-section and has been resharpened and heavily used. Several discreet edge units on this tool are rounded and glossy with polish.

Constricting end bifaces (n= 14, 2.5%) exhibit the common characteristic of intentional narrowing of a terminal end (Figure 12f). These may be haft elements, though microscopic examination revealed no evidence of edge wear or hafting. They are utilized primarily as scrapers, and may be resharpened distal ends of hafted bifaces.

Flake Tools

A total of 514 artifacts from the Tosawihi assemblages are classified as flake tools. This general category consists of tools made on flakes, with limited shaping. When bifacial or unifacial shaping is present, it usually has been applied to create a particular type of edge or outline rather than as a means of thinning. Thus, flake tools range from utilized flakes without modification to specialized tools such as end scrapers, drills, and backed knives. However, Table 14 shows that only 16.7% of flake tools are simple utilized flakes without purposeful modification. The Tosawihi collection includes 39 reworked and utilized bifaces that have functional similarities with flake tools as defined above. Because biface analysis focuses on reduction stage, with little emphasis on use wear, these utilized bifacial artifacts are characterized by functional class and technological approach along with flake tools in Table 14.

Table 14. Comparison of Functional Class by Technological Approach.

	Unmodified Flake		Modified Flake		Uniface		Biface		Indeterminate		Other		
	n	%	n	%	n	%	n	%	n	%	n	%	Total
Scraper	55	18.3	206	68.4	6	2.0	15	.5	21	6.7	10	3.3	313
End Scraper	0	0	32	91.4	0	0	2	5.7	0	0	1	2.9	35
Knife	6	35.3	10	58.8	0	0	0	0	0	0	0	5.9	17
Graver	2	9.5	16	76.2	0	0	2	9.5	1	4.8	0	0	21
Perforator	0	0	24	54.6	0	0	17	38.6	3	6.8	0	0	44
Concave EU	0	0	10	100.0	0	0	0	0	0	0	0	0	10
Mutipurpose	22	40.7	31	57.4	0	0	1	1.9	0	0	0	0	54
Indeterminate	1	5.5	7	38.8			2	11.1	8	44.4	0	0	18
Other	0		2	100.0									2
Total	86	16.7	338	65.7	6	1.2	39	7.6	33	4.0	12	2.3	514

The method used for identification of use wear on tools first was developed by Knudson (1973) and defines an area of use, or employable unit as:

> ...that implement segment or portion (continuous edge or projection) deemed appropriate for use in performing a specific task, e.g. cutting, scraping, perforating, drilling, chopping. The unit is identified by deliberate retouch and/or apparent post production utilization modification, and its boundaries are defined subject to the analyst's concept of habitual use.

In the present analysis, a modified definition of EU, as employed by Elston, Davis, and Townsend (1976:27), is applied. Elston and his associates use EU as an Edge Unit which is "a segment of an edge which has been used, as demonstrated by the presence of obvious damage flake scars, polish or edge rounding." Zeier and Elston (1986:176) elaborate "... in that edges exhibiting modification without use wear are excluded (e.g. retouch, platform preparation). Further, EUs must show evidence of human use in the form of edge damage."

The present analysis was restricted, for the most part, to macroscopic observations and is considered to be preliminary. Functional assignments of EU(s), based on shape, location, and gross wear patterns (if any), include Scraper, End Scraper, Knife, Graver, Perforator, Spokeshave, Multipurpose, Indeterminate, and Other.

Table 15 gives the number of formed and resharpened EUs by functional class. Formed EUs are those created by flaking, while resharpening occurs after the EU has been utilized.

Table 15. Frequency of Formed and Resharpened EUs by Functional Class.

	Formed		Resharpened		
	n	%	n	%	Mean EUs
Scraper	253	81.1	9	2.9	1.93
End Scraper	35	100.0	3	8.6	3.62*
Knife	11	64.7			1.66
Graver	18	85.7			2.67
Perforator	44	100.0			2.27
Spokeshave	10	100.0			1.61
Multipurpose	32	59.2	1	1.9	2.70
Indeterminate	12	80.0			2.61
Other	2	100.0			

* This high value reflects hafting wear and damage on proximal lateral margins.

Raw material of flake tools is predominately local opalite (n=468, 91%), with 49.4% (n=231) showing evidence of thermal alteration. Frequencies of functional class by material type are given in Table 16.

Table 16. Frequency of Functional Class by Material Type.

	Opalite		Obsidian		Basalt		Exotic CCS		
	n	%	n	%	n	%	n	%	Total
Scraper	287	91.7	19	6.0	4	1.3	3	1.0	313
End Scraper	35	100.0	0		0		0		35
Knife	17	100.0	0		0		0		17
Graver	17	81.0	4	19.0	0		0		21
Perforator	41	93.2	3	6.8	0		0		44
Spokeshave	9	90.0	1	10.0	0		0		10
Multipurpose	45	83.3	9	16.7	0		0		54
Indeterminate	15	83.3	3	16.7	0		0		18
Other	2	100.0	0		0		0		2
Total	468						514		

Scrapers

Three hundred thirteen specimens are categorized as scrapers, representing a wide variety of flake type and sizes (Figure 13a-c). They tend to be unshaped, with appearance in planview determined by original flake shape, regardless of modification. When modified (retouched) prior to use, the result is a more substantial, steeper edge. Use wear, when present is unifacial and perpendicular to the edge.

End Scrapers

Thirty five artifacts fall into this class of more highly stylized tools. End scrapers are characterized by plano-convex cross-section and steep, unifacially modified EU which is commonly the distal termination of a flake (Figure 13d-g). The scraper edge is convex in planview, with modification (retouch) limited to the dorsal surface. In many cases, the flake has a slight longitudinal curvature and is distally expanding, with maximum thickness below the midsection. This flake type has lateral margins that constrict toward the platform. Hafting is suggested by frequent edge wear or damage on the proximal lateral margins. Several specimens made on large, thick flake blanks are quite hefty, and have been heavily utilized as *evident in rounded, crushed EUs. Specimen 26Ek3173-2001-1 is* unique in that it is a modified opalite cobble fragment, severely battered on two edges in addition to having been utilized as a scraper.

Knives

Seventeen artifacts are categorized as knives. These are small to medium size flakes, and, when retouched, the modification is limited to discreet edges with no significant alteration of the original flake shape. Use wear is generally bifacial, at an oblique angle to the edge.

Gravers

A total of 21 artifacts are gravers, or tools used to engrave or incise soft material such as wood or bone Figure 14a-c). Many of these are flakes with a pronounced longitudinal dorsal ridge and slight ventral curvature, modified on the margins to produce a stout, short unifacial projection. There is little or no retouch on the ventral surface.

Perforators

Forty-four artifacts are perforators, tools used to produce holes; drills and awls are not distinguished from this class. Perforators include a wide variety of forms, from simple flake tools to finely retouched bifaces (Figure 14d-k). They range from the classic shape (a wide proximal end with a drastic constriction near the distal end which produces the bit) to a delicate, lanceolate form. Bits vary from thick and triangular, to thin and lenticular in cross section. One unusually large specimen (26Ek3095-519-1, Figure 14g) is a reworked, Stage III quarry biface. Specimen 26Ek3271-500-263 is unique in that it is an end or lateral edge fragment of a quarry biface, reworked on the truncation to produce a very thick, triangular puncturing tool.

Figure 13. Selected Scrapers (a-c), and End Scrapers (d-g).

a. 26Ek3095, specimen 2022-11
b. 26Ek3237, specimen 500-14
c. 26Ek3160, specimen 2041-2
d. 26Ek3192, specimen 502-35
e. 26Ek3184, specimen 518-2
f. 26Ek3171, specimen 506-2
g. 26Ek3095, specimen 500-27

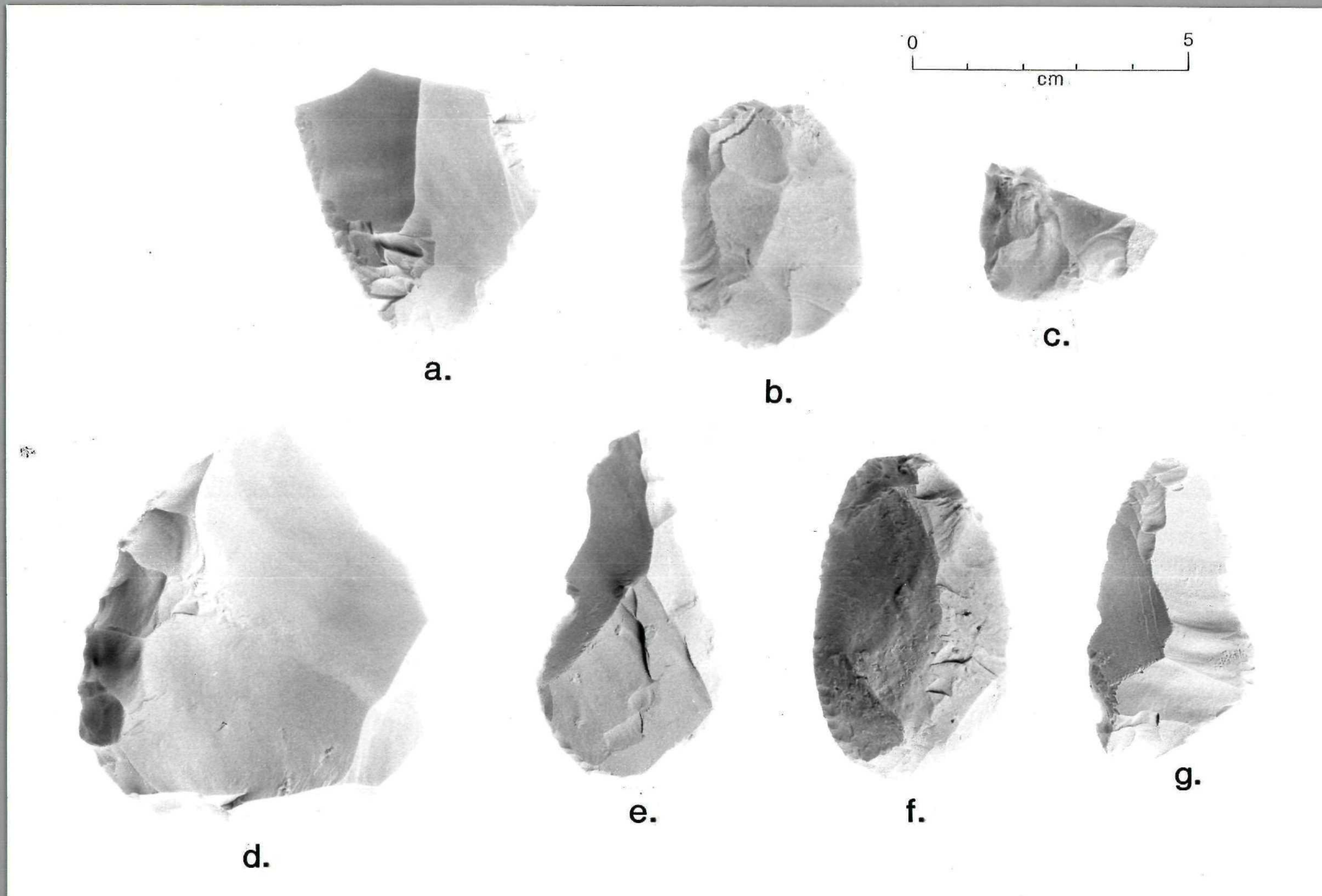
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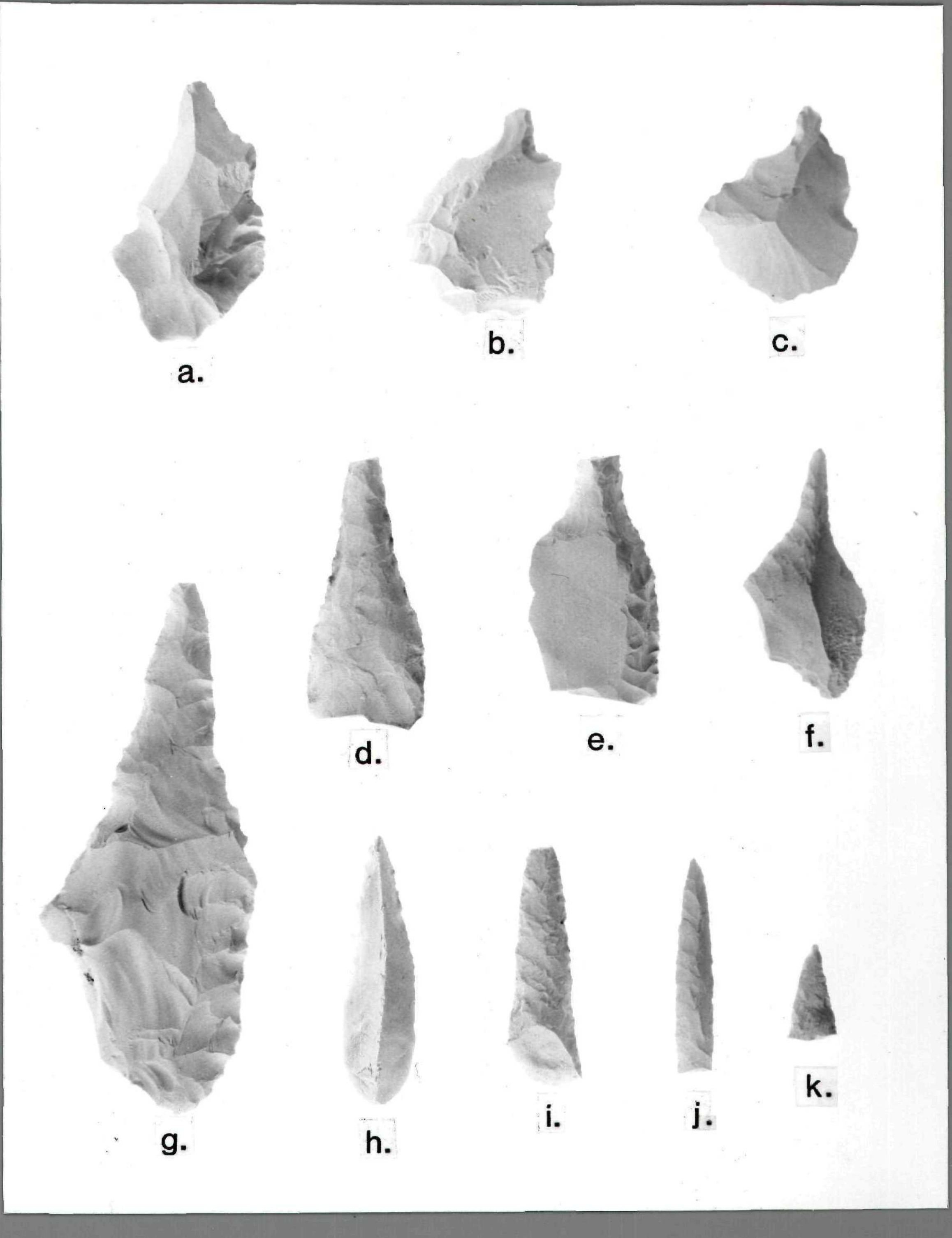
Figure 14. Selected Gravers (a-c) and Perforators (d-k).

a. 26Ek3149, specimen 1001-1
b. 26Ek3116, specimen 1006-4
c. 26Ek3271, specimen 1038-5
d. 26Ek3170, specimen 500-20
e. 26Ek3160, specimen 512-12
f. 26Ek3160, specimen 500-128
g. 26Ek3095, specimen 519-1
h. 26Ek3095, specimen 1043-5
i. 26Ek3192, specimen 1022-3
j. 26Ek3095, specimen 510-11
k. 26Ek3198, specimen 1017-5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Spokeshave

Ten tools are characterized by a wide notch, or concave EU(s). These EUs are steep, and exhibit unifacial retouch and utilization, with crushing on the extreme edge indicating use as scraping tools. Flake shape and size is variable; none of the specimens has been shaped or stylized, though several have cutting and scraping EUs in addition to the concave EUs.

Multipurpose Flake Tool

These 54 artifacts represent a combination of scrapers and cutting tools, or knives. Nearly half (44.4%) are fragments with no assignment to technological class. The remainder are primarily modified, medium to large flakes.

Indeterminate

Eighteen fragments of flake tools retain no diagnostic characteristics.

Other Flake Tools

Two artifacts are not assigned to functional class as they show no sign of use wear. Both are minimally shaped, with pressure retouch on the edges.

Chapter 4. PROJECTILE POINTS

by Michael P. Drews

Projectile points have proven accurate temporal indicators in the western and central Great Basin (Heizer and Baumhoff 1961; Heizer and Hester 1978; O'Connell 1967; Clewlow 1967; Thomas 1971, 1981). Here, 237 artifacts recovered during testing are discussed as projectile points; 111 of these are classifiable as to type, 61 are fragmentary, and 104 are projectile point preforms.

Typological criteria and temporal constraints employed in the present analysis follow those outlined by Thomas (1981). In this system, projectile point types are defined through a series of morphological observations including length, width, thickness, weight, basal width, and notch angles. In addition to Thomas's parameters, notations are also made concerning completeness and reworking or resharpening. For analytical purposes, reworking is defined as post production modification directed toward <u>repair</u> of a broken margin, while resharpening relates to edge <u>maintenance</u>. Both forms of modification can be identified by a change in flaking pattern, notch execution, or outline.

Phase names and chronological sequences throughout this section refer to the regional chronology for the Upper Humboldt Valley based upon stratified radiocarbon dated deposits at James Creek Shelter (Elston and Budy 1990).

Table 17 provides provenience, and typological data, and attributes of 111 typed projectile points. Thomas's key (1981), addresses six of the seven temporal classifications appearing below. Chronological and morphological attributes for Great Basin Stemmed Series follow Layton (1979), Clewlow (1968), and Frison (1978).

<u>Great Basin Stemmed Series</u>

The Great Basin Stemmed series combines variants of Cougar Mountain and Lake Parman types into a contemporaneous series (Layton 1979). They are long shouldered forms with square to contracting bases. Edge grinding along stem and basal margins is a common and diagnostic trait. Points in this series usually are associated with pluvial lakes in the Great Basin (Bedwell 1973; Butler 1970; Clewlow 1968; Tuohy 1969; 1970). They date between 8000 and 6000 B.C. the Dry Gulch Phase.

Of seven points of this type recovered, two are basalt and five are obsidian. All are basal fragments broken well below the shoulder, and all exhibit extensive grinding along stem

Table 17. Attributes of Typed Projectile Points.

SPECIMEN NO.	REF. NO.	AREA	UNIT	LEVEL	DEPTH	FEA.	TYPE	MAT'L	CON-DITION	Lt	La	Lm	Wm	Wb	NECK WIDTH	THICK	WT	EST. WT.	DSA	PSA	NOI	La/ Lt	Lt/ Wm	Wb/ Wm	Lm/ Lt	RE-WORK	RE-SHARP
26EK3095	509-5	1	NA	NA	NA	SF9	CT	OBS	COM	23.0	23.0	8.0	15.5	15.1		3.4	1.5	1.5				1.00	1.48	0.97	0.35	NO	NO
26EK3160	500-326	1	NA	NA	NA	NA	CT	OBS	INC	24.9	24.9	0.0	17.8	17.8		4.0	1.0	1.2				1.00	1.39	1.00	0.00	NO	NO
26EK3170	2002-1	2	EU1	2	10-20	NA	CT	OBS	COM	21.2	20.1	0.0	16.3	16.3		2.7	0.8	0.8				0.94	1.30	1.00	0.00	YES	NO
26EK3198	1018-1	2	18	1	0-2	SF1	CT	OBS	INC	26.0	25.5	0.0	14.7	14.7		2.8	0.7	0.7				0.98	1.77	1.00	0.00	NO	NO
26EK3198	1025-1	2	25	1	0-2	SF1	CT	OBS	COM	26.7	26.0	0.0	13.5	12.8		3.1	0.9	0.9				0.97	1.97	0.94	0.00	NO	NO
GRID	2672-1	2	DSC1	NA	NA	N-14	CT	OBS	INC	25.1	25.1	4.1	12.8	12.4		2.9	0.6	0.8				1.00	1.96	0.96	0.16	NO	NO
26EK3095	514-1	1	NA	NA	NA	IF14	CT	OPL	INC	17.7	14.9	14.7	9.5	9.5		2.4	0.3	0.4				0.84	1.86	1.00	0.17	NO	NO
26EK3106	2001-4	1	EU1	1	2-10	1	CT	OPL	COM	16.8	15.2	0.0	11.8	11.8		3.0	0.5	0.5				0.90	1.42	1.00	0.00	YES	NO
26EK3160	1003-9	1	NA	NA	NA	NA	CT	OPL	COM	29.8	29.0	7.9	14.8	13.6		2.5	1.1	1.1				0.97	2.01	0.91	0.26	NO	NO
26EK3184	503-28	2	NA	NA	NA	IF3	CT	OPL	INC	29.7	29.7	3.7	15.7	15.7		3.1	1.2	1.3				1.00	1.89	1.00	0.12	NO	NO
26EK3185	1003-2	2	NA	NA	NA	SF1	CT	OPL	INC	29.0	29.0	7.6	15.9	15.9		2.3	1.4	1.4				1.00	1.82	1.00	0.26	NO	NO
26EK3192	2067-1	2	EU4	7	60-70	SF2	CT	OPL	INC	28.4	27.7	8.3	17.1	15.8		2.5	1.2	1.8				0.98	1.66	0.92	0.29	NO	NO
26EK3198	1017-1	2	17	1	0-2	SF1	CT	OPL	COM	24.5	23.6	4.6	14.2	14.2		2.4	0.7	0.7				0.96	1.73	1.00	0.19	NO	NO
26EK3198	1018-4	2	18	1	0-2	SF1	CT	OPL	INC	30.0	29.3	0.0	16.0	16.0		2.3	0.7	1.2				0.98	1.88	1.00	0.00	NO	NO
26EK3251	500-19	3	NA	NA	NA	NA	CT	OPL	INC	26.1	26.1	0.0	17.7	17.7		3.2	1.2	1.2				1.00	1.48	1.00	0.00	NO	NO
26EK3251	1003-1	3	NA	NA	NA	3	CT	OPL	INC	26.5	26.5	3.5	18.3	18.3		3.2	1.1	1.3				1.00	1.45	1.00	0.13	NO	NO
16																											
26EK3095	2023-1	1	EU2	3	20-30	19	DSN	CHA	INC	31.2	27.6		12.4	12.3	6.9	2.4	0.7	0.9	185	182	3	0.88	2.53	1.00		NO	NO
26EK3171	505-2	2	NA	NA	NA	IF5	DSN	CHA	INC	31.2	26.9		15.0	15.0	5.6	3.1	0.8	1.0	204	175	29	0.86	2.08	1.00		NO	NO
26EK3116	1002-1	1	NA	NA	NA	1	DSN	OBS	INC	24.3	21.8		14.7	14.7	9.5	3.0	0.4	1.0	202	159	43	0.89	1.65	1.00		NO	NO
26EK3160	1003-4	1	NA	NA	NA	NA	DSN	OBS	INC	21.6	19.6		10.8	10.8	7.8	2.3	0.2	0.6	201	171	30	0.90	2.00	1.00		NO	NO
26EK3178	502-1	2	NA	NA	NA	IF2	DSN	OBS	INC	15.4	13.7		10.6	10.6	6.1	2.9	0.4	0.4	214	168	46	0.89	1.45	1.00		YES	NO
26EK3192	2061-6	2	EU4	1	0-10	SF2	DSN	OBS	INC	19.1	17.8		13.8	13.8	9.2	3.1	0.7	0.8	254	153	101	0.93	1.38	1.00		NO	NO
26EK3192	502-8	2	NA	NA	NA	IF2	DSN	OBS	INC	22.9	18.8		13.7	13.7	7.8	3.8	0.6	1.1		163		0.82	1.67	1.00		NO	NO
26EK3198	1016-1	2	16	1	0-2	SF1	DSN	OBS	COM	21.4	17.4		14.2	14.2	8.5	2.9	0.7	0.7	210	181	29	0.81	1.51	1.00		NO	NO
26EK3198	508-1	2	NA	NA	NA	IF8	DSN	OBS	INC	32.0	29.6		11.8	11.8	6.0	2.4	0.5	0.7	186	181	5	0.93	2.71	1.00		NO	NO
26EK3271	522-1	2	NA	NA	NA	IF22	DSN	OBS	INC	16.5	13.6		13.3	13.3	7.0	2.5	0.3	0.7	241	164	77	0.82	1.24	1.00		NO	YES
26EK3092	500-2		NA	NA	NA	NA	DSN	OBS	INC	32.0	29.7		14.9	14.9	7.4	3.4	1.0	1.4	180	180	0	0.92	2.14	1.00		NO	NO
26EK3092	2024-2	1	EU2	4	30-40	T1	DSN	OPL	COM	23.5	21.1		13.8	13.8	7.2	2.8	0.7	0.8	204	186	18	0.89	1.70	1.00		NO	YES
26EK3092	2042-14	1	EU3	2	10-20	T3	DSN	OPL	INC	25.1	19.7		12.3	12.3	5.9	2.0	0.2	0.9	179	174	5	0.78	2.04	1.00		NO	NO
26EK3095	510-38	1	NA	NA	NA	SF10	DSN	OPL	COM	23.4	20.5		11.7	11.7	6.2	2.6	0.5	0.5	182	168	14	0.87	2.00	1.00		NO	NO
26EK3114	1010-1	1	NA	NA	NA	1	DSN	OPL	INC	8.0	17.3		12.8	12.8	9.5	2.3	0.5	0.6	225	144	81	0.92	1.46	1.00		YES	NO
26EK3116	1007-1	1	NA	NA	NA	1	DSN	OPL	INC	21.3	19.1		12.7	12.7	7.5	2.5	0.5	0.8	191	179	12	0.89	1.67	1.00		NO	YES
26EK3160	1002-3	1	NA	NA	NA	NA	DSN	OPL	INC	21.5	18.7		13.4	13.4	9.5	2.5	0.4	0.5	206	163	43	0.86	1.60	1.00	0.00	NO	NO
26EK3160	1005-7	1	NA	NA	NA	NA	DSN	OPL	INC	23.4	19.4		13.6	13.6	9.3	2.0	0.2	0.5	191	135	56	0.82	1.72	1.00		NO	NO
26EK3271	500-87	1	NA	NA	NA	NA	DSN	OPL	COM	25.2	22.2		12.0	12.0	7.2	2.8	0.7	0.7	182	178	4	1.14	2.10	1.00		NO	NO
26EK3170	2001-1	2	EU1	1	2-10	NA	DSN	OPL	INC	28.3	25.6		15.9	15.9	10.0	2.6	1.2	1.3	169	166	4	0.90	1.78	1.00		NO	NO
26EK3170	2001-6	2	EU1	1	2-10	NA	DSN	OPL	INC	30.8	28.1		13.2	12.4	8.7	2.5	0.6	1.2	163	155	8	0.91	2.33	0.93		NO	NO
26EK3178	501-7	2	NA	NA	NA	1	DSN	OPL	INC	30.0	26.1		16.4	16.4	7.4	2.8	0.9	1.2	178	178	0	0.87	1.83	1.00		NO	NO
26EK3185	1015-1	2	NA	NA	NA	SF1	DSN	OPL	INC	27.8	24.6		13.4	13.4	6.7	2.8	0.6	1.0	182	164	17	0.88	2.10	1.00		NO	NO
26EK3185	1004-2	2	NA	NA	NA	SF1	DSN	OPL	INC	32.9	28.6		16.8	16.8	7.2	3.3	1.2	1.3	207	169	38	0.87	1.96	1.00		NO	NO
26EK3190	1003-1	2	NA	NA	NA	SF1	DSN	OPL	INC	25.9	22.8		14.2	14.2	5.3	3.2	0.5	1.0		150		0.88	1.82	1.00		NO	NO
26EK3190	508-2	2	NA	NA	NA	IF8	DSN	OPL	INC	27.8	24.8		11.8	11.8	6.4	2.4	0.5	0.8	191	183	8	0.89	2.34	1.00		NO	NO
26EK3192	1054-1	2	14	1	0-2	SF2	DSN	OPL	INC	26.0	24.8		12.4		8.3	2.7	0.6	0.8	194	160	34	0.95	2.10			YES	NO
26EK3198	503-7	2	NA	NA	NA	IF3	DSN	OPL	COM	28.3	24.9		12.6	12.6	7.0	3.0	0.9	0.9	178	163	15	0.88	2.25	1.00		NO	NO
26EK3251	500-27	3	NA	NA	NA	NA	DSN	OPL	INC	24.8	21.5		12.4	12.4	5.5	2.1	0.4	0.6	188	171	17	0.87	2.00	1.00		NO	NO
29																											
26EK3271	513-4	2	NA	NA	NA	IF13	RSG	CHA	INC	34.1	34.1		19.5	7.3	5.6	3.4	1.3	1.6	130	105	25	1.00	1.75	0.37		NO	YES
26EK3095	519-12	1	NA	NA	NA	IF19	RSG	OBS	INC	22.6	20.9		12.5	9.2	7.4	3.0	0.6	0.7	190	117	73	0.92	1.80	0.73		YES	NO
26EK3271	1046-5	2	NA	NA	NA	SF12	RSG	OBS	INC	28.5	28.5		14.6	9.8	8.2	2.6	0.7	1.2	123	111	12	1.00	1.95	0.67		NO	NO
26EK3271	500-191	2	NA	NA	NA	NA	RSG	OBS	INC	35.0	35.0		21.4	8.7	10.5	4.0	1.7	1.8	158	110	48	1.00	1.64	0.41		YES	NO
26EK3239	500-1	3	NA	NA	NA	NA	RSG	OBS	INC	26.3	26.1		11.5	5.8	5.5	2.8	0.7	0.9	174	109	65	0.99	2.28	0.50		NO	NO
26EK3095	500-45	1	NA	NA	NA	NA	RSG	OPL	INC	26.6	26.6		17.0	7.5	5.6	2.8	0.7	1.3	129	124	5	1.00	1.56	0.44		NO	NO
26EK3102	500-10	1	NA	NA	NA	NA	RSG	OPL	INC	25.3	25.3		11.8	6.5	5.7	3.4	0.9	1.0	146	98	48	1.00	2.14	0.55		NO	YES
26EK3160	1009-2	1	NA	NA	NA	NA	RSG	OPL	COM	20.8	20.8		11.1	6.8	3.9	2.3	0.4	0.4	130	115	15	1.00	1.87	0.61		NO	NO
26EK3160	517-1	1	NA	NA	NA	NA	RSG	OPL	COM	26.8	26.8		15.5	5.3	4.7	3.2	1.3	1.3	126	105	21	1.00	1.72	0.34		NO	NO
26EK3160	500-103	1	NA	NA	NA	NA	RSG	OPL	INC	37.4	37.4		14.5	6.4	4.2	3.7	1.2	1.5	139	118	21	1.00	2.57	0.44		NO	YES
26EK3160	500-310	1	NA	NA	NA	NA	RSG	OPL	INC	38.6	38.6		15.0	7.0	6.5	3.4	1.6	7.0	137	110	27	1.00	2.57	0.46		NO	NO
26EK3160	500-259	1	NA	NA	NA	NA	RSG	OPL	INC	41.3	41.3		12.6	6.4	4.7	3.2	1.4	1.7	120	104	16	1.00	3.27	0.50		NO	YES
26EK3271	500-138	1	NA	NA	NA	NA	RSG	OPL	INC	28.9	28.9		19.8	8.8	6.4	3.7	1.3	1.7	135	118	17	1.00	1.46	0.44		NO	YES
26EK3204	2002-1	2	EU1	2	10-20	SF1	RSG	OPL	INC	35.7	35.7		14.7	6.4	5.0	3.1	1.3	1.4	140	112	28	1.00	2.43	1.00		NO	NO
26EK3271	500-146	2	NA	NA	NA	NA	RSG	OPL	COM	20.9	20.9		10.0	8.0	6.7	3.0	0.5	0.5	151	125	26	1.00	2.09	0.80		YES	NO
26EK3271	500-301	2	NA	NA	NA	NA	RSG	OPL	INC	29.2	29.2		16.5	7.7	5.8	3.3	1.0	1.2	123	118	5	1.00	1.77	0.47		NO	YES
26EK3271	500-293	2	NA	NA	NA	NA	RSG	OPL	INC	32.7	32.7		12.9	10.0	7.9	3.7	1.1	1.3	152	112	40	1.00	2.53	0.78		NO	NO
26EK3271	1050-1	2	NA	NA	NA	SF12	RSG	OPL	INC	34.0	34.0		20.3	6.7	6.5	2.8	1.4	1.5	123	96	27	1.00	1.67	3.02		NO	NO
26EK3231	500-1	3	NA	NA	NA	NA	RSG	OPL	INC	29.5	29.5		19.0	7.9	7.6	3.7	1.3	1.6	133	104	29	1.00	1.55	0.41		YES	NO
26EK3237	1544-1	3	NA	NA	NA	DSC4	RSG	OPL	INC	31.5	31.5		14.3	7.9	6.9	3.3	1.2	1.5	159	98	61	1.00	2.20	0.55		NO	NO
26EK3237	500-56	3	NA	NA	NA	NA	RSG	OPL	INC	35.3	35.3		21.5	8.7	7.4	2.9	1.1	1.5	123	109	14	1.00	1.64	4.00		NO	YES
26EK3251	1022-3	3	NA	NA	NA	2	RSG	OPL	INC	29.5	29.5		13.3	8.2	5.0	2.4	0.7	1.3	158	115	43	1.00	2.21	0.61		NO	NO
22																											
26EK3239	500-5	3	NA	NA	NA	NA	ECN	OBS	INC	34.8	33.8		18.0	10.6	9.3	4.5	1.9	2.3	146	120	26	0.97	1.93	0.58		NO	NO
26EK3095	510-19	1	NA	NA	NA	SF10	ECN	OPL	INC	55.9	53.8		35.3	17.4	15.7	4.3	5.5	6.0	151	115	36	0.96	1.58	0.49		NO	NO
26EK3160	500-260	1	NA	NA	NA	NA	ECN	OPL	INC	42.8	42.8		21.6	12.0	9.6	3.9	2.8	3.0	139	110	29	1.00	1.00	0.55		NO	YES

Table 17, continued.

SPECIMEN NO.	REF. NO.	AREA	UNIT	LEVEL	DEPTH	FEA.	TYPE	MAT'L	CON-DITION	Lt	La	Lm	Wm	Wb	NECK WIDTH	THICK	WT	EST. WT.	DSA	PSA	NOI	La/ Lt	Lt/ Wm	Wb/ Wm	Lm/ Lt	RE-WORK	RE-SHARP
26EK3160	500-63	1	NA	NA	NA	NA	ECN	OPL	INC	53.6	53.6		17.7	13.7	10.7	5.5	4.2	5.0	167	110	57	1.00	3.02	0.77		YES	NO
26EK3160	500-26	1	NA	NA	NA	NA	ECN	OPL	INC	57.8	57.8		22.5	16.3	11.7	5.1	4.3	5.0	150	135	15	1.00	2.56	0.72		NO	NO
5																											
26EK3160	500-78	1	NA	NA	NA	NA	EE	OPL	INC	32.5	27.2		28.0	18.8	14.3	4.3	3.0	3.5	127	126	1	0.83	1.16	0.67		YES	YES
26EK3160	500-131	1	NA	NA	NA	NA	EE	OPL	INC	47.5	43.5		29.2	19.3	15.6	4.9	4.1	4.5	125	111	14	0.91	1.62	0.66		YES	NO
26EK3271	500-159	2	NA	NA	NA	NA	EE	OPL	INC	33.2	30.6		21.4	12.6		4.2	1.7	2.1	160	136	30	0.92	1.54	0.59		NO	NO
3																											
26EK3092	2009-2	1	EU1	9	80-90	T2	GSS	OBS	INC	43.4	42.0		21.7	10.7	11.2	4.7	3.0	4.0	190	95	95	0.96	2.00	0.50		YES	NO
26EK3095	516-10	1	NA	NA	NA	IF16	GSS	OPL	INC	51.3	49.5		21.8	11.5	11.5	4.7	3.2	4.0	179	93	86	0.96	2.35	1.00		YES	NO
26EK3095	500-8	1	NA	NA	NA	NA	GSS	OPL	INC	65.1	59.6		20.0	11.4	11.3	4.9	4.5	5.0	198	95	74	0.91	3.25	0.57		NO	YES
26EK3160	500-308	1	NA	NA	NA	NA	GSS	OPL	INC	55.4	52.4		24.2	17.5	15.2	4.5	3.4	7.0	169	96	73	0.94	2.28	0.72		NO	NO
26EK3198	500-4	2	NA	NA	NA	NA	GSS	OPL	INC	7.0	50.3		24.3	11.4	10.4	5.9	4.5	5.1	155	98	57	0.91	2.25	0.20		NO	YES
26EK3237	500-74	3	NA	NA	NA	NA	GSS	OPL	INC	53.7	49.7		23.7	11.0	13.2	5.8	6.0	6.2	184	97	87	0.92	2.26	0.46		NO	NO
26EK3238	500-1	3	NA	NA	NA	NA	GSS	OPL	INC	52.7	49.6		25.5	11.8		6.1	6.7		195	94	101	0.94	2.06	0.46		YES	NO
7																											
26EK3116	2500-1	1	NA	NA	NA	NA	HS	OBS	INC	42.4	38.1	10.4	17.9	15.7		5.3	3.7	3.9				0.90	2.36	0.87	0.25	NO	YES
26EK3160	500-267	1	NA	NA	NA	NA	HS	OPL	INC	49.6	47.6	20.9	18.8	15.9		5.2	4.3	4.8				0.95	2.63	0.84	0.42	NO	NO
26EK3192	2203-2	2	EU11	3	20-30	SF1	HS	OPL	INC	27.3	26.7	17.9	18.4	13.6		5.3	2.8	4.0				0.97	1.48	0.73	0.65	YES	NO
26EK3198	1012-4	2	12	1	0-2	SF1	HS	OPL	INC	51.6	49.4	18.8	23.3	20.3		3.2	1.3	4.5				0.95	2.21	0.87	0.36	NO	NO
4																											
26EK3093	505-4	1	NA	NA	NA	IF5	LSN	OPL	COM	41.4	38.3		15.5	15.5	6.6	3.1	15.5	15.5	172	177	5	0.92	2.67	1.00		NO	NO
26EK3184	524-2	2	NA	NA	NA	IF24	LSN	OPL	INC	49.3	46.6		24.9	24.9	11.8	3.7	3.5	5.0	202	182	20	0.94	1.97	1.00		NO	NO
26EK3271	500-270	2	NA	NA	NA	NA	LSN	OPL	COM	34.7	31.2		19.3	17.6	10.1	4.4	3.2	3.2	165	165	0	0.89	1.80	0.91		YES	NO
26EK3237	500-43	3	NA	NA	NA	NA	LSN	OPL	INC	31.4	31.0		17.0	17.0	7.9	4.2	1.3	1.5	189	184	5	0.98	1.84	1.00		NO	NO
26EK3238	500-37	3	NA	NA	NA	NA	LSN	OPL	INC	43.6	41.6		16.7	16.7	9.2	4.3	2.5	3.0	180	152	28	0.95	2.61	1.00		NO	NO
5																											
26EK3107	500-2	1	NA	NA	NA	NA	STM	BAS	INC	52.3			18.8			7.4*											
26EK3192	502-20	2	NA	NA	NA	SF2	STN	BAS	INC	28.2			25.1			6.6	6.1									NO	NO
26EK3170	500-31	2	NA	NA	NA	NA	STM	OBS	INC	25.3			21.5			8.0	4.1										
26EK3170	500-67	2	NA	NA	NA	NA	STM	OBS	INC	25.4			23.1			7.1	3.9									YES	NO
26EK3237	500-21	3	NA	NA	NA	NA	STM	OBS	INC	20.2			17.3			8.5	3.4										
26EK3238	500-25	3	NA	NA	NA	NA	STM	OBS	INC	22.5			21.3			7.8	4.3										
26EK3238	500-23	3	NA	NA	NA	NA	STM	OBS	INC	25.3			19.3			7.9	4.0										
7																											
26EK3106	2002-1	1	EU1	2	10-20	1	OO	CHA	COM	16.3	14.2	1.4	9.4	9.4	6.8	3.0	0.4	0.4	252	120	132	0.87	1.73	1.00	0.09	YES	NO
26EK3092	2500-1	1	NA	NA	NA	T1	OO	OBS	INC	24.4	223.2		10.0	9.8	7.0	3.0	.6+	0.7	225	111	114	0.95	2.44	0.98		YES	NO
26EK3095	510-46	1	NA	NA	NA	SF10	OO	OBS	INC	18.8	18.8		9.5	9.5	6.8	3.8	0.6	0.8	183	116	67	1.00	0.37	1.00		NO	NO
26EK3171	504-7	2	NA	NA	NA	IF4	OO	OBS	INC	35.0	33.5	4.4	12.1	11.8		2.8	1.1	1.4				0.95	1.04	0.97	0.12	NO	NO
26EK3093	505-11	1	NA	NA	NA	IF5	OO	OPL	INC	38.0	37.2	0.0	17.1	17.1		2.8	1.5	1.5				0.98	2.22	1.00	0.00	NO	YES
26EK3095	510-44	1	NA	NA	NA	SF10	OO	OPL	INC	34.5	32.8	0.0	14.3	14.3		2.3	0.8	1.2				0.95	2.41	1.00	0.00	NO	NO
26EK3095	510-49	1	NA	NA	NA	SF10	OO	OPL	INC	37.7	36.8		20.0	17.3	13.1	5.4	4.3	4.4	195	128	67	0.97	1.88	0.88		YES	NO
26EK3160	520-2	1	NA	NA	NA	NA	OO	OPL	INC	27.6	25.0	0.0	17.7	17.7		4.0	2.2	2.3				0.90	1.55	1.00	0.00	YES	NO
26EK3160	500-2	1	NA	NA	NA	NA	OO	OPL	INC	46.9	41.9	0.0	20.2	20.2		4.3	3.0	3.2				0.89	2.32	1.00	0.00	NO	NO
26EK3177	2001-10	2	EU1	1	2-10	NA	OO	OPL	COM	16.1	16.1		10.2	5.9	7.0	3.5	0.1	0.1	228	75	53	1.00	1.58	0.58		YES	NO
26EK3177	2001-1	2	EU1	1	0-10	1	OO	OPL	COM	43.5	41.8		18.0	17.6	15.7	4.4	3.0	3.0	242	140	102	0.96	2.46	0.97		NO	NO
26EK3190	1004-5	2	NA	NA	NA	SF1	OO	OPL	INC	34.3	31.8		17.9	17.9		2.9	1.2	2.0				0.93	1.91	1.00	0.00	NO	NO
26EK3237	500-17	3	NA	NA	NA	NA	OO	OPL	INC	49.2	49.2		20.4	12.5	9.6	4.8	2.6	3.0	188	106	82	1.00	2.41	0.61		NO	YES
13																											
26EK3160	1062-1	1	NA	NA	NA	NA	UN	CHA	INC	31.8	30.5	9.1	14.7	14.7		4.2	2.0	2.3				0.95	2.16	1.00	0.29	YES	YES
26EK3160	500-97	1	NA	NA	NA	NA	UN	OBS	INC	18.1			12.0			3.3	0.5										
26EK3173	1010-1	2	10	NA	NA	SF10	UN	OBS	INC	19.2			15.0			3.2	1.0										
26EK3184	503-14	2	NA	NA	NA	IF3	UN	OBS	INC	20.8			13.8			3.1	0.7										
26EK3192	502-11	2	NA	NA	NA	IF2	UN	OBS	INC	14.0			19.5			2.8	0.6										
26EK3198	1017-3	2	17	1	0-2	SF1	UN	OBS	INC	8.2			10.0			2.5	0.2										
26EK3198	1018-3	2	18	1	0-2	SF1	UN	OBS	INC	26.4			16.8			3.7	1.4										
26EK3116	1010-1	1	NA	NA	NA	1	UN	OPL	INC	10.8			10.6			2.7	0.4										
26EK3160	500-242	1	NA	NA	NA	NA	UN	OPL	INC	24.6			17.1			5.2	2.3										
26EK3173	1011-1	2	11	NA	NA	SF1	UN	OPL	INC	20.8			14.0			2.2	0.5										
26EK3198	1014-4	2	14	1	0-2	SF1	UN	OPL	INC	14.5			7.3			1.7	0.2									NO	NO
26EK3271	500-203	2	NA	NA	NA	NA	UN	OPL	INC	23.0			11.8			3.0	0.6										
26EK3271	1045-2	2	25	0	S	SF12	UN	OPL	INC	25.9			17.1			4.8	2.2										
26EK3237	2081-3	3	3	1	0-10	NA	UN	OPL	INC	27.3	22.6	18.2	11.2	11.2		3.2	0.4	1.0				0.82	2.43	1.00	0.66	NO	NO
14																											

NOTE: UNTYPABLE specimens are basal point fragments that retain basal morphology but, nevertheless, cannot be typed.

Key:

Area 1 = USX-West
Area 2 = USX-East
Area 3 = North Access Corridor

Type
CT = Cottonwood Triangular
DSN = Desert Side-notched
RSG = Rosegate
ECN = Elko Corner-notched
EE = Elko Eared
GSS = Gatecliff Split Stem
HS = Humboldt Series
LSN = Large Side-notched
STM = Stemmed
OO = Out of Key
UN = Untypable

Material
OBS = Obsidian
OPL = Opalite
CHA = Chalcedony
BAS = Basalt

Condition
COM = Complete
INC = Incomplete

margins (Figure 15). Most appear to be contracting stem forms; two (Figure 15c, d) have square bases. While they bear some resemblance to the more rectangular bases of the Lake Parman type, their characteristics are more typical of square based Eden points. This point type has a similar age range to Stemmed Points, and is associated commonly with bison kill sites in the Great Plains (Frison 1978).

Large Side-notched Points

This broad category includes Northern Side-notched, Bitterroot Side-notched, Madeline Dunes Side-notched, Elko Side-notched, and Rose Spring Side-notched types (Gruhn 1961; Swanson 1966; Riddell 1960; O'Connell 1975; Clewlow 1968; Hester and Heizer 1973). They are triangular in form with straight, concave, or notched bases. Margins are notched along the side rather than at the corner. Few morphological distinctions are evident between types, leading Thomas (1981) to combine all into this broadly defined, temporally distinct series. Large Side-notched points pre-date A.D. 1300, and may occur as early as the No Name Phase (5000 B.C.).

Five Large Side-notched points were identified during analysis, two of which are complete specimens (Figure 16e,f). All are opalite; the tip of one (Figure 16f) has been reworked.

Humboldt Series

The Humboldt Series was defined by a surface assemblage at the Humboldt Lakebed Site by Heizer and Clewlow (1968). Humboldt points are lanceolate forms of variable size. Bases are slightly to deeply concave (Figure 15g, h). Morphological variability within the series renders it a relatively poor time marker in the Great Basin. Dating between 3000 B.C. and A.D. 700 (Thomas 1981), the series spans several chronological phases of the Upper Humboldt Valley cultural sequence.

Four projectile point fragments, two from USX-East and two from USX-West were identified in the sample. One is obsidian and three are opalite. Two of the specimens appear to have been reworked or resharpened.

Gatecliff Series

Combined in the Gatecliff Series are a number of contracting and split stem forms previously identified as "Elko Contracting Stem" (Heizer and Baumhoff 1961), "Gypsum Cave" (Harrington 1933; Fowler, Madsen and Hattori 1973; Heizer and Berger 1970), and "Pinto Points" (Clewlow 1967; Hester and Heizer 1978; Thomas 1971). On the basis of morphology, these

Figure 15. Projectile points, specimens a-m.

a. 3192-502-20
b. 3170-500-31
c. 3238-500-25
d. 3238-500-23
e. 3093-505-4
f. 3271-500-270
g. 3116-2500-1
h. 3160-500-267
i. 3095-500-8
j. 3238-500-1
k. 3160-500-26
l. 3160-500-260
m. 3160-520-131

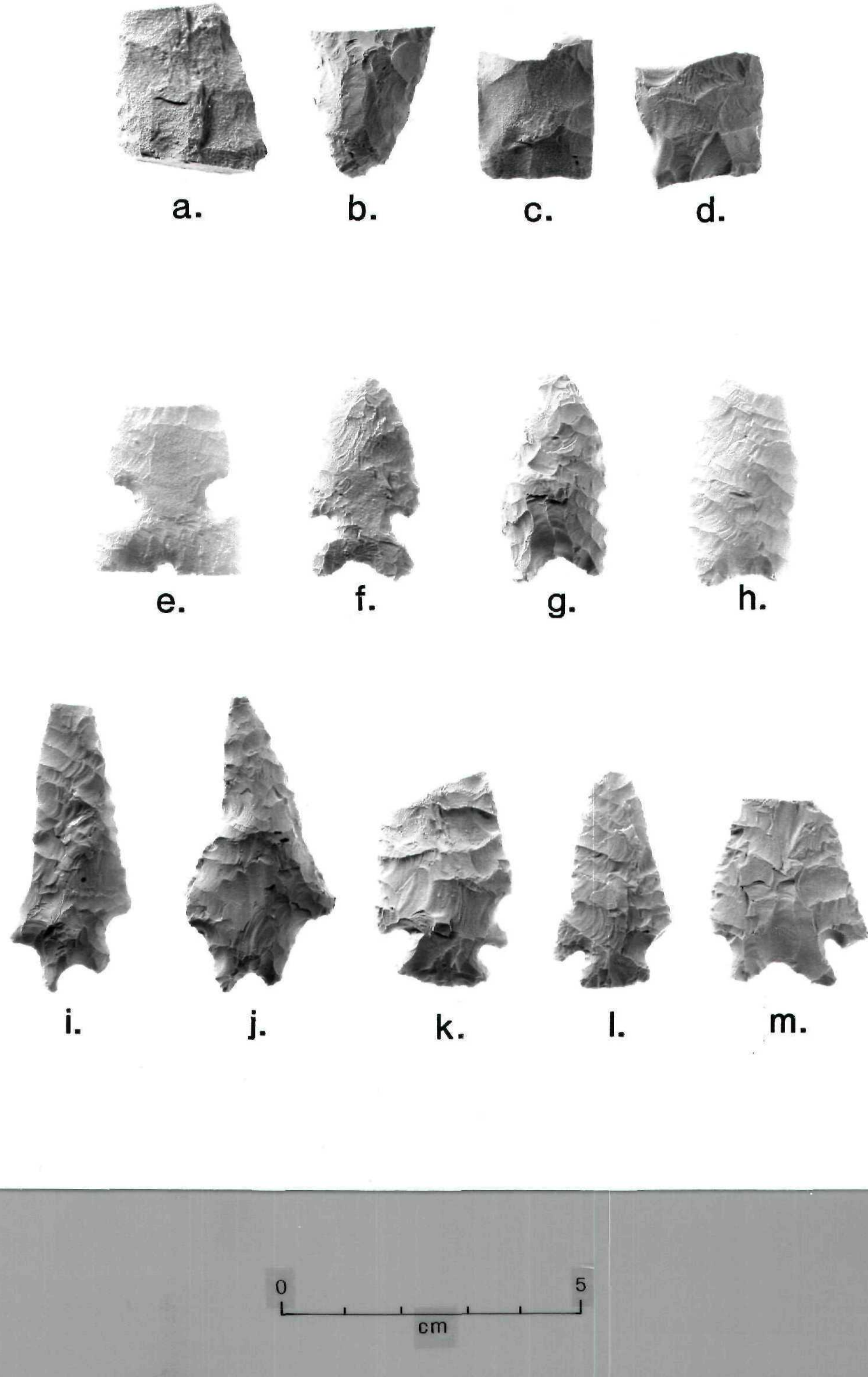
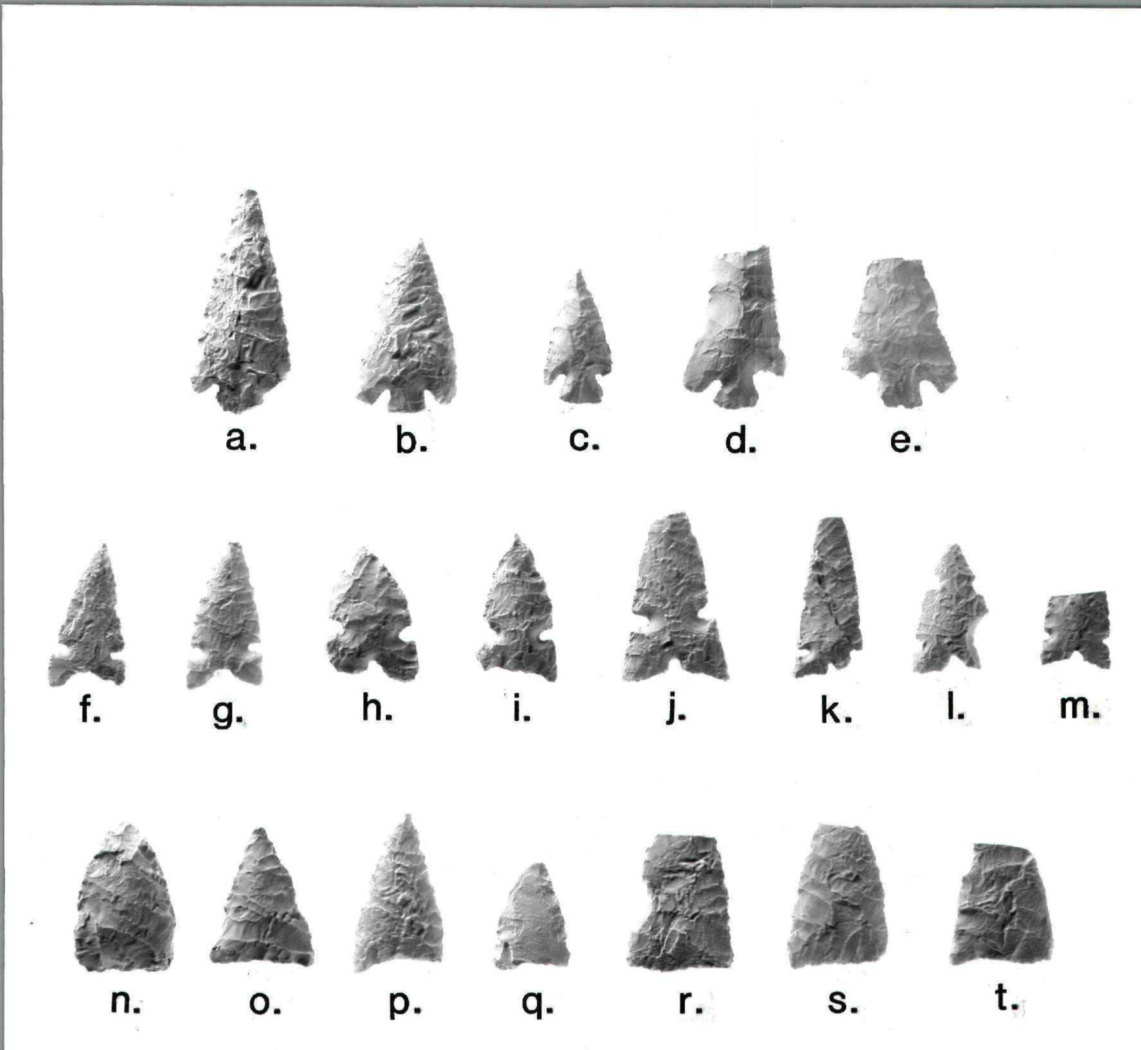

a.
b.
c.
d.
e.
f.
g.
h.
i.
j.
k.
l.
m.
0
5
cm

Figure 16. Projectile points, specimens a-y.

a.	3160-500-310	n.	3095-509-5
b.	3160-517-1	o.	3170-2002-1
c.	3160-1009-2	p.	3198-101701
d.	3160-500-103	q.	3106-2002-4
e.	3271-513-11	r.	3184-503-28
f.	3095-510-38	s.	3198-1018-4
g.	3271-500-87	t.	N-14 2672-1
h.	3198-1016-1	u.	3177-7001-1
i.	3092-2024-2	v.	3237-500-17
j.	3185-1004-2	w.	3171-504-7
k.	3198-508-1	x.	3092-2500-1
l.	3160-1002-3	y.	3106-2002-1
m.	3160-1003-4		


a.
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types are assigned to Gatecliff Split Stem (Pinto) or Gatecliff Contracting Stem (Elko Contracting Stem and Gypsum Cave) types (Thomas 1981). Gatecliff Series points are relatively large, triangular forms with sloping to deeply notched shoulders. Bases are parallel to contracting, and the split stem form is notched basally (Figure 16i,j). The Gatecliff Series is dated between 3000 B.C. and 1300 B.C. (Thomas 1981:22), falling within the latter part of the No Name Phase and most of the South Fork phase in the Upper Humboldt Valley cultural sequence.

Seven points, all Gatecliff Split Stem variants are present in the collection. One was manufactured from obsidian, while the remainder are opalite. Reworking or resharpening is evident on all but two of the points.

Elko Series

The Elko Series combines Elko Eared and Elko Corner-notched point styles into a single temporal type. They may be distinguished by a deeply notched (Elko Eared) or a relatively straight (Elko Corner-notched) base (Figure 16k-m). Flenniken and Raymond (1986) warn that reworking of Elko points often obscures typological boundaries. The type and its variants were defined previously by several researchers (Heizer and Baumhoff 1961; Heizer, Baumhoff and Clewlow 1968; Lanning 1963).

The utility of Elko points as time markers in the western Great Basin has been established firmly by O'Connell (1967). Occurring within the latter portion of the South Fork Phase and the entirety of the James Creek cultural phase, the series dates between 1300 B.C. and A.D. 700 (Thomas 1981).

Eight Elko Series points are present in the collection. Five are morphologically similar to Elko Corner-notched types and three are Elko Eared. Opalite is the most common material; only one point was made from obsidian. None of the Elko Series points is a complete specimen.

Rosegate Series

Within this series, Rose Spring and Eastgate projectile point styles are combined into a single contemporaneous type. Rose Spring Corner-notched points, named for the Rose Spring site in Owens Valley first were defined by Lanning (1963). Wagon Jack Shelter, near Eastgate, Nevada is the type locality for Eastgate points (Heizer and Baumhoff 1961). Both types are small, triangular forms with relatively deep corner notching (Figure 16a-e). Notches are generally finer and bases slightly expanding among Eastgate variants.

Thomas (1981) recognizes that the two types may be regionally differentiated, but remain temporally indistinct. Both types occur within a relatively short time span, dating between A.D.700 and A.D. 1300. Rosegate points are assigned to the Maggie Creek phase of the Upper Humboldt sequence.

Twenty-two points, only three of which are complete, key to the Rosegate Series. Opalite is the predominate material type (n=17); four points are obsidian and one is chalcedony. The margins of four Rosegate points are reworked and seven are resharpened.

Desert Series

Three coeval types, Desert Side-notched, Cottonwood Triangular, and Cottonwood Leaf-shaped, comprise the Desert Series. The types, although morphologically dissimilar, fall within the Eagle Rock phase of the Upper Humboldt cultural chronology and date from A.D. 1300 to the Historic Period (Thomas 1981).

Desert Side-notched points, originally defined by Baumhoff and Byrne (1959), are divided into four subtypes on the basis of basal treatment: General, Sierra, Delta, and Redding. They are distributed throughout southern and central California and the Great Basin. The Cottonwood variants have a similar spatial distribution and are named for the Cottonwood Site in Owens Valley, are described by Riddell (1951) and Lanning (1963).

Desert Side-notched points are small, triangular in outline, with a shallow notch high along each lateral margin. They can be distinguished from Large Side-notched types by weight (< 1.5 gms) and by acuteness of proximal shoulder angle (Figure 16f-m). Twenty-nine Desert Side-notched points appear in the collection. Eighteen are opalite, two are chalcedony, and nine are obsidian. Five are complete, three are reworked and two have been resharpened. One point (Figure 16l) has shallow notches at two locations along each lateral margin.

Cottonwood Triangular points are small (< 30mm long and 4mm thick) and triangular in outline. Notching is absent on lateral margins, and bases are straight to slightly concave (Figure 16n-t). Sixteen points from the collection are classified as Cottonwood Triangular. Of these, six are complete specimens; ten are made from opalite and six from obsidian. Two appear to be reworked. A broad notch along the margin of one point (Figure 16t) appears to have functioned as a spokeshave. No Cottonwood Leaf-shaped points were identified in the collection.

Other Projectile Points

In addition to the projectile points described above, 13 other specimens were manufactured or modified in a such a way that they fall out of Thomas's (1981) key. Of the 13 artifacts that slip through the key, five resemble Cottonwood Triangular forms (Table 18). Of these, four are rejected by the key due to excessive length (Figure 16w), and one by shallow notches on its reworked margins (Figure 16x). Similarly, reworking along margins and notches cause one probable Rosegate point and two probable Elko Series points to be rejected by the key (Figure 16v), and excessive basal width/maximum width ratios affect two probable Humboldt forms. Shallow side notching on two more points create anomalous Cottonwood/Desert Side-notched (Figure 16y) and Elko/Large Side-notched (Figure 16u) forms. Finally, a small, ovate, stemmed point that has been reworked extensively and utilized does not key.

Table 18. Probable Affiliations for Out of Key Projectile Points.

Site No.	Ref. No.	Type	Probable Type	Remarks
26EK3092	2500-1	Out of Key	Cottonwood	Reworked margin
26EK3093	505-11	Out of Key	Cottonwood	Too long
26EK3095	510-46	Out of Key	Rosegate	Reworked notch
26EK3095	510-44	Out of Key	Cottonwood	Too long
26EK3095	510-49	Out of Key	Elko	Reworked notch
26EK3106	2002-1	Out of Key	Cottonwood/DSN	PSA too small
26EK3160	520-2	Out of Key	Humboldt	Wb/Wm too large
26EK3160	500-2	Out of Key	Humboldt	Wb/Wm too large
26EK3171	504-7	Out of Key	Cottonwood	Too long
26EK3177	2001-1	Out of Key	Elko ?	PSA too small
26EK3177	2001-10	Out of Key	?	Extensive rework
26EK3190	1004-5	Out of Key	Cottonwood	Too long
26EK3237	500-17	Out of Key	Elko	PSA too small

Projectile Point Fragments

Sixty-one artifacts from the collection are classified as projectile point fragments. These consist of tips, midsections, bases, and lateral margins of small, thin bifacially worked artifacts lacking sufficient morphology to attempt typing. Fourteen of the 61 retain most basal morphology but, nevertheless, cannot be typed.

Projectile Point Preforms

One hundred and four artifacts are classified as projectile point preforms (Table 19): small, bifacially modified flakes,

Table 19. Attributes of Projectile Point Preforms.

Site (26Ek)	Ref.	Length	Width	Thick	Weight	Mat'l	Frag.
3090	2001-3	33.7	25.8	5.8	5.4	1	2
3092	500-5	37.1	18.7	5.5	4.9	1	2
3093	503-3	31.5	26.2	5.2	4.1	1	1
3093	1011-2	26	16.6	3.5	1.1	1	2
3093	1016-2	18.2	16.8	3.7	1.3	1	2
3093	1023-5	14	14.6	2.9	0.5	1	2
3093	1037-2	21.3	16.5	3.8	1.4	1	2
3095	500-18	47.1	21.4	6.6	7.9	1	2
3095	500-94	28	17	4.1	2.2	1	2
3095	510-3	26.4	13.7	3.5	1.2	3	2
3095	511-8	14	14.1	1.7	0.4	3	2
3095	516-7	22.2	17.9	3	1.3	1	2
3095	1002-3	28.4	19.4	4.3	1.9	1	1
3099	500-3	62.5	23.6	6.3	7.6	1	2
3251	1010-2	13.8	19.2	3.5	1.1	1	2
3101	500-7	42	32.7	10.5	17.5	4	2
3101	500-11	44.9	35.2	9.6	16.9	5	2
3160	500-87	17.4	17.8	2.3	0.8	1	2
3160	500-90	23.2	20	3.7	1.2	1	2
3160	500-228	29.6	13.4	3.3	1.2	1	2
3160	500-251	30	27.3	4.3	3.2	1	2
3160	500-303	22.4	15.5	4.2	1.5	1	2
3160	500-311	31.5	23.6	4	3	1	2
3160	512-2	38.3	22.2	6.1	5.7	1	2
3160	513-2	17.1	23.9	5.1	2.6	1	2
3160	517-4	22.1	13.6	4.8	1.6	1	2
3160	520-1	53.3	21.1	6.3	6.1	1	1
3160	523-12	21.6	19.5	5	2.2	1	2
3160	523-13	14.9	11.5	4.3	0.5	1	2
3160	1002-2	20.6	17.5	4.2	1.2	1	2
3160	1021-1	25.2	25	3.7	2.4	1	2
3160	1068-1	21.3	21	2.8	1.4	1	2
3160	2104-1	23.7	12.6	5.1	1.6	1	2
3165	500-1	28.7	22.2	7.2	4	3	2
3165	1024-1	35.7	21.4	4.8	4	1	2
3170	500-61	42.1	21.2	5.2	4.7	1	1
3170	500-67	25.4	23.1	7.1	3.9	3	2
3170	2001-2	27	24.9	4	2.5	1	2
3184	503-29	23.9	17.4	3	1.7	1	1
3184	508-5	41.4	23.7	5.2	6	3	1
3185	506-1	21	18.9	6.3	2.3	1	2
3185	1009-1	31.3	16.5	3.4	1.4	1	1
3185	1010-10	41.3	28	5.9	4.4	1	1
3185	1010-11	31.4	17.5	3.5	1.5	1	2
3189	500-1	25.6	23.8	4.5	2.9	3	2
3190	507-1	20.4	16.7	4	1.6	3	2
3192	1009-4	33.2	21.6	4.1	3.1	1	1
3192	2061-15	20.8	23.2	2.6	1.7	1	2
3198	503-3	47.2	18.3	5.1	5.3	1	2
3198	1003-2	22	21.4	4.8	2.4	3	2
3198	1007-1	27.1	16.8	3.6	1.9	3	2
3198	1007-2	35.1	14.8	2	1.3	1	1
3198	1012-10	25.5	20.4	4.2	1.9	1	2
3198	1014-1	50.6	22	2.6	2.1	1	1
3198	1017-2	30.2	16.8	5.9	3	3	1
3198	1017-4	11.1	18.5	5.1	1.4	1	2
3198	1017-6	19.2	18.5	3	1.1	1	2
3198	1017-7	34.1	15.1	3.7	2.3	1	2
3198	1017-9	35.7	16.6	3	1.8	1	1
3198	1017-16	16.7	19	3.4	0.9	1	2
3198	1018-2	29.5	20.2	5.2	3.5	3	1
3198	1018-5	22.5	15.1	2.6	1.1	1	2
3198	2001-3	19.3	17	2.4	1.2	1	2
3204	500-74	16	15.3	2.4	0.8	3	2
3231	1001-1	31.4	18.5	4.9	2.7	3	1
3237	500-1	25.1	25.8	5.2	3.3	1	2
3237	500-8	25.4	16.3	5.8	1.8	3	2
3237	500-36	30.6	16.5	3.1	1.3	1	2
3237	500-44	40	25.7	6.5	7.7	1	1
3237	2141-1	11.9	9.7	4	0.2	3	2
3251	500-9	20.7	15.9	3.2	1.1	1	2
3251	500-10	30.3	32.3	5.5	4.7	1	2
3251	500-21	15.3	22.7	4.4	1.7	1	2
3251	501-3	15.8	20.6	2.6	1	1	2
3251	501-6	21.2	31	5.7	4.2	1	2
3251	503-2	26	24	2.9	2	1	2
3251	505-1	29.1	23.5	6.9	6.3	1	2
3251	506-2	22.7	20	3.9	1.9	1	2
3251	1004-3	19.8	21.6	3.5	1.4	1	2
3251	1005-1	34.1	25.3	4.7	4.3	1	1
3251	1005-2	11.2	18.2	5.9	1.2	1	2
3251	1006-3	18.7	16.8	3.2	1.1	1	2
3251	1007-2	18.8	15	4.4	1.3	1	2
3251	1009-2	17.3	21.2	6.5	2	1	2
3251	1025-1	36.9	11.9	2.5	1.2	1	2
3251	1028-2	22.8	22.4	2.4	1.8	1	2
3251	1029-1	19.4	18.8	3.2	1.1	1	2
3251	1030-1	30.2	14.5	2.8	1.1	1	2
3251	2001-3	11.1	14.8	1.8	0.4	1	2
3251	2002-1	28.1	15.8	2.8	1.3	1	1
3271	500-130	22.2	13.9	3.6	1.2	3	2
3271	500-134	22.4	15.9	3.9	1.7	1	2
3271	500-170	31.5	24	3.9	3.2	1	2
3271	500-252	34	20.7	6.4	4.8	1	2
3271	500-304	33	25.5	4.6	3.8	1	2
3271	503-5	36	21.9	4	2.8	1	2
3271	511-1	16.6	12	3.6	1	1	2
3271	511-4	14.5	17.4	3.1	1.1	1	2
3271	514-5	37.5	16.9	2.5	1.8	1	2
3271	1028-3	28	17.2	3	1.6	1	2
3271	1032-5	27	17	3.2	1.6	1	2
3271	1044-10	30.4	28.8	4.8	4.1	1	2
Grid	2671-1	21.5	16.8	3.4	1.1	1	2
Grid	2674-1	30.4	18.6	5.4	3.2	1	2

Key:

Material
1 = Opalite
3 = Obsidian
4 = Basalt
5 = Other

Fragment
1 = Complete
2 = Fragment

similar in outline to various projectile point styles, but lacking final notching and basal treatment. Only 18 preforms are complete specimens. Table 20, gives mean dimensions for preforms and typed points; Great Basin Stemmed Series points are excluded since lengths and weights were not estimated. While slightly larger than the mean for all points combined, preform dimensions consistently fall between those of Elko and Rosegate series points. Thus, most appear to be precursors of Rosegate or Desert Series points. Size ranges, however, show significant overlap and preforms for larger point styles may well be present in the sample.

Table 20. Mean Dimensions of Preforms and Typed Points (excluding Great Basin Stemmed).

Type	Mean Length	Mean Width	Mean Thickness	Mean Weight
Cottonwood Triangular	25.338	15.100	2.863	1.050
Desert Side-notched	24.883	13.330	2.714	.085
Rosegate	30.477	15.423	3.168	1.541
Preforms	35.617	20.600	4.456	3.394
Elko Corner-notched	48.980	23.020	4.660	4.260
Elko Eared	37.733	26.200	4.666	3.366
Gatecliff Split Stemmed	46.943	23.028	5.229	5.216
Humboldt	42.725	19.600	4.750	4.300
Large Side-notched	40.080	18.680	3.940	5.640
All	30.009	16.226	3.617	2.007

Chapter 5. GROUND, BATTERED, AND SCRATCHED STONE

by Dave N. Schmitt

Test excavations at sites peripheral to the Tosawihi Quarries retrieved a host of ground stone, striated stone, and battered and flaked cobble tools. Although some specimens appear to have been employed in two or more tasks and functional interpretations of a few others remain ambiguous, this chapter segregates assemblage components according to four analytic categories: ground stone (e.g., manos and metates), percussion tools (e.g., hammerstones), fabrication tools (e.g., abraders), and other modified stone (e.g., pipes and ornaments).

Each specimen was assigned its respective analytic category based on gross morphology, ethnographic observations, and comparison with specimens recovered from other Great Basin sites (e.g., Kramer and Thomas 1983; Juell 1990). Documentation of each artifact included type and degree of use-wear, raw material type, dimensions, weight, degree of completeness, and provenience, as well as additional salient characteristics pertaining to its use history (e.g., fire alteration). When possible, fragmented artifacts were reconstructed.

Ground Stone

Investigations at 21 sites recovered a total of 62 ground stone artifacts. Most are metates or metate fragments (n=36), followed by manos (n=17); occasional mortars, pestles, and undifferentiated ground stone appear in the assemblage.

Manos

Eleven of 17 manos were sufficiently intact to observe shape/type distinctions. Included are six shaped and two unshaped unifacial manos, one shaped and one unshaped bifacial mano, and one shaped handstone displaying surficial use-wear polish (Table 21). Shaped manos are commonly ovoid to sub-rectangular in plan outline (i.e., "breadloaf"; Kramer and Thomas 1983:234-235), possess slightly convex working surfaces, and have a mean thickness of 4.5 cm. While most (75%) of the shaped manos exhibit light use-wear, two shaped uniface types recovered from site 26Ek3160 (specimens 1005-2 [Figure 17b] and 2041-1) display rather extensive use-wear polish.

Clearly, the inferred function of manos (whether shaped or not) is seed/nut processing, but nine specimens (53% of the total assemblage) exhibit characteristics indicative of use at other tasks. Four manos (specimens 26Ek3095-510-10, 26Ek3192-2061-2, 26Ek3204-2500-8, and 26Ek3271-500-73 have battered ends

Table 21. Attributes and Provenience of Groundstone.

All Measurements are in centimeters.

Site No. (26Ek)	Spec. No.	Fea.	No. Frags.	Material	% Complete -ness	Plan Outline	Shaped	Facial Use	Use Surface Profile	Use Wear	Type	Length	Width	Thickness	Weight (gms)	Fire Affected
3093	500-2	-	1	RH	100	SR	-	U	CV	L	ME	22.5	22.0	5.0	4100.0	-
	1040-1	4	1	TF	?	IN	+	U	CN	L	GS	6.7	4.4	3.8	106.1	-
3095	500-22	-	1	RH	50	SR	+	U	CN	L	PE	9.9	6.8	4.7	470.5	-
	500-31	-	1	TB	?	IN	-	U	CV	L	GS	7.9	5.9	1.6	101.6	-
	500-46	-	1	TB	50	IR	-	U	CN	L	ME	9.0	15.8	2.8	998.1	-
	510-10	10	1	RH	50	OV	+	U	CV	L	MO	6.0	9.1	4.2	232.5	-
	515-9	15	1	MB	25	IN	-	U	PL	M	ME	8.0	15.0	12.2	4200.0	-
	519-20	19	1	SS	20	OV	+	B	CV	H	ME	19.0	12.5	1.2	535.1	-
	525-3	25	1	TB	25	IN	-	U	PL	L/M	ME	13.1	10.2	2.7	669.5	+
	1002-2	15/19	10	IG	?	OV	+	B	PL	L/M	ME	?	?	3.1	1459.3	-
	1023-1	15	25	TF	75	OV	+	B	ML	L/H	ME	(33.0)	(20.0)	1.8	1749.3	-
	1029-1	15	4	TB	60	IN	-	B	PL	L	ME	(34.0)	(30.0)	2.9	3458.4	-
	1032-5	15	1	TB	?	SR	-	U	PL	M	ME	15.4	10.0	3.0	955.7	-
	1044-1	22	4	TB	60	IN	-	U	PL	M	ME	(33.5)	(20.5)	5.9	3868.0	-
3096	1002-2	1	1	MB	100	OV	-	U	CV	L	MO	13.2	8.4	5.5	782.1	-
3106	1037-1	4	1	TB	?	IN	?	U	PL	L	ME	6.6	5.1	3.6	227.6	-
3149	500-6	-	1	MB	95	OV	?	U	PL	M	ME	30.0	24.5	14.0	9500.0	-
	500-7	-	1	RH	40	OV	?	B	CV	L	MO	5.9	8.7	4.3	220.2	-
3160	500-53	-	2	TB	100	SR	+	M	ML	M	PE	(19.5)	(6.8)	6.7	1431.2	-
	500-74	-	1	SS	10	OV	+	B	PL	L	ME	7.0	5.0	2.5	75.9	-
	500-110	-	1	TB	?	IR	-	U	PL	L	ME	21.2	12.0	2.0	682.1	-
	501-2	1	1	RH	100	SR	+	B	CV	L	MO	13.1	8.8	4.9	747.5	-
	520-7	20	1	TB	50	IR	-	U	CN	M	ME	28.1	19.0	3.0	2140.1	-
	519-8	19	1	TB	100	SR	-	U	PL	L	MR	28.5	15.0	9.5	6400.0	-
	523-14	23	1	TB	50	OV	-	U	CN	L	MR	20.5	12.3	9.9	3600.0	-
	1005-2	1	1	RH	40	SR	+	U	CV	M	MO	6.8	8.0	4.7	358.4	-
	2041-1	-	1	RH	75	OV	+	U	CV	M	MO	13.1	7.4	4.6	612.4	-
3165	501-1	1	1	TB	100	IR	+	U	CN	L	ME	41.4	26.9	2.5	4000.0	-
	502-1	2	1	TB	?	IR	-	U	CN	M	ME	24.7	20.0	3.4	3900.0	-
	A-1*	-	1	TB	100	IR	-	U	PL	L	ME	47.5	30.0	3.0	-	-
3170	500-5	-	1	QZ	50	OV	+	U	CV	L	MO	10.4	8.3	3.8	402.0	-
	2023-1	-	1	TB	25	IN	?	B	PL	M	ME	18.9	13.0	2.7	975.8	-
3171	2022-1	-	1	RH	75	SR	?	B	CV	L	MO	15.2	9.1	4.3	628.7	-
3181	1015-1	1	1	RH	100	OV	?	B	CV	L	MO	18.2	11.0	7.4	1627.0	+
3185	1010-2	1	1	RH	50	OV	+	U	CV	L	MO	12.5	8.9	4.8	500.9	-
3190	505-4	5	3	TF	25	IN	+	U	PL	L	ME	(14.3)	(8.9)	6.7	835.6	-
3192	1015-3	1	1	TB	?	IN	?	U	PL	L	ME	8.4	4.3	1.5	73.3	-
	2061-1	2	1	QZ	60	OV	-	B	ML	L	MO	6.3	9.9	3.4	327.9	-
3196	502-5	2	1	TF	100	SR	-	U	PL	L	GS	7.0	4.1	3.6	60.7	-
3201	502-15	2	1	RH	100	OV	?	U	CV	L	MO	13.2	9.0	5.8	956.6	-
	503-5	3	17	RH	50	IN	+	U	PL	L	ME	(36.0)	(22.5)	5.3	4077.4	+
3204	2500-8	-	1	QZ	50	OV	?	U	CV	L	MO	7.6	7.4	2.9	238.0	+
3228	1001-1	1	2	TB	95	IR	-	U	PL	L	ME	(22.7)	(19.6)	4.9	2191.3	-
3237	500-81	-	1	RH	10	IN	?	U	CN	L	ME	9.0	5.4	4.3	232.8	-
3238	500-16	-	1	RH	?	SR	+	U	CN	L	ME	9.1	8.2	4.6	541.7	-
3251	500-4	-	1	RH	25	OV	+	U	CN	M	ME	19.0	19.0	5.2	2108.9	-
	500-6	-	1	QZ	20	IN	?	U	CN	M	ME	10.8	9.3	5.9	558.4	-
	500-8	-	1	TF	?	IN	?	U	PL	L	ME	8.6	7.9	5.1	365.0	-
	500-11	-	1	TF	?	IN	?	U	PL	L	ME	4.8	5.3	2.1	62.1	-
	500-14	-	1	RH	20	SR	+	U	CN	L	ME	11.6	9.6	2.6	480.2	-
	500-15	-	1	TF	100	OV	+	U	CV	L	MO	14.4	8.4	6.7	1146.0	-

Table 21, continued.

All Measurements are in centimeters.

Site No. (26Ek)	Spec. No.	Fea.	No. Frags.	Material	% Complete -ness	Plan Outline	Shaped	Facial Use	Use Surface Profile	Use Wear	Type	Length	Width	Thickness	Weight (gms)	Fire Affected
3251	501-1	1	1	RH	25	OV	+	U	CN	L/M	ME	15.0	17.0	3.3	1006.4	-
(cont.)	501-4	1	1	RH	40	OV	-	U	CV	L	MO	9.8	6.5	4.4	384.7	+
	506-1	6	1	TF	?	IN	?	B	PL	L	ME	13.6	7.6	3.3	402.5	-
	506-5	6	1	RH	?	IN	?	U	PL	L	ME	12.2	5.8	2.6	211.0	-
	1006-5	1	1	TF	5	OV	+	B	PL	L	ME	5.8	4.6	3.7	123.8	+
3271	500-73	-	1	RH	75	SR	+	M	CV	L	MO	12.0	6.2	3.8	532.0	+
	500-133	-	1	TB	?	IN	?	U	PL	M	ME	11.0	10.3	2.9	481.0	+
	500-150	-	1	RH	40	SR	+	M	ML	L	PE	7.1	7.4	5.6	501.1	-
	500-273	-	2	TB	?	SR	?	U	PL	L	ME	(17.0)	(10.8)	2.8	882.8	-
	1008-1	2	1	RH	25	OV	?	U	CV	L	MO	7.4	5.1	2.4	108.3	-
	1101-2	18	1	MB	100	OV	-	U	PL	M	MR	22.0	18.5	11.0	2600.0	-

Key:

Material
IG = Brecciated Obsidian
MB - Mass Basalt
TB = Tabular Basalt
QZ = Quartzite
RH = Rhyolite
SS = Sandstone
TF = Tuff

Plan Outline
SR = Sub-rectangular
OV = Ovoid
IR = Irregular
IN = Indeterminant

Facial Use
U = Unifacial
B = Bifacial
M = Multiple

Use Surface Profile
CN = Concave
CV = Convex
PL = Planer
ML = Multiple

Use Wear
L = Light use; polished facets only on elevated areas of surface; retains characteristics of original surface.

M = Moderate use; thin layer of original surface of stone is removed by grinding; polished facets cover ca. 50% of surface area.

H = Heavy use; perceptible trough developed below original surface; ground facets over entire surface; often resharpened by pecking.

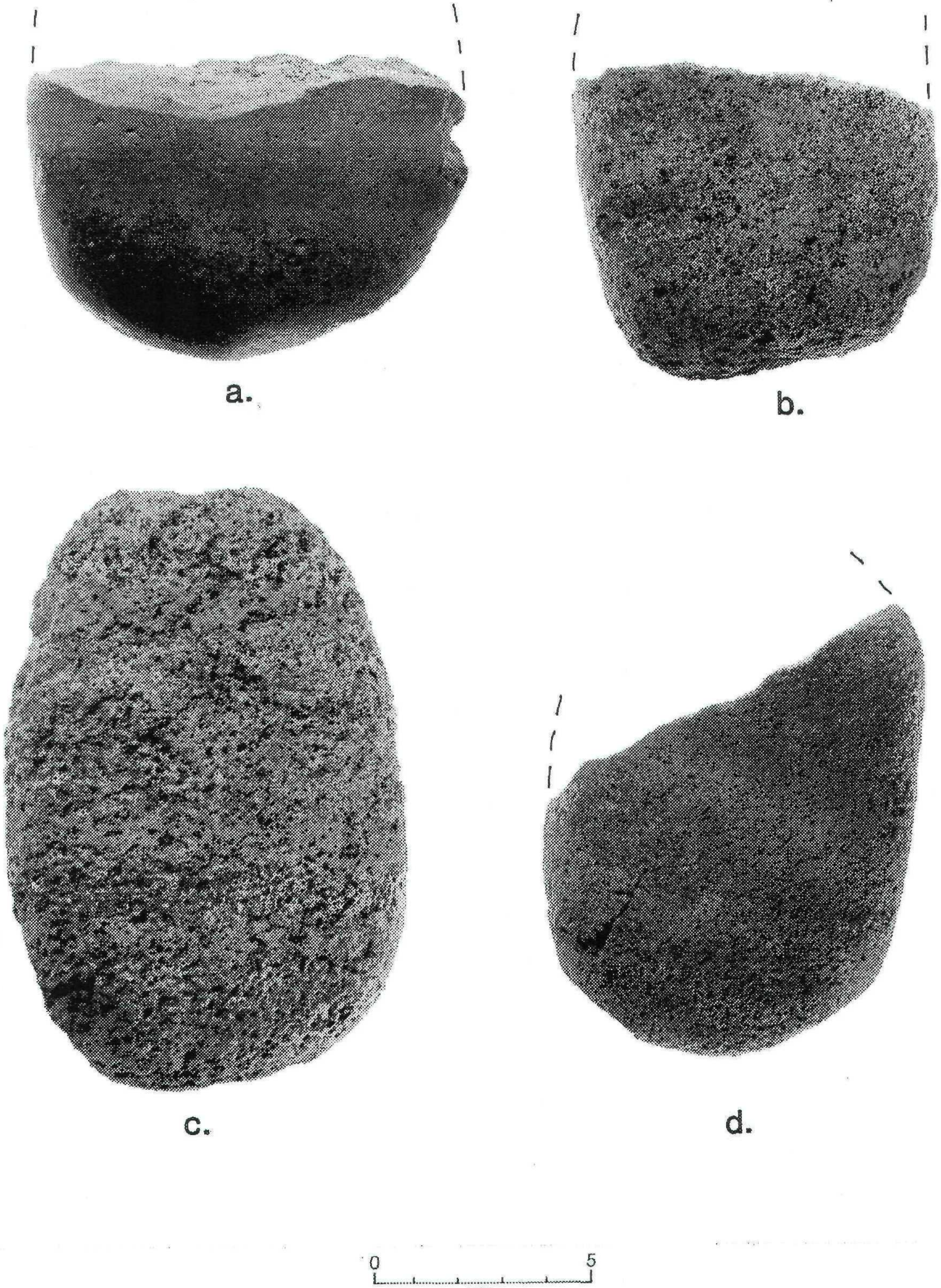
Type
MO = Mano
ME = Metate
PE = Pestle
MR = Mortar
GS = Undifferentiated Ground Stone

Parentheses denote measurement of two or more refitted pieces.

* Recorded and left in the field.

Figure 17. Selected manos.

a. 26Ek3251, specimen 501-4
b. 26Ek3160, specimen 1005-2
c. 26Ek3160, specimen 501-2
d. 26Ek3170, specimen 500-5



a.
b.
c.
d.
0
5
cm

and/or margins suggesting percussion tasks; this type of damage probably accrued when the tools were used to resharpen other grinding surfaces (e.g., pecking a metate) to pound roots, bones, and/or dried meat, or perhaps from use as hammerstones employed in lithic reduction.

Collected from the surface of site 26Ek3170, unifacially shaped specimen 500-5 (Figure 17d) bears ochre staining on the working surface and along one margin, indicative of pigment manufacture (cf. Juell 1990; see also Drews 1986; Kramer and Thomas 1983). Finally, four specimens (see Table 21) are blackened and fire-cracked, suggesting re-use for lining roasting pits and/or hearths.

Metates

Represented largely by specimens displaying unifacial use-wear (n=28, 78%), a total of 36 metates was recovered (see Table 21). The metate assemblage contains both thin, "portable" tabular types, and thick, heavy boulder types (see, for example, attributes of specimens 26Ek3095-500-46 and 26Ek3095-1044-1 in Table 21, respectively. Twelve specimens were shaped by percussion flaking and abrasion, most of which (60%) was done to achieve an oval plan outline (see also Steward 1941:325).

Although raw material types vary, stone utilized as metates reflects locally available rocks. For example, the bedrock of Bitterroot Ridge area is tabular basalt. Although tabular basalt metates were found elsewhere in the study area, people occupying sites on Bitterroot Ridge favored this rock type, as demonstrated by a preponderance (n=12, 67%; 75% of the total assemblage) of tabular basalt metates.

The presence of metates (and/or other grinding implements) clearly testifies to subsistence resource processing in conjunction with toolstone acquisition and reduction in the study area. As observed in Table 21, metate wear patterns reveal predominantly light use (n=20). Many of these specimens were recovered from sites lacking discrete cultural features and/or additional artifact types suggestive of residential use (e.g., sites 26Ek3093 and 26Ek3228). Conversely, virtually all the implements exhibiting moderate to heavy use were collected from sites with discrete cultural features inferring residential occupation. In particular, specimens 519-10 and 1023-1 recovered from site 26Ek3095 display highly polished ground surfaces; the former also has a well developed trough and possesses numerous pecking marks, together indicative of a resharpened working surface that had become exhausted.

Metates displaying multiple, parallel use-wear striations were recovered from three sites: specimens 26Ek3095-500-46 and 26Ek3095-525-7, 26Ek3160-500-74 and 26Ek3160-520-7, and

26Ek3170-2023-1. While such linear grooves probably were produced during seed grinding, deep striae truncating light surface use-wear on specimens 26Ek3095-500-46 and 26Ek3095-500-74 may also suggest the artifacts were used as cutting slabs (cf. Juell 1990).

Fragments of the same distinctive ignimbrite* metate were recovered from site 26Ek3095 in features 15 and 19, ca. 25 meters apart. Based on context, it appears numerous fragments of a broken metate were scavenged from Feature 15 for use as boiling stones and/or hearth rocks by inhabitants of Feature 19 where angular fragments were found in association with an ashy hearth-like feature (Intermountain Research 1988b). The ignimbrite rock of which this artifact is made is highly distinctive; a geologist working in the area identified its source as an outcrop located approximately 3 km east of the site.

Use of metates for activities other than food processing is evident at sites 26Ek3201 and 26Ek3251. Surface collections at Feature 3, site 26Ek3201 retrieved 17 fragments of one metate (see Table 21): as illustrated in Figure 18, reconstruction of the artifact found approximately 75% of the refitted pieces extensively fire blackened, but the remaining pieces virtually unaffected, suggesting that some, but not all, fragments of the broken metate were scavenged and used as hearth rocks. Finally, specimen 500-4 recovered from the surface of 26Ek3251 displays red ochre residue indicating the metate was used for pigment manufacture, probably in addition to food processing.

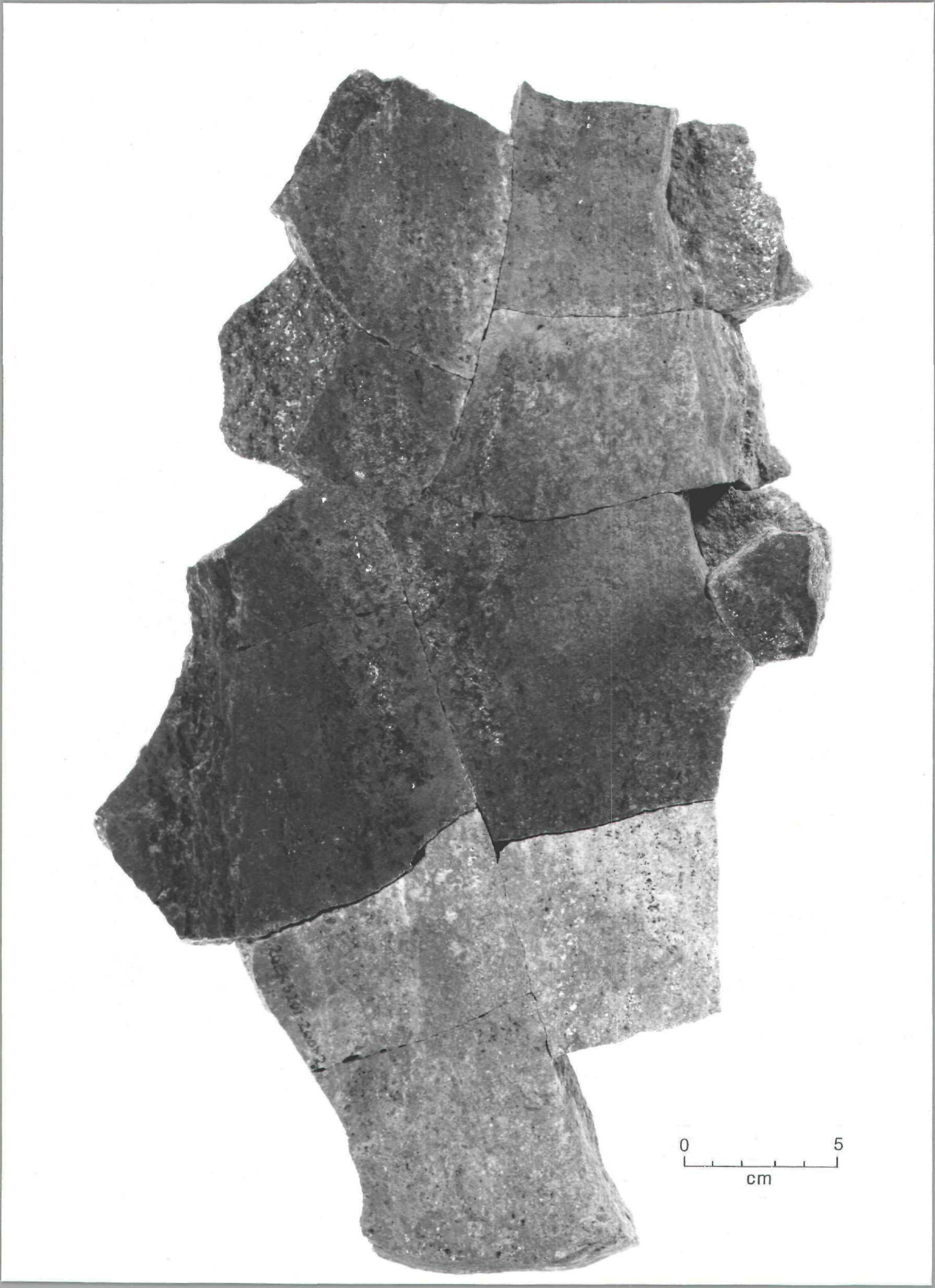
Pestles

Three ground stone artifacts were classified as pestles (see Table 21). One specimen (26Ek3160-500-53) is complete in two refitted pieces. It is oval in cross section, and exhibits overall polish and striations perpendicular to its long axis; these modifications appear to be a result of manufacturing techniques (e.g., shaping by abrasion) rather than use-wear.

The two remaining pestles are represented by fragments; specimen 26Ek3095-500-22 is an end fragment and specimen 26Ek3271-500-150 is a midsection. Both implements display overall (superficial) polish, are oval in cross section, and subrectangular in outline. The working ends of specimens 500-22 and 500-53 are blunt and flat, suggesting use with stone mortars; the former is spalled from use.

* Ignimbrite, in this case, is <u>not</u> a glassy obsidian-like mineral; rather, it is comprised of macroscopic crystals of quartz, feldspar, and biotite in a glassy matrix (Prinz et al. 1977:349).

Figure 18. Refitted metate; 26Ek3201, specimen 503-5.


0
5
cm

Mortars

Testing at two sites on Bitterroot Ridge recovered three incipient mortars (see Table 21). Each specimen displays superficial use-wear and each also may have functioned as a metate and/or anvil.

At site 26Ek3160, surface collections at features 19 and 23 returned a mortar and mortar fragment, respectively. Specimen 26Ek3160-519-8 is a mortar manufactured on a tabular basalt cobble. The artifact possesses a circular (diameter ca. 6.5 cm), blackened, slightly polished facet central to its planar surface. Although fragmented, specimen 26Ek3160-523-14 displays a similar, centrally worn area (diameter ca. 6.0 cm) on a slightly concave surface.

Surface collections at Feature 18, site 26Ek3271 also yielded an incipient mortar. The artifact bears a circular, slightly battered area with polished margins (diameter = 6.5 cm) central to a relatively flat surface on a large basalt cobble. Because this use-wear truncates a striated, polished surface, it appears the artifact functioned as a mortar subsequent to its overall facial use as a grinding surface. We speculate that these artifacts probably were used in conjunction with pestles, and possibly with hopper baskets, to process plant foods including bitterroot and other tubers. Steward (1941:235) notes that "a few small mortars, adopted by the (Snake River) Shoshone from the Plateau or Northwest, were used only by toothless old people to grind their food".

Undifferentiated Ground Stone

An additional three specimens classified as undifferentiated ground stone (see Table 21) are small, fragmented artifacts lacking sufficient morphology to infer function. Each specimen exhibits light polish on one surface.

Percussion Tools

Percussion tools in the form of hammerstones, battered cobble fragments, and choppers were recovered from 30 of the 65 sites investigated. Hammerstones are presented first, followed by undifferentiated battered stone, then choppers.

Hammerstones

Not surprisingly, a wealth of hammerstones was recovered from sites peripheral to the Tosawihi Quarries. Most (61%) are from the USX-East area and were associated with the numerous quarry pits, opalite outcrops and cobble fields, and lithic reduction features blanketing the region (see, for example, Chapter 16). The hammerstone assemblage contains an array of shapes and sizes (Table 22), but most abundant are fist-sized cobbles (Figure 19), exhibiting two or more extensively battered edges, that can be held and used with one hand (i.e., less than 1200 grams). A few hammerstones have been shaped via percussion flaking to achieve a "pointed" working edge(s), probably to facilitate controlled flake removal when applied to biface reduction.

Similar to the metate assemblage, raw material selection for hammerstones seemingly reflects exploitation of the immediate environment. For example, virtually all the hammerstones collected from sites along Undine Ridge are quartzite cobbles; aside from opalite, informal survey of the creek bottom in Undine Gorge during field operations found quartzite cobbles to be a common, often dominant rock type. Similarly, over one-half (54%) the hammerstones retrieved in the USX-West area are basalt, a rock type common in the Bitterroot Ridge area and, of course, in adjacent Basalt Canyon.

While the inferred function of these artifacts is reduction of toolstone and, to a lesser extent, processing resistant organics (e.g., wood, fiber), many may have been used in other percussion tasks (e.g., sharpening exhausted grinding surfaces). Two hammerstones (specimens 26Ek3192-2062-1 and 26Ek3204-500-22 exhibit such deviant employment in pigment manufacture, the evidence for which is ochre staining. Specimen 26Ek3237-500-331 recovered from the surface of site 26Ek3237 has a pitted, crushed area central to a slightly convex surface (Figure 19a), possibly from use as a percussor during bipolar core reduction (cf. Ahler 1986:60-63).

Undifferentiated Battered Stone

An additional six percussion tools were classified as undifferentiated battered stone (see Table 22). These fragmented artifacts display either spalling or battering along one edge or surface. Although they were utilized for some sort of rough percussion and may have served functions similar to the hammerstones presented above, there is distinctly less wear damage on them than on hammerstones (after Thomas and Bierwirth 1983:229-230).

Table 22. Attributes and Provenience of Hammerstones and Miscellaneous Battered Stone.

All Measurements are in centimeters.

Site No. (26Ek)	Specimen No.	Fea.	Material	Length	Width	Thickness	Weight (gms)	Type	Shaped	Complete
3084	502-1	2	MB	12.3	11.5	6.8	1253.2	HM	-	-
	502-2	2	RH	13.2	6.6	6.9	756.2	BS	?	-
	502-3	2	MB	10.2	3.4	3.8	163.2	BS	+	-
	502-4	2	MB	13.1	11.6	6.0	1032.9	HM	?	+
3085	508-1	8	MB	8.1	6.4	5.5	427.3	HM	-	+
3092	2041-1	-	OP	6.4	5.4	3.5	159.5	HM	+	+
3095	500-49	-	QZ	10.4	9.7	7.3	925.1	HM	-	+
	511-3	11	MB	17.5	13.3	6.4	3000.0	BS	-	-
	513-1	13	QZ	8.3	6.2	5.9	433.5	HM	-	+
	514-3	14	MB	8.6	7.3	4.8	283.9	HM	+	+
	514-4	14	MB	7.5	2.8	3.2	8.7	HM	?	-
	1004-3	19	MB	10.3	8.1	5.1	484.6	HM	-	+
	1006-1	19	MB	8.7	8.6	4.7	589.6	HM	-	-
3096	500-3	-	QZ	8.4	6.6	2.6	190.8	HM	-	+
	504-1	4	MB	6.7	5.2	3.8	221.0	HM	-	+
3099	501-1	1	OP	9.2	8.0	3.6	28.0	HM	+	+
3104	500-10	-	QZ	10.8	8.9	8.2	889.2	HM	-	+
3106	2021-4	5	MB	12.0	9.7	6.1	751.0	HM	+	+
3160	507-4	7	RH	6.7	6.0	5.5	280.2	HM	-	+
	2001-1	1	MB	9.4	6.6	2.6	162.0	HM	-	-
3170	500-11	-	QZ	6.3	2.7	2.6	51.7	BS	?	-
	500-50	-	MB	8.6	6.5	5.9	326.1	HM	-	-
3171	502-5	2	OP	7.7	7.6	7.3	480.7	HM	-	+
	502-8	2	QZ	17.6	14.5	12.4	2600.0	HM	-	+
	507-5	7	RH	9.2	8.1	3.4	299.9	HM	+	+
	507-9	7	QZ	20.0	14.0	9.2	2610.0	HM	-	+
	1004-2	1	QZ	15.7	11.0	10.2	2030.0	HM	-	+
3177	501-1	1	RH	13.2	8.3	5.6	746.9	HM	-	+
3184	2021-13	13	QZ	6.8	5.7	4.4	207.0	HM	-	+
3185	504-1	4	QZ	9.5	4.3	5.8	349.9	HM	-	+
	1012-1	1	QZ	9.2	9.1	8.0	832.2	HM	-	+
3192	2062-1	2	TF	11.4	9.6	4.6	615.6	HM	-	+
	2064-1	2	QZ	10.9	9.8	5.6	639.7	HM	-	+
	2122-1	1	QZ	8.0	7.4	6.5	390.5	HM	-	+
3195	502-1	2	RH	25.0	14.0	6.8	3600.0	HM	-	+
	502-2	2	RH	25.0	14.5	9.3	2440.0	HM	-	-
	503-1	3	QZ	6.1	4.8	1.9	73.4	HM	-	-
	507-1	7	QZ	5.7	5.8	3.6	155.4	HM	-	+
	507-2	7	QZ	10.6	7.1	6.0	627.5	HM	-	+
	507-6	7	MB	8.1	7.5	6.4	469.7	HM	-	+
3196	501-2	1	QZ	9.2	6.8	3.4	196.8	HM	-	-
	502-1	2	QZ	9.2	7.7	2.6	126.6	HM	-	-
	502-8	2	QZ	10.7	10.0	6.7	755.1	HM	-	+
	502-9	2	QZ	18.5	13.0	5.8	1497.1	HM	-	+

Table 22, continued.

All Measurements are in centimeters.

Site No. (26Ek)	Specimen No.	Fea.	Material	Length	Width	Thickness	Weight (gms)	Type	Shaped	Complete
3196	1007-1	1	QZ	8.6	7.5	5.2	391.4	HM	-	+
(cont.)	1033-1	2	QZ	9.5	9.3	4.3	354.3	HM	-	-
	2002-3	1	QZ	8.8	7.3	3.6	338.1	HM	-	-
3197	504-2	4	QZ	9.4	6.9	5.7	320.1	HM	?	-
	504-4	4	QZ	8.0	5.5	1.7	53.9	HM	-	-
	506-1	6	MB	6.8	6.6	3.9	191.4	HM	?	-
	506-2	6	OQ	7.6	6.0	3.4	158.4	HM	-	-
	507-2	7	QZ	11.9	6.8	4.4	361.0	HM	-	-
	509-5	9	QZ	9.0	8.4	3.8	263.1	HM	-	+
3198	514-5	14	QZ	6.7	5.1	3.1	104.3	HM	-	-
	514-6	14	QZ	4.7	5.1	1.2	38.5	HM	-	-
3200	501-2	1	QZ	16.8	14.4	3.0	1328.8	BS	?	?
	2500-1	-	QZ	9.1	8.8	5.1	500.4	HM	-	+
3201	500-1	-	QZ	11.4	7.0	6.9	827.4	HM	-	+
	502-14	2	QZ	8.1	8.2	4.3	382.7	HM	?	+
	503-4	3	QZ	13.8	9.7	5.0	928.5	HM	-	-
	504-1	4	MB	5.9	4.6	4.9	139.3	HM	-	-
3204	500-22	-	QZ	13.0	9.9	2.5	501.4	HM	-	-
	500-26	-	QZ	10.9	10.4	4.9	529.0	HM	-	+
	500-32	-	QZ	7.8	6.4	4.0	208.2	HM	-	+
	500-33	-	QZ	12.1	8.8	5.0	708.6	HM	-	+
	2005-12	-	OP	5.9	3.6	3.2	51.4	BS	-	-
	2500-7	-	MB	9.8	8.2	5.2	495.2	HM	-	+
3208	501-2	1	MB	18.6	12.3	11.0	2500.0	HM	-	+
	508-1	8	QZ	15.5	8.5	6.7	1259.0	HM	-	-
3237	500-6	-	OP	9.4	6.7	4.9	361.9	HM	-	+
3239	500-23	-	QZ	16.0	8.5	7.7	1109.7	HM	-	+
	500-24	-	MB	5.3	5.7	5.1	227.4	HM	-	+
3271	500-18	-	QZ	7.8	5.4	3.2	188.2	HM	-	+
	500-82	-	RH	7.5	5.9	3.6	184.0	HM	-	+
	500-261	-	MB	10.7	9.2	4.2	560.1	HM	-	+
	500-311	-	QZ	7.7	9.0	4.8	467.4	HM	-	-
	506-5	6	QZ	7.6	5.9	2.6	172.6	HM	-	-
	516-1	16	MB	20.0	17.0	11.9	4000.0	HM	-	+
	1026-1	12	OQ	7.5	6.0	5.0	379.4	HM	?	+

Key:

Material

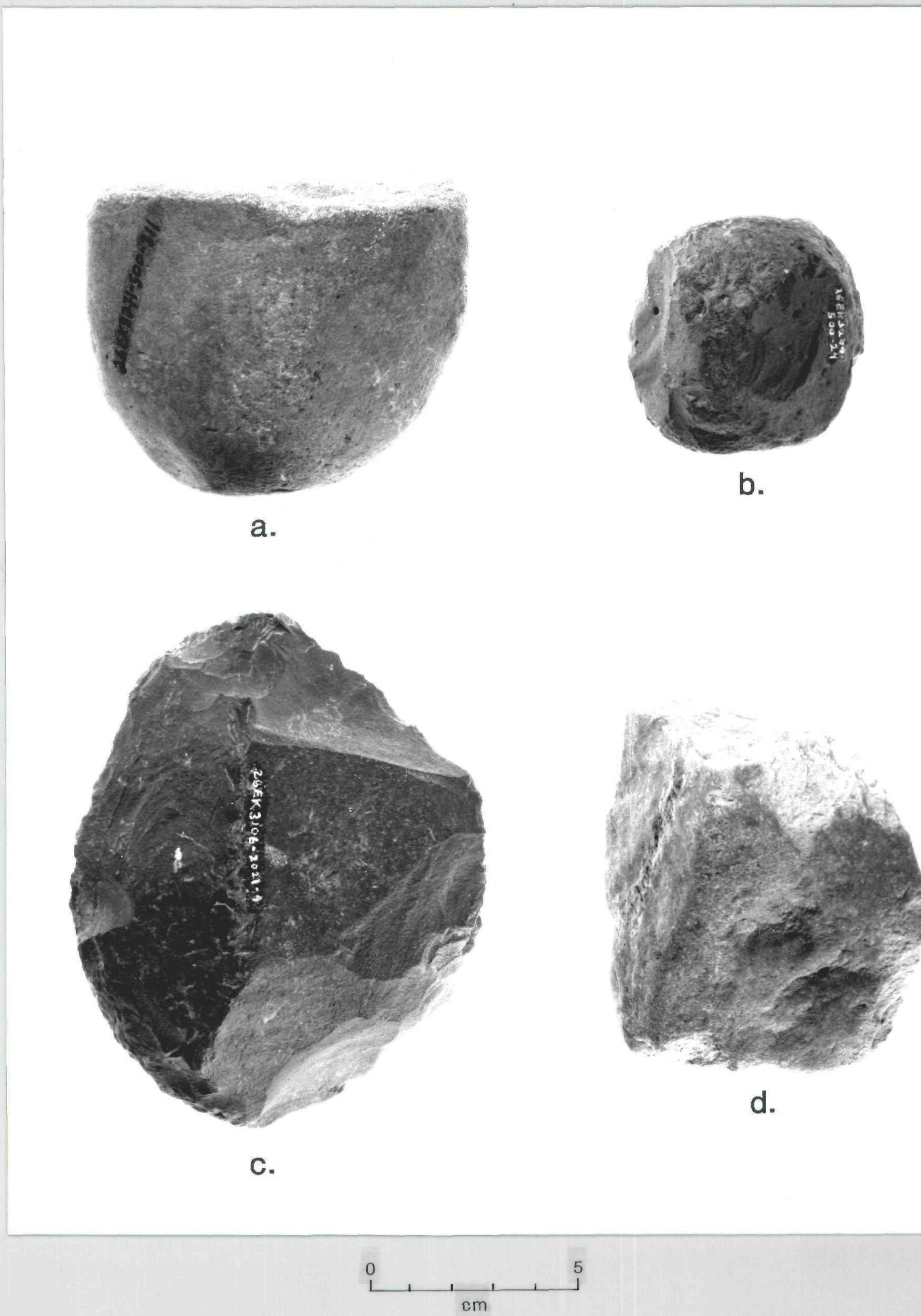
MB = Mass Basalt
OP = Opalite
OQ = Opalite w/Quartzite
QZ = Quartzite
RH = Rhyolite
TF = Tuff

Type

HM = Hammerstone
BS = Undifferentiated Battered Stone

Figure 19. Selected hammerstones.

a. 26Ek3271, specimen 500-311
b. 26Ek3239, specimen 500-24
c. 26Ek3106, specimen 2021-4
d. 26Ek3196, specimen 1007-1


a.
b.
c.
d.
0
5
cm

Choppers

Testing at 16 sites yielded 31 choppers (Table 23). The assemblage contains a variety of shapes, sizes, and raw material types (including opalite, basalt, and rhyolite), but most were manufactured on cobbles or tabular slabs that easily can be manipulated with one hand (Figure 20). Although choppers may have been used in an array of processing tasks, they probably were employed most frequently in the processing of organic materials (e.g., wood, fiber, and dried meat) (cf. Elston 1986).

Manufacturing techniques involved removal of two or more flakes by percussion (commonly unifacial) to achieve a sharp, roughly linear working edge. Working edge angles vary between 20° and 80°, but most (n=21, 68%) are between 50° and 70° (mean = 57.7° +/- 12.1°). Differences in working edge angles may represent purposeful modification for a specific task(s), or they simply may be a function of raw material type (i.e., hardness and initial morphology); perhaps too, some may represent reuse of a spalled rough percussion tool for an expedient task. All of the implements display some degree of use-wear, but attrition is most apparent on opalite choppers where polish and extensive step fracturing is common.

One noteworthy specimen (26Ek3160-500-67) is a large tabular piece of basalt exhibiting unifacial manufacture and use-wear edge damage (i.e., flaking) along one long (30 cm), linear margin. Based on its size and overall morphology, this spatulate artifact may have functioned as a quarrying or digging tool.

Table 23. Attributes and Provenience of Choppers.

All Measurements are in centimeters.

Site No. (26Ek)	Specimen No.	Fea.	Material	Length	Width	Thickness	Weight (gms)	Working Edge Angle (°@?)	Complete
3084	1021-1	2	OP	16.0	10.5	4.8	813.1	42	+
3085	508-2	8	TB	13.9	9.6	4.0	452.9	28	-
3093	505-9	5	OQ	11.8	7.8	3.6	401.2	42	+
3096	502-3	2	MB	10.4	7.8	5.5	568.0	64	+
3099	502-1	2	OP	8.0	8.0	3.1	161.9	46	+
3101	500-2	-	OP	10.2	6.0	2.9	211.5	60	+
3104	500-5	-	MB	11.2	10.5	8.0	2000.0	80	?
3107	1002-1	1	TF	13.6	10.4	4.7	663.0	80	+
3149	500-11	-	OP	9.7	7.0	3.7	269.4	64	+
3160	500-67	-	RH	7.6	6.9	3.3	227.6	66	+
	501-1	1	TB	30.5	25.6	2.6	2600.0	50	-
3170	500-12	-	OP	8.7	7.1	1.9	99.8	40	+
	500-21	-	MB	11.5	10.0	2.7	364.7	52	+
	500-51	-	OP	8.4	4.5	1.8	71.3	55	-
	500-52	-	OP	7.9	6.3	4.9	244.1	66	-
3184	503-3	3	OP	10.8	8.9	5.2	382.7	64	?
3208	501-1	1	MB	13.9	11.4	5.0	818.4	58	+
3238	500-33	-	QZ	18.1	12.7	4.2	1282.4	55	-
3239	500-22	-	TB	11.2	7.1	5.8	576.1	56	+
	500-27	-	OQ	5.9	4.8	3.4	77.1	45	+
	500-29	-	OP	10.4	10.2	3.6	412.9	64	+
3251	500-20	-	QZ	9.9	6.9	3.5	293.5	68	+
	1009-1	1	TB	12.4	7.7	3.3	449.0	48	+
3271	500-4	-	TB	13.5	8.5	3.4	601.9	68	+
	500-21	-	MB	13.8	9.5	2.8	494.8	62	?
	500-163	-	OQ	6.1	4.5	2.1	58.5	56	-
	505-2	5	OP	8.2	6.0	3.6	201.0	74	+
	516-2	16	OP	7.1	6.8	3.4	148.6	68	-
	1022-3	12	OP	11.1	7.5	4.7	344.9	50	+
	1023-2	12	OP	11.9	8.0	4.9	525.2	65	+
	1038-1	12	MB	8.3	5.2	3.1	155.0	52	?

Key:

Material

MB = Mass Basalt
OP = Opalite
OQ = Opalite w/Quartzite
QZ = Quartzite
RH = Rhyolite
TF = Tuff

Fabrication Tools

Fabrication tools (defined here as tools used to manufacture other tools) were recovered from 14 sites (Table 24). Clearly, hammerstones and choppers can be classified as fabrication tools, but this discussion focuses on more elaborate and/or task specific tools in order to highlight their attributes and functional interpretations. Fabrication tools include abraders, shaft abraders (or smoothers), scratched stone, and basalt planers.

Figure 20. Selected choppers.

a. 26Ek3170, specimen 500-52
b. 26Ek3160, specimen 500-67
c. 26Ek3251, specimen 1009-1
d. 26Ek3251, specimen 500-20

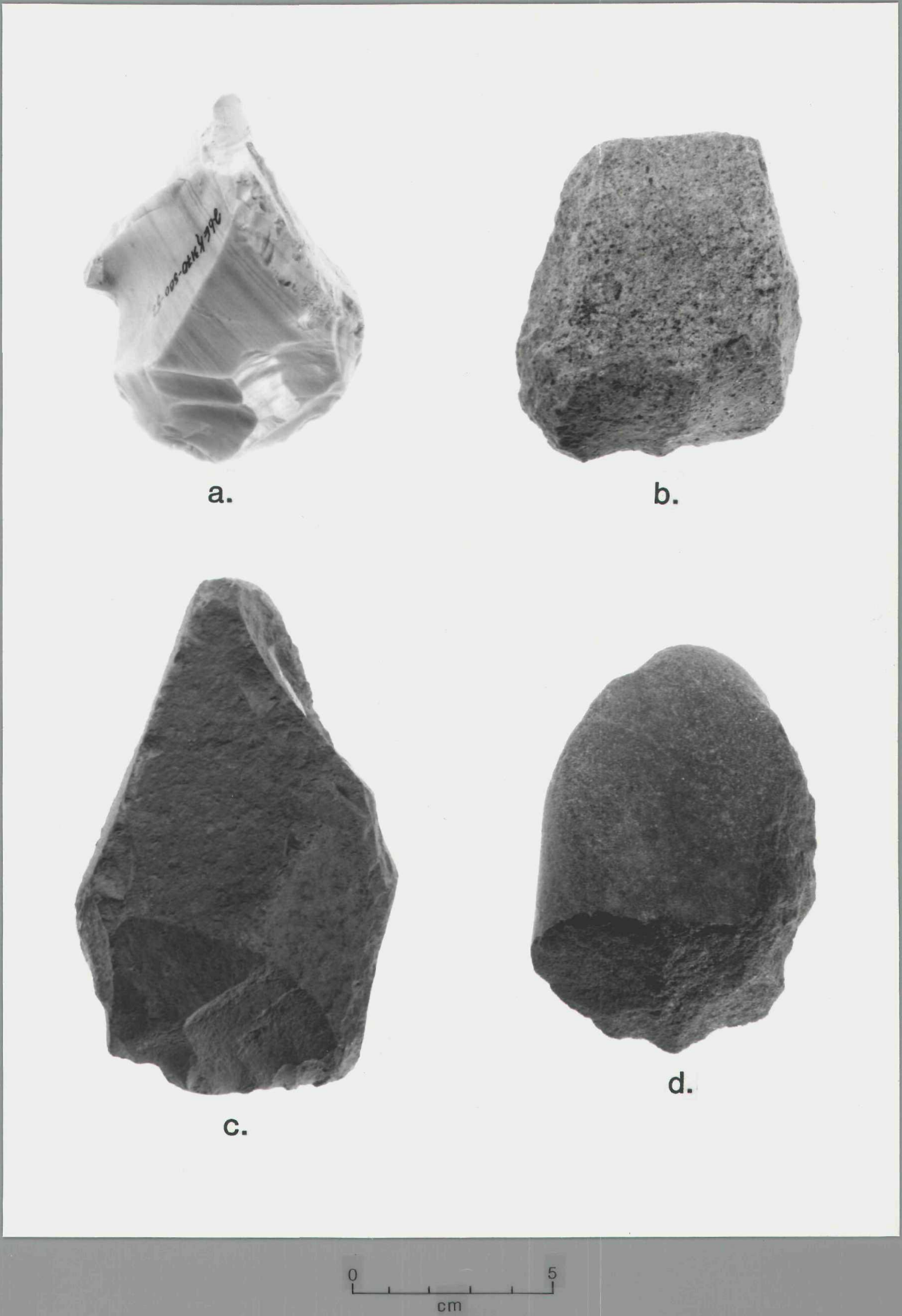

a.
b.
c.
d.
0
5
cm

Table 24. Attributes and Provenience of Fabrication Tools.

All Measurements are in centimeters.

Site No. (26Ek)	Spec. No.	Fea.	Material	% Complete -ness	Plan Outline	Shaped	Facial Use	Use Surface Profile	Type	Length	Width	Thickness	Weight
3092	500-3	-	TF	100	RC	+	M	PL	AB	4.5	1.4	1.4	8.4
3095	500-57	-	RH	?	IN	-	U	PL	SS	10.0	7.9	2.6	252.0
	1002-7	19	SD	25	SR	+	U	GV	SA	3.2	4.1	1.9	27.6
	1025-1	15	SD	75	OV	+	U	GV	SA	11.7	6.6	2.0	203.1
3106	1050-1	4	TB	?	IN	-	U	PL	SS	12.1	7.1	3.5	280.8
3114	1007-5	1	TB	100	OV	?	B	IR	SS	10.9	10.0	3.2	447.8
3160	500-118	-	MB	100	SR	+	M	PL	PL	14.6	8.7	6.1	778.5
	501-15	1	MB	100	OV	+	M	PL	PL	11.4	8.5	4.4	441.9
	515-1	15	TF	50	OV	+	U	GV	SA	4.6	2.8	2.2	17.6
	1001-1	1	MB	100	OV	+	M	PL	PL	14.4	8.8	5.7	752.5
	1005-4	1	TB	95	OV	?	B	CN	SS	11.4	9.7	1.9	430.3
	1007-4	1	TB	?	IN	-	U	PL	SS	8.0	4.3	2.4	115.7
3171	500-4	-	TF	100	SR	?	U	CV	SS	11.6	12.9	3.0	447.6
3184	503-27	3	SD	100	OV	+	U	GV	SA	9.9	5.0	4.0	177.0
3185	1010-1	1	TF	90	OV	+	U	CV	SS	14.0	12.4	3.9	731.8
3190	1006-3	1	TF	100	IR	-	M	ML	AB	4.2	2.6	1.9	19.2
3193	506-1	6	TF	100	SR	-	U	PL	SS	4.3	3.2	0.9	14.6
3198	1003-1	1	SD	100	RC	+	M	GV	SA	5.5	2.6	1.7	33.9
3201	1002-1	1	TF	75	IR	?	B	ML	SS	13.0	10.9	3.5	387.8
3204	500-23	-	RH	80	SR	-	U	CV	SS	10.1	8.1	2.6	326.7
3271	500-62	-	TF	100	IR	+	U	PL	SS	7.7	7.2	3.4	137.8
	1047-2	12	TB	90	OV	-	U	PL	SS	12.6	7.0	2.7	410.5

Key:

Material
MB - Mass Basalt
RH = Rhyolite
SD = Sandstone
TB = Tabular Basalt
TF = Tuff

Plan Outline
OV = Ovoid
RC = Rectangular
SR = Sub-rectangular
IR = Irregular
IN - Indeterminant
IR = Irregular

Facial Use
U = Unifacial
B = Bifacial
M = Multiple

Use Surface Profile
CN = Concave
CV - Convex
PL = Planer
ML = Multiple
GV = Groove

Type
AB = Abrader
SA = Shaft Abrader
SS = Scratched Stone
PL = Planer

Abraders

Two abraders were recovered, one from site 26Ek3092 and one from 26Ek3190 (Table 24). The former has been modified extensively to create a rectangular shape while the latter is unshaped, but possesses five polished and striated planar facets from use-wear. Both specimens are small and easily can be employed in limation while held with two or three fingers. Although untested, these artifacts probably were utilized in the finishing stages of bone or wood tool manufacture (e.g., awls, needles).

Shaft Abraders

Five shaft abraders were recovered from four sites (Table 24). Four specimens are manufactured on sandstone and one on a piece of coarse-grained welded tuff. Groove width/diameters are similar, ranging between 7.1 mm and 8.0 mm (mean = 7.6 mm).

At site 26Ek3095, shaft abraders (n=2) were recovered from surface collections at features 15 and 19. Each is manufactured on sandstone and possess one linear groove. Specimen 26Ek3095-1025-1 is interesting in that it still retains manufacture (i.e., pecking) marks in the groove, suggesting minimal use (Figure 21a). While the other four specimens represent single artifacts, this groove, manufactured on a planate surface, may represent half of a paired abrader (see Flenniken and Ozbun 1988).

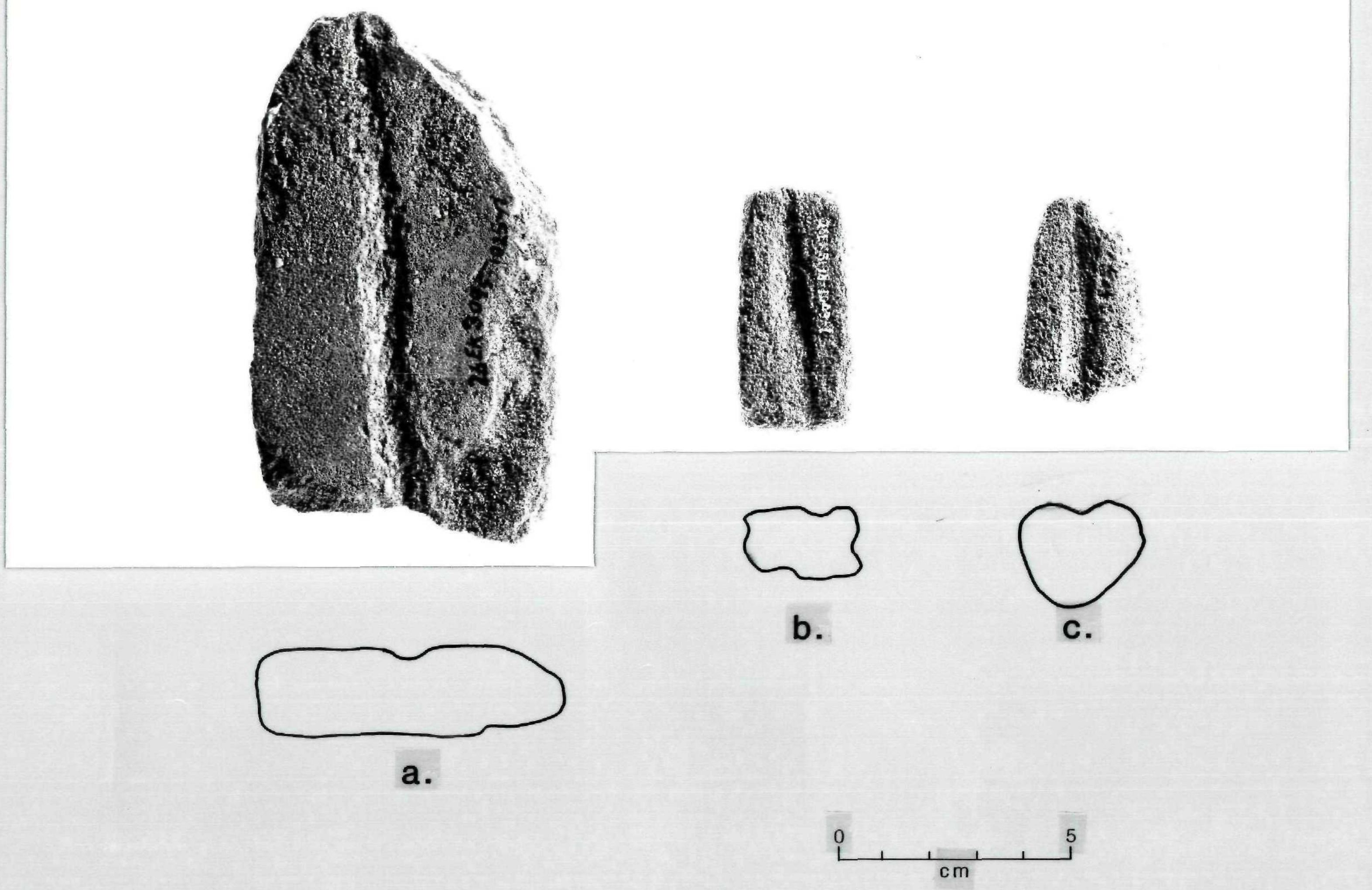
Surface collection at Feature 3, site 26Ek3184, recovered a sandstone shaft abrader with three linear grooves on one surface, two of which intersect near the middle of the working surface to form an "X" with the third groove offset to one side. Specimen 26Ek3198-1003-1 is a small rectangular piece of sandstone with linear grooves truncating each of its four flat surfaces (Figure 21b). Finally, specimen 26Ek3160-515-1, an ovate shaft abrader exhibiting one groove (Figure 21c), is very similar to a specimen recovered from Gatecliff Shelter (see Kramer and Thomas 1983: Figure 105). Arrow shaft abraders also have been recovered from Danger Cave (Jennings 1957), Swallow Shelter (Dalley 1976), Hogup Cave (Aikens 1970), and James Creek Shelter (Juell 1990).

Scratched Stone

A collection of 12 scratched stones comprise one of the more interesting artifact classes. These distinct artifacts possess numerous, often deep, parallel striations, probably from employment in edge preparation (i.e., weaken or strengthen biface margins) to facilitate flake removal in lithic reduction.

Figure 21. Selected shaft abraders.

a. 26Ek3095, specimen 1025-1
b. 26Ek3198, specimen 1003-1
c. 26Ek3160, specimen 515-1


a.
b.
c.
0
5
cm

Although some may have functioned as grinding implements (i.e., some have small polished facets), the number, extent, and morphology of scratches indicates that most were "dragged" repeatedly across sharp, undulating edges. Similar damage was experimentally produced on tabular basalt by such activities.

Further support to their inferred use in lithic reduction tasks is evident in their battered margins. Three specimens (26Ek3160-1005-4, 26Ek3114-1007-5, and 26Ek3271-1047-2 exhibit extensively damaged edges characteristic of percussion. Most of the scratched stones are tabular pieces (mean thickness = 3.3 mm) easily wielded with one hand. Two specimens (26Ek3160-1007-4 and 26Ek3106-1050-1 are fire-cracked and blackened indicating reuse as hearth rocks or boiling stones.

Planers

The planer assemblage consists of three nearly identical specimens collected from site 26Ek3160 (see Table 24). Each specimen is triangular in cross section and exhibits purposeful decortication on two surfaces to create sharp edges. Further flake removal along these edges is present in the form of small flake scars and step fractures that resulted from scraping and battering tasks, perhaps from use in wood working. Two specimens (26Ek3160-501-15 and 1001-1) display large polished areas on their flat "bottom" surfaces and adjacent flaked margins. Based on context (i.e., all are from Bitterroot Ridge), these artifacts may also have been utilized in the processing of bitterroot or other tubers; their polished surfaces resulted from occlusion with a hard grinding surface. Thomas and Bierwirth (1983:226-229) report similar artifacts from Gatecliff Shelter.

Other Modified Stone

The other modified stone assemblage incorporates extensively shaped, "exotic" artifacts. Two specimens are formed ornamental objects and three represent various stages of pipe manufacture.

Ornaments

Collected as an extra-feature surface find at 26Ek3160, specimen 500-31 is a fragment of an incised tuff disc (Figure 22a). The artifact bears evidence of numerous attempts to biconically perforate its center (i.e., three drilled pits truncate one surface and ca. four the other), one of which succeeded to create an aperture 6.5 mm in diameter. Numerous decorative linear striae are present on one surface, creating a "sunburst" pattern radiating from the perforation. The artifact is 17 mm thick and weighs 18.7 gms (estimated complete weight = ca. 80 gms).

Similar artifacts have been found in Great Basin sites, particularly in western Nevada (see Drews and Schmitt 1986 and references therein). These artifacts are functionally enigmatic, but may have been used as ornaments, charms, fishing sinkers, or spindle whorls employed in the manufacture of cordage.

Specimen 2142-1 was collected from subsurface deposits adjacent a hearth (Feature 2) at site 26Ek3237. The artifact possesses a scored neck near one end (maximum diameter = 12.7 mm) truncating an otherwise unmodified chalcedony nodule (Figure 22b). This enigmatic artifact probably served as an ornament/effigy, but might have been employed in fishing (e.g., a net sinker or lure weight). It weighs 11.2 grams and has a maximum diameter of 21.8 mm.

Pipes

Two fragmented smoking pipes and an unfinished pipe (i.e., a preform) were collected. Shovel-skimming at Feature 19, site 26Ek3095, retrieved a shaped tuff cylinder with a small drilled pit in one end (maximum diameter = 8.4 mm; Figure 22c); the opposite end is truncated. This fragment probably represents a pipe preform that broke early in manufacture.

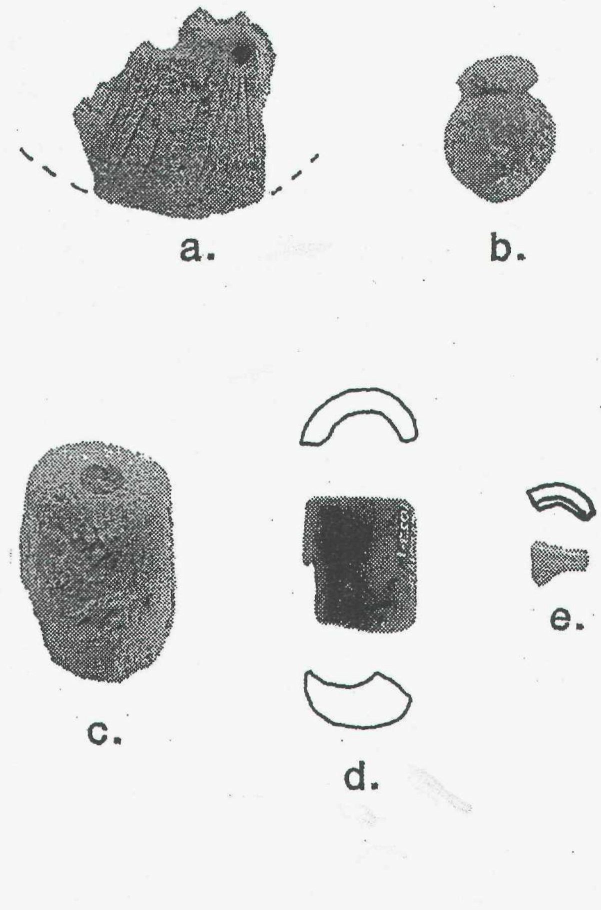
Specimen 26Ek3192-502-10 is a schist pipe in several fragments (outer diameter = ca. 22 mm) exhibiting multiple, longitudinal manufacture ("filing") striations within its aperture. The external surface is also striated (Figure 22d), but decoratively; the striations are isolated and circumscribe its short axis. The aperture is flared at one end, gradually tapering to a smaller opening at the other, a trait characteristic of ethnographic Shoshone pipes illustrated in Steward (1941:Figure 4 c-d).

A small pipe fragment (specimen 2021-20) was also recovered from test excavations at site 26Ek3184 (Figure 22e). Manufactured on a piece of welded tuff, the artifact possesses a small ridge adjacent to its aperture on one end indicating that it had been scored repeatedly and then snapped off a larger cylindrical segment, a technique commonly employed in the manufacture of bone tubes and beads (see Aikens 1970; Schmitt 1990). Its internal surface is blackened from use and its projected (i.e., estimated) outer diameter is 18 mm.

Unfinished pipes, complete pipes, and pipe fragments have been recovered from archaeological sites throughout the Great Basin (e.g., Budy 1987; Juell 1990; Kramer and Thomas 1983).

Figure 22. Ornaments and pipes.

a. Ornament; 26Ek3160, specimen 500-31
b. Ornament/effigy; 26Ek3237, specimen 2142-1
c. Pipe preform; 26Ek3095, specimen 1001-3
d. Pipe fragment; 26Ek3192, specimen 502-10
e. Pipe fragment; 26Ek3184; specimen 2021-20


a.
b.
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d.
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0
5
cm

Chapter 6. CERAMICS

by Dave N. Schmitt and Kenneth E. Juell

One hundred ceramic sherds were recovered by testing procedures in the Tosawihi Quarries vicinity. Most (n=55) were collected from five sites in the USX-East study area, while investigations at two sites in the USX-West study area and one site in the North Access Corridor yielded the remainder; 43 and 2 specimens, respectively. Four ceramic types are represented: Shoshone Brownware, Great Salt Lake Corrugated, Promontory Gray, and Snake Valley Gray.

Analytic Methods

Ceramics were described and typed according to observations of color, decorative technique and style, method of forming, shaping, and firing, and microscopic qualities of temper (after Juell 1987). Temper was identified by examining a freshly broken edge under a binocular microscope (25-30x). Following definitions reported in Madsen (1977), Fremont types were identified based on temper and mineral inclusions added to the paste. Shoshone Brownware sherds were identified by examining surface color, vessel wall thickness, surface manipulation, and temper. Each specimen was measured.

Brownware

Shoshone Brownware (n=82) appeared in four sites on the periphery of the Tosawihi Quarries (Table 25). Forty sherds were recovered at site 26Ek3192; 39 were collected from shovel-skimming and subsurface excavations at Feature 1, and 1 sherd was collected from the surface of Feature 2 (Table 25). Interior and exterior surface colors range from light brown to a medium reddish brown, indicating a poorly controlled oxidizing firing atmosphere. Most surfaces are deeply striated from smoothing/scraping prior to firing (Figure 23a-c). The composition and color of rock inclusions in the temper are similar to small gravels found in local drainages (e.g., rounded quartz grains, subangular rhyolite, and rounded white rock [opalite?]), suggesting that Brownwares found here may have been manufactured on or near-site.

Two Shoshone Brownware Sherds were recovered from Feature 1 at site 26Ek3181. The sherds have brown interior surfaces and medium reddish brown exterior surfaces, also indicative of firing in an uncontrolled oxidizing atmosphere. Provenience, overall morphology, and similarity in temper indicate these specimens are from the same vessel.

Table 25. Attributes and Provenience of Brownware Ceramic Sherds.

All Measurements are in Millimeters

Site No.	Reference No.	No. Sherds	Fea.	Unit Type	Level	(Mean) Length	(Mean) Width	Max. Wall Thickness	TYPE Style	TYPE Culture	SURFACE COLORS Interior	SURFACE COLORS Exterior	Temper
26Ek3160	1013	17	1	SFC	0	(23.7)	(18.3)	7.5	SBW	N	LB-RB	MB-RB	2
	1014	8	1	SFC	0	(24.8)	(19.9)	7.4	SBW	N	LB-RB	MB-RB	2
	1015	3	1	SFC	0	(21.0)	(17.0)	6.5	SBW	N	LB-MB	MB-RB	2
	1016	4	1	SFC	0	(26.1)	(18.2)	7.5	SBW	N	LB-RB	MB-RB	2
	1017	7	1	SFC	0	(30.2)	(19.8)	7.2	SBW	N	LB-MB	MB-RB	2
26Ek3174	502	1	2	IFC	S	29.9	28.9	9.4	SBW	N	KG	MB	1
26Ek3181	1010	1	1	SFC	0	20.4	19.4	6.6	SBW	N	MB	RB	2
	1011	1	1	SFC	0	14.7	10.1	6.5	SBW	N	MB	RB	2
26Ek3192	502	1	2	IFC	S	28.0	21.3	7.8	SBW	N	LB	MB	3
	1005	4	1	SFC	S	(33.4)	(24.9)	8.1	SBW	N	LB-MB	LB-RB	3
	1007	3	1	SFC	0	(31.3)	(24.6)	7.8	SBW	N	LB	LB-RB	3
	1016	1	1	SFC	0	24.1	22.5	6.8	SBW	N	LB	LB	3
	1022	10	1	SFC	0	(24.3)	(19.4)	7.8	SBW	N	LB-MB	LB-RB	3
	1024	1	1	SFC	0	20.3	17.0	6.7	SBW	N	-	RB	3
	2101	1	1	EU	1	27.7	23.5	6.6	SBW	N	LB	RB	3
	2261	18	1	EU	1	(23.4)	(20.6)	8.5	SBW	N	LB-RB	RB-MB	3
	2281	1	1	EU	1	39.5	29.5	7.6	SBW	N	LB	RB	3

Key:

Unit Type
EU = Excavation Unit
IFC = Inventory Feature Collection
SFC = Sample Feature Collection

Level
S = Surface
0 = 0-2 cm B.S.
1 = 2-10 cm B.S.

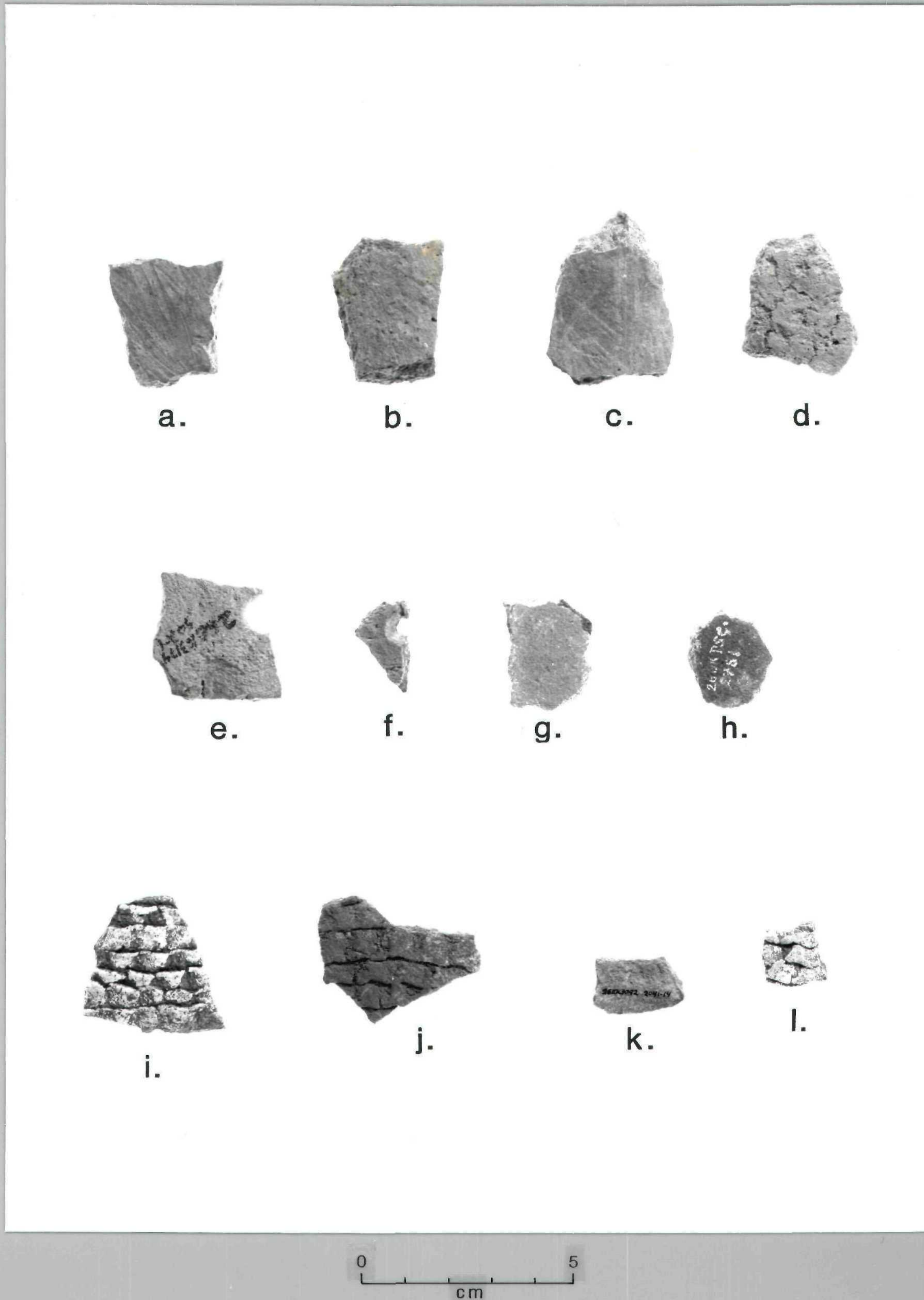
Type
SBW = Shoshone Brownware
N = Numic

Surface Colors
LB = Light Brown
MB = Medium Brown
RB = Reddish Brown
KG = Blackish Gray

Temper
1 = Fine-grained, Rounded Quartz (i.e., sand)
2 = Rounded Quartz, Sparse Angular Quartz, Undifferentiated Angular White Rock (Opalite?), and Mica
3 = Undifferentiated Rounded White and Blue-gray Rock (Opalite?), Subangular Red Rock (Rhyolite?), Rounded Quartz Grains, and Subangular Chalky (Pink) Rock

Figure 23. Examples of Shoshone Brownware (a-f), Snake Valley Gray (g), Promontory Gray (h), and Great Salt Lake Gray (i-l) ceramic sherds from testing on the peripheries of the Tosawihi Quarries.

a. 26Ek3192; specimen 1022-2, interior surface
b. 26Ek3160; specimen 1013-1-1, exterior surface
c. 26Ek3192; specimen 2281-20, exterior surface
d. 26Ek3160; specimen 1013-1-2, exterior surface
e. 26Ek3174; specimen 502-1, exterior surface
f. 26Ek3160; specimen 1013-1-3, exterior surface
g. 26Ek3198; specimen 509-3, exterior surface
h. 26Ek3092; specimen 2781-1, exterior surface
i. 26Ek3092; specimen 2042-1, exterior surface
j. 26Ek3092; specimen 2042-2, exterior surface
k. 26Ek3092; specimen 2041-14, exterior surface
l. 26Ek3092; specimen 2041-15, exterior surface


a.
b.
c.
d.
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cm

Testing at Feature 1, site 26Ek3160, yielded 39 Brownware sherds. Probably representing a single vessel, temper consists largely of rounded quartz grains with some angular quartz particles, unidentified white rock, and mica. Similar to Brownware sherds collected at 26Ek3192, most surfaces (particularly interior) are striated from scraping prior to firing. One specimen possesses a biconically drilled hole (outer diameter = 9.0 mm; Figure 23f), probably drilled through the sherd in an attempt to repair a crack, but may represent an opening to facilitate hanging or carrying the vessel (cf. Heizer et al. 1968; see also Butler 1979: Figure 2). Although four rimsherds were identified in the 26Ek3160 ceramic assemblage, they are too small to infer vessel type.

A single, thick Shoshone Brownware Sherd was collected from the surface of Feature 2 at site 26Ek3174 (Figure 23e). The sherd has a very slight lateral and longitudinal curvature and may represent a basal fragment of a flat-bottomed jar. The sherd possesses a biconically drilled hole along one margin (inner diameter = 8.5 mm, outer diameter = 6.2 mm); this aperture probably also represents a hole drilled for the purpose of vessel repair.

Brownware sherds have been recovered from numerous sites in the central and eastern Great Basin (e.g., Jennings 1957; Magee 1964; Spencer et al. 1987; Thomas 1988; see especially Fowler 1968). Although the highly fragmented condition of the Tosawihi Brownware ceramic assemblage (and paucity of rimsherds) precludes inferences on vessel type, it is suspected that many specimens are fragments of large wide-mouthed, flat-bottomed jars, the most common Shoshonean vessel form (cf. Madsen 1986:211). Shoshone Brownware is poorly dated, but most likely postdates A.D. 1300 in northern Nevada (Madsen 1986:214).

Grayware

Fremont grayware was recovered from four sites in the Tosawihi Quarries vicinity. At site 26Ek3171, eight sherds (Table 26) were recovered from a discretionary surface collection unit just south of Feature 3. The sherds have exterior surface colors ranging from brownish to blackish gray, interior surfaces ranging from light to blackish gray, and a mean vessel wall thickness of 6.3 mm. The temper, consisting of rounded and subangular quartz grains, feldspar, and mica, compares most favorably to Promontory Gray (Madsen 1977:23). Promontory Gray originally was described as a Fremont grayware variety found in the Great Salt Lake variant of northwestern Utah, dating between A.D. 1000 and A.D. 1300 (Madsen 1977). Recently, however, it has been suggested that Promontory Gray vessels may also have been manufactured by later Paiute-Shoshone groups (Madsen 1986).

Table 26. Attributes and Provenience of Grayware Ceramic Sherds.

All Measurements are in Millimeters

Site No.	Reference No.	No. Sherds	Fea.	Unit Type	Level	(Mean) Length	(Mean) Width	Max. Wall Thickness	TYPE Style	TYPE Culture	SURFACE COLORS Interior	SURFACE COLORS Exterior	Temper
26Ek3092	2041	2	-	EU	1	(18.4)	(14.2)	4.1	SLC	F	LG-KG	TN	4
	2042	2	-	EU	2	(35.2)	(30.8)	3.6	SLC	F	DG	TN-BG	4
26Ek3171	2781	6	-	DSC	0	(18.2)	(12.3)	6.7	PRG	F/N	KG-MG	LG-KG	5
	2782	1	-	DSC	0	18.3	13.0	6.5	PRG	F/N	DG	LG	5
	2784	1	-	DSC	0	18.5	16.9	6.3	PRG	F/N	MG	LG	5
26Ek3198	509	3	9	IFC	S	(22.6)	(16.5)	6.7	SVG	F	LG-LB	MG	6
	1082	1	9	SFC	0	20.4	16.5	6.3	SVG	F	LG-LBG	MG-BG	6
26Ek3239	1001	1	1	SFC	0	38.8	36.4	5.8	SVG	F	LBG	BG	6
	2001	1	1	EU	1	16.6	16.4	5.9	SVG	F	LG	LBG	6

Key:

Unit Type
EU = Excavation Unit
DSC = Discretionary Unit Collection
IFC = Inventory Feature Collection
SFC = Sample Feature Collection
F/N = Fremont or Numic

Level
S = Surface
0 = 0-2 cm B.S.
1 = 2-10 cm B.S.
2 = 10-20 cm B.S.

Type
SLC = Great Salt Lake Gray, Corrugated
PRG = Promontory Gray
SVG = Snake Valley Gray
F = Fremont

Surface Colors
TN = Tan
LG = Light Gray
MG = Medium Gray
DG = Dark Gray
KG = Blackish Gray
LB = Light Brown
LBG = Light Brownish Gray
BG = Brownish Gray

Temper
4 = Rounded and Subangular Quartz Grains
5 = Rounded and Subangular Quartz Grains, Black Feldspar, Mica, and sparse white (opaque) rock
6 = Angular Quartz, Black Feldspar, and Mica

Six Snake Valley Gray sherds also were collected; four were recovered from testing at Feature 9, site 26Ek3198, and two were recovered from site 26Ek3239 during surface collections and subsurface excavations at Feature 1 (see Table 26). These sherds have interior surfaces ranging in color from light brown to light gray and exterior surfaces ranging from medium gray to brownish gray. Temper components include angular quartz, mica, and black feldspar; characteristic of Snake Valley Gray (Madsen 1977:1). This type of ceramic is the principal plainware of the Parowan Fremont variant, centered in the Parowan Valley of southwestern Utah (see Figure 4 in Madsen [1986] for a map depicting all Fremont grayware core areas). Snake Valley Gray has a temporal range of A.D. 900 - 1300 (e.g., Madsen 1977).

Finally, four corrugated Great Salt Lake Gray sherds were retrieved from subsurface excavation at site 26Ek3092 (see Table 26). Temper constituents are almost entirely rounded and subangular quartz. One specimen (2041-14; Figure 23k) is an everted neck sherd, probably representative of a cooking pot. Great Salt Lake Gray pottery has the most extensive temporal range of all Fremont ceramics; A.D. 500 to A.D. 1300 (e.g., Marwitt 1970; Madsen 1986). Elsewhere in northeast Nevada, Zeier and Zeanah (1987) report a surface collected Great Salt Lake Gray sherd from Toano Draw and Madsen (1990) reports a Great Salt Lake Gray sherd from James Creek Shelter bracketed by an overlying hearth dated to 930 B.P. and a stratigraphically earlier hearth dated to 1240 B.P., well within the range of Great Salt Lake Gray.

Although specific pottery types were not ascertained, Fremont-like grayware sherds have also been recovered from sites along the Snake River in southern Idaho (Butler 1979) and at South Fork Shelter (Heizer et al. 1968).

Part III. North Access Corridor Study Area

The results of testing at eight North Access Corridor sites are presented in Chapter 7.

Chapter 7. TESTING RESULTS

by Dave N. Schmitt

The North Access Corridor project area is a 100 foot wide, 3.5 mile linear corridor along the existing Ivanhoe Creek road. Beginning at Willow Creek on the north, the corridor traverses a series of low stream terraces before it enters Perron Canyon. The canyon, characterized by relatively steep slopes (containing occasional large rhyolitic outcrops), likely served as a natural low elevation access corridor to and from the heart of the Tosawihi Quarries. Emerging from the southern mouth of the canyon, Big Butte looms approximately four miles to the southeast; a natural landmark signifying the toolstone, water, and small mammal resources that lie ahead.

As the corridor continues south from the head of Perron Canyon, it enters the gentle, open terrain of Ivanhoe Creek Valley. This area is characterized by numerous small knolls and grassy meadows, and the alluvial slopes and stream terraces that border Ivanhoe Creek.

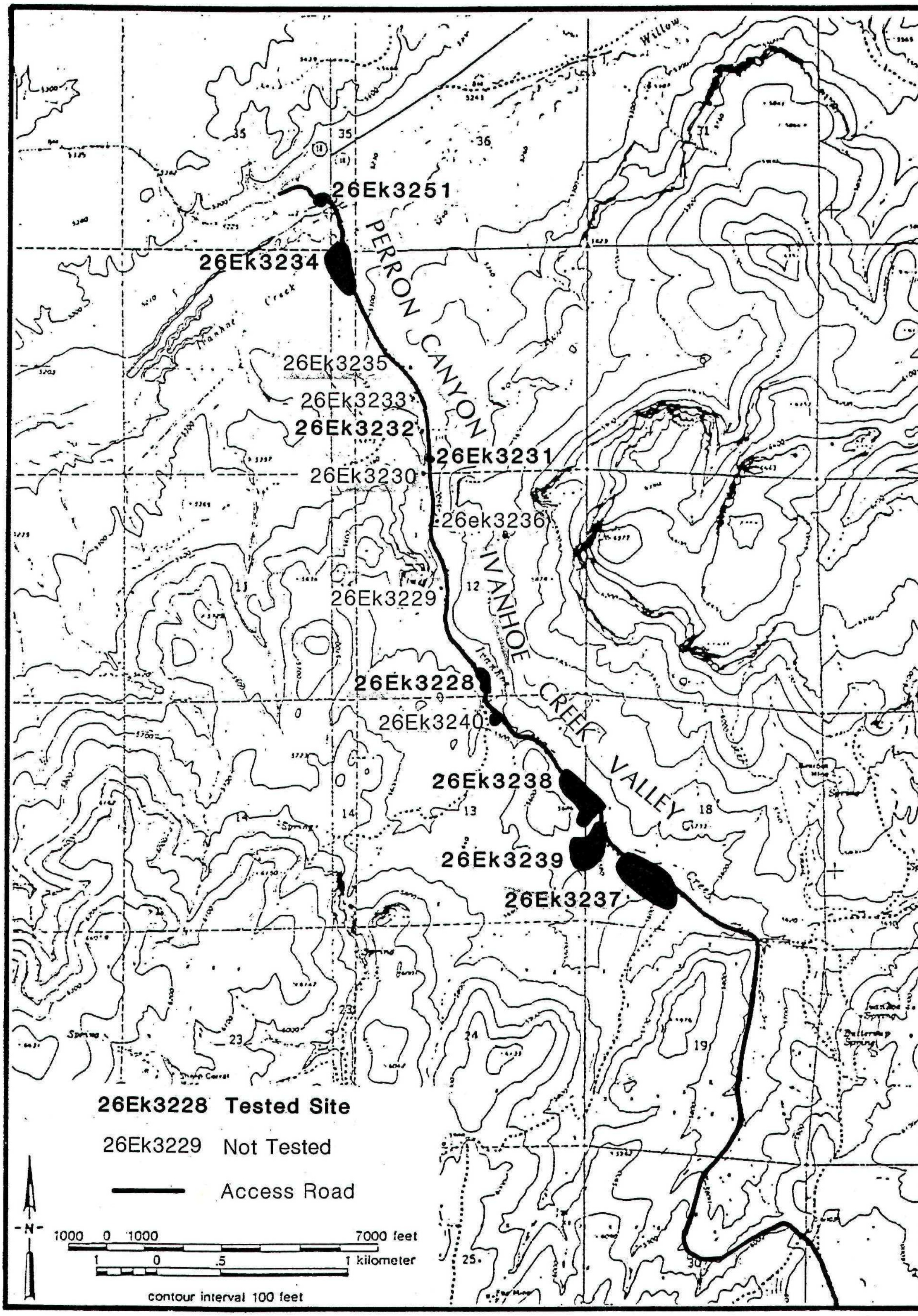
Vegetation in the corridor is comprised largely of big sage and low sage communities, with a sparse to dense cheatgrass understory. Big sage is most common in deeper soils, especially in alluvial sediments along stream channels, while low sage occurs more frequently in association with exposed bedrock and shallow colluvial deposits. In addition to sage, both communities include rabbitbrush, Great Basin wildrye, bluebunch wheatgrass, squirreltail, fescue, and lupine.

This chapter presents the results of archaeological testing in the northern segment of the North Access Corridor. The chapter first summarizes sites by type, then presents methods employed in field investigations. Chronological markers and intersite comparisons of artifact assemblages are discussed next, followed by descriptions specific to topographic location, site structure, and artifact constituents and frequencies. Finally, the results of testing are summarized in terms of their data potential in relation to the economics of toolstone transportation, their place in the regional economy, and cultural chronology.

Descriptive Site Summary

Fourteen archaeological sites were identified along the northern segment of the Access Road corridor (Figure 24, Table 27) of which six sites were not tested: three isolates, two diffuse, undifferentiated lithic scatters, and one historic can scatter (see Drews 1988). The remaining eight sites, five reduction loci and three reduction/ residential complexes, were examined further and are the subjects of this chapter.

Figure 24. North access corridor site location map.



Willow
35
35
36
31
26Ek3251
26Ek3234
PERRON CANYON
Ivanhoe Creek
26Ek3235
26Ek3233
26Ek3232
26Ek3231
26Ek3230
26ek3236
26Ek3229
12
11
IVANHOE CREEK VALLEY
26Ek3228
26Ek3240
26Ek3238
14
13
18
26Ek3239
26Ek3237
23
23
24
19
25
30
26Ek3228 Tested Site
26Ek3229 Not Tested
Access Road
N
1000 0 1000 7000 feet
1 0 .5 1 kilometer
contour interval 100 feet

Table 27. Descriptive Summary, North Access Corridor Sites.

Site Number	Type	Features (n)	Maximum Site Area (sq m)
26Ek3228	Reduction Complex	2	4,750
26Ek3229	Historic [NOT TESTED]	-	100
26Ek3230	Undifferentiated Scatter [NOT TESTED]	-	100
26Ek3231	Reduction Station	1	2,100
26Ek3232	Reduction Station	1	1,590
26Ek3233	Isolate [NOT TESTED]	-	N/A
26Ek3234	Undifferentiated (Reduction) Scatter	None	4,200
26Ek3235	Isolate [NOT TESTED]	-	N/A
26Ek3236	Isolate [NOT TESTED]	-	N/A
26Ek3237	Reduction/Residential Complex	2	42,000
26Ek3238	Reduction Complex	2	22,500
26Ek3239	Reduction/Residential Complex	1	12,800
26Ek3240	Undifferentiated Scatter [NOT TESTED]	-	15,000
26Ek3251	Reduction/Residential Complex	6	15,000

Reduction sites in the North Access Corridor study area occur in a variety of geographic settings. Two sites (26Ek3231 and 26Ek3232) are situated on stream terraces bordering the eastern bank of Ivanhoe Creek at the northern mouth of Perron Canyon. Each site contains a small lithic concentration surrounded by a sparse scatter of opalite debitage. Located approximately one mile north of Perron Canyon, site 26Ek3234 (an undifferentiated lithic scatter) occupies a terrace riser overlooking Willow Creek to the north and Ivanhoe Creek to the west. The two remaining reduction sites are situated on low stream terraces and associated knolls and inset fans along the west bank of Ivanhoe Creek. Site 26Ek3228 is characterized by two spatially discrete debitage concentrations and a light to sparse lithic scatter that roughly defines its northern boundary. Similarly, site 26Ek3238 (one kilometer upstream of 26Ek3228) contains a lithic concentration within sparse scatters of opalitic debitage.

Although debris from toolstone processing is abundant, sites 26Ek3237, 26Ek3239, and 26Ek3251 yielded large, diverse artifact assemblages suggesting short term campsites. Site 26Ek3237 exhibits three topographically distinct lithic concentrations containing a variety of chert, opalite, and obsidian debitage, and formed artifacts, such as projectile points and preforms, scrapers, hammerstones, and a host of Small and Quarry Bifaces. Test excavations revealed a near-surface fire hearth in the northern site area.

Just north of 26Ek3237, site 26Ek3239 contains a small lithic concentration located on the north trending lobe of a finger ridge. Use as a short term camp is suggested by the recovery of pottery, scrapers, choppers, bifaces, and expedient flake tools. A small opalite cobble field (Locus A) is located adjacent an ephemeral drainage along the northern boundary of the site: although the grainy, weathered toolstone is poor quality, a few hammerstones and assayed pieces were observed in this site area.

Occupying a terrace above the north bank of Willow Creek, six discrete, functionally diverse features are located within the confines of site 26Ek3251. As suggested by the wealth of stylized tools, Small Bifaces, and ground stone, this area also appears to have served as a short term habitation locus where a variety of subsistence tasks were undertaken.

Testing Strategies

Testing in the North Access Corridor was designed to characterize surface manifestations and to explore the extent of subsurface deposits, as summarized in Table 28 below.

Table 28. Summary of Testing Procedures, North Access Corridor.

	FEATURES RECORDED		FEATURE CONTEXT		NONFEATURE CONTEXT		RECOVERED COLLECTIONS	
Site Number	Total (n)	Sampled (n)	Surface Skim Area (sq m)	Subsurface Excavation Volume (cu m)	Surface Skim Area (sq m)	Subsurface Excavation Volume (cu m)	Debi- tage (n)	Formed Artifacts (n)
26Ek3228	2	2	4.00	0.10	-	-	497	9
26Ek3231	1	1	4.00	-	-	-	313	5
26Ek3232	1	1	4.00	-	-	-	163	7
26Ek3234	-	-	-	-	2.00	-	13	3
26Ek3237	2	*1	-	0.20	9.00	1.20	1,887	97
26Ek3238	2	1	8.00	-	2.00	0.65	3,610	44
26Ek3239	1	1	4.00	0.10	-	-	1,944	47
26Ek3251	6	3	24.00	1.15	-	0.10	12,751	119

* Feature 2 was discovered in subsurface excavation.

Each site was examined by close-interval transects; identified features and extra-feature artifacts (i.e., formed artifacts found within site boundaries in non-feature contexts) flagged for subsequent mapping and collection. Unlike surface expressions in and adjacent to the Tosawihi Quarries (see, for example, Chapter 16), discrete feature concentrations are rare in the northern corridor; consequently, testing was directed towards retrieval of tools and debitage from large, undifferentiated scatters. This was achieved through systematic shovel skimming of units established along a baseline transect and/or placement and excavation of a test unit. When present, a feature (or features) was investigated by similar techniques and all surrounding artifacts were mapped and collected.

At site 26Ek3251, three of the six identified feature loci were sampled via systematic surface collections and/or excavation units. The selection of features for special scrutiny was based largely on surface debitage and tool densities and to sample the range of variability displayed by (inferred) different feature types. As was the case with a core reduction locus at 26Ek3237 and a collapsed rock cairn at 26Ek3238, features not systematically sampled at 26Ek3251 were inventoried; recordation included documentation of flake densities, functional inferences based on structure and content, and construction of a sketch map where all stylized tools were plotted and collected.

Chronology

Relative and absolute time markers were recovered from five of the eight sites investigated. At Willow Creek, sparse flecks of charcoal were observed during excavations at site 26Ek3251, but larger composite samples and/or exposure of a hearth feature are needed for radiocarbon assay. Projectile points from 26Ek3251, however, denote occupation during the Late Archaic, perhaps until protohistoric times; Rosegate, Desert Side-notched, and Cottonwood points were recovered (Table 29). Similarly, a single Rosegate point from Site 26Ek3231 also indicates Late Archaic occupation in the Perron Canyon area.

Numerous time sensitive artifacts were recovered from sites in Ivanhoe Creek Valley, suggesting occupation over thousands of years. Testing at site 26Ek3238 returned a Large Side-notched point and a Gatecliff Split Stem point indicating occupation sometime between 4,500 and 2,800 years ago. Although two point fragments from 26Ek3238 fall out of Thomas's (1981) key, both are square, edge ground basal fragments of large, stemmed lanceolate points that may be indicative of great antiquity; projectile points with similar basal morphology have been found in association with lacustrine Pre-Archaic sites in northwest Nevada (see Clewlow 1968, Figure 10o; Layton 1979, Figure 5).

At site 26Ek3239, recovery of an Elko Corner-notched point and a Rosegate point indicate occupation occurred between 850 B.C. and A.D.1300. Corresponding with the A.D. 700 - A.D. 1300 Rosegate occupation, two Snake Valley Gray pot sherds collected from Feature 1 date between A.D. 900 and A.D. 1200 (Madsen 1977).

Test excavations and surface collections at site 26Ek3237 retrieved a diverse array of projectile points and a radiocarbon date from a hearth feature. Diagnostic points there include Great Basin Stemmed (obsidian), Gatecliff Split Stem, Large Side-notched, and Rosegate Series. Radiocarbon assay of charcoal collected from Feature 1 returned a date of 150 +/- 60 B.P. (Beta-28314), indicating a very late prehistoric (perhaps protohistoric) occupation as well. While the stemmed point fragment may signify an occupation as early as 8,000 B.P., it appears to have been reworked and may have been scavenged elsewhere and transported to the site by later inhabitants (cf. Schmitt et al. 1988). Minimally, diagnostic artifacts and the C^{14} date indicate various occupations occurred between about 4.000 B.P. and the mid-to-late 1800s.

Table 29. Projectile Point Types from North Access Corridor Sites.

Site Number	Classifiable Types STM	GGS	LSN	ECN	RSG	CTN	DSN	OOK	TOTAL
Reduction Sites									
26EK3228	-	-	-	-	-	-	-	-	0
26Ek3231	-	-	-	-	1	-	-	-	1
26Ek3232	-	-	-	-	-	-	-	-	0
26Ek3234	-	-	-	-	-	-	-	-	0
26Ek3238	2	1	1	-	-	-	-	-	4
Reduction/ Residential Sites									
26Ek3237	1	1	1	-	2	-	-	2	7
26Ek3239	-	-	-	1	1	-	-	-	2
26Ek3251	-	-	-	-	1	2	1	-	4
Total	3	2	2	1	5	2	1	4	20

Type Designations (after Thomas 1981)

STM = Great Basin Stemmed
GGS = Gatecliff Split Stem
LSN = Large Side-notched
ECN = Elko Corner-notched
RSG = Rosegate Series
CTN = Cottonwood Series
DSN = Desert Side-notched
OOK = Points Rejected by Thomas (1981) Key

Assemblage Composition

Artifacts collected from sites in the North Access Corridor include an array of reduction artifacts (e.g., cores and Quarry and Small Bifaces) as well as subsistence related artifacts and stylized tools (Table 30). Overall, bifaces dominate tool assemblages, on the average comprising 73% of the total artifacts recovered. Except at site 26Ek3251, Quarry Bifaces are most abundant (n=67) followed closely by Small Bifaces (n=59) and finally by Preforms (n=6). Reduction artifacts collected from site 26Ek3251 display a quite different pattern as Small and Preform Bifaces are most abundant (see Table 30) and Quarry Bifaces are represented by only six fragmentary specimens. This may be due in part to the residential character of the site and the economics of toolstone transportation; its distance from the Tosawihi Quarries suggests that a certain amount of latter stage lithic processing occurred before flaked stone items reached the site (cf. Elston 1988).

Table 30. Intersite Artifact Class Frequency Comparisons, North Access Corridor Sites.

ARTIFACT CLASS	ARTIFACT FREQUENCY PER SITE: Reduction Sites					Reduction/Residential Complexes		
Lithic Processing/ Reduction Tools	26Ek3228	26Ek3231	26Ek3232	26Ek3234	26Ek3238	26Ek3239	26Ek3237	26Ek3251
Hammerstones	-	-	-	-	-	2	1	-
Other Percussion	-	-	-	-	1	3	-	2
Subtotal (%)	0(0)	0(0)	0(0)	0(0)	1(2.3)	5(10.6)	1(1.0)	2(1.7)
Reduction Artifacts								
Assayed Pieces	-	-	-	-	-	-	1	-
Cores	-	-	1	-	1	-	6	-
Quarry Bifaces	5	1	4	1	14	11	31	6
Preform Bifaces	-	1	-	-	-	-	5	21
Small Bifaces	1	1	1	1	13	10	32	38
Indeterm. Bifaces	2	1	-	-	5	10	1	23
Subtotal (%)	8(88.9)	4(80.0)	6(85.7)	2(66.7)	33(75.0)	31(66.0)	76(78.4)	88(73.9)
Projectile Points								
Classifiable Types	-	1	-	-	2	2	5	4
Unclassifiable	-	-	-	-	3	-	2	3
Subtotal (%)	0(0)	1(20.0)	0(0)	0(0)	5(11.4)	2(4.3)	7(7.2)	7(5.9)
Maintenance and/or Processing Tools								
Scrapers	-	-	1	-	3	4	8	5
Knives	-	-	-	-	-	1	-	1
Gravers	-	-	-	-	-	-	1	-
Perforators	-	-	-	-	-	1	-	1
Multipurpose Flakes	-	-	-	1	1	-	1	1
Simple Flake Tools	-	-	-	-	-	1	1	3
Subtotal (%)	0(0)	0(0)	1(14.3)	1(33.3)	4(9.1)	7(14.9)	11(11.3)	11(9.2)
Plant Processing								
Metates	1	-	-	-	1	-	1	9
Manos	-	-	-	-	-	-	-	2
Subtotal (%)	1(11.1)	0(0)	0(0)	0(0)	1(2.2)	0(0)	1(1.0)	11(9.2)
Miscellaneous Artifacts								
Exotic/Decorated	-	-	-	-	-	-	1	-
Pottery	-	-	-	-	-	2	-	-
Subtotal (%)	0(0)	0(0)	0(0)	0(0)	0(0)	2(4.3)	1(1.0)	0(0)
Site Total	9	5	7	3	44	47	97	119

Maintenance and/or processing tools were collected from six sites, and, not surprisingly, are most frequent at large residential/reduction complexes. Represented by an assortment of shapes and sizes, scrapers constitute the most abundant processing tool type; some are carefully formed flakes (modified for hafting?) with unifacially retouched and extensively utilized edges, while others display little or no stylistic modification and minimal use-wear. These latter specimens tend to be smaller and more irregular in shape than formed scrapers, probably indicative of expedient use in a single task.

With the exception of site 26Ek3251, ground stone artifacts are rare in the North Access Corridor (see Table 30). However, one of the largest assemblages of ground stone artifacts retrieved in the Tosawihi Quarries vicinity to date came from site 26Ek3251. Nine metate fragments were recovered from a variety of contexts, each representing a separate artifact as evident by differences in overall morphology and raw material types. Metates range from coarse tuff exhibiting moderate use-wear (often bifacial) to shaped, tabular rhyolite displaying extensive polish over large surface areas. In conjunction with other artifact classes, the relative wealth of ground stone at 26Ek3251 clearly suggests residential site use.

Reduction Sites

Except for site 26Ek3234, where no features were observed, reduction sites in the North Access Corridor generally are characterized by one or two distinct debitage concentrations apparently generated during the reduction of bifaces. Biface reduction features are usually small in area (on the average covering less than 8 m^2), each seemingly representative of a single reduction episode. Each of these reduction loci is situated within sparse opalite flake scatters ranging between 1,590 m^2 at site 26Ek3232 to over 22,000 m^2 at site 26Ek3238.

Site 26Ek3228

Site 26Ek3228 is located along the western terrace of Ivanhoe Creek at an elevation of 5460 ft. (1665 m). Although transected by the Ivanhoe Creek road, most of the site remains intact. The southern portion of the site consists of two discrete lithic concentrations (Locus A; features 1 and 2) situated approximately 5 meters apart. The northern site area is roughly defined by Locus B, a sparse density (2 items per m^2) lithic scatter encompassing 700 m^2. While no systematic collections were undertaken, surface reconnaissance identified two Quarry Biface fragments in this site area. Cultural materials between these loci were sparse, not exceeding one item per 3 m^2.

Features 1 and 2 were sampled systematically by surface scraping a block of four contiguous 1 by 1 m units in the center of each concentration. Feature 1 yielded 132 pieces of opalite debitage and a metate exhibiting faint use-wear polish (Tables 31 and 32). In order to further explore the contents of the feature, a 50 cm by 1 m test unit was excavated to a depth of 20 cm. Only five opalite flakes were recovered from subsurface testing, all of which were encountered in the uppermost 10 cm of excavated deposits.

Although Feature 2 returned a higher frequency of debitage and six reduction artifacts (see Tables 31 and 32), both features appear to represent brief reduction episodes where Quarry Bifaces manufactured on high quality toolstone were further reduced as suggested by the wealth of small flakes and lack of angular shatter.

Table 31. Debitage from Sample Collections at Reduction Sites in the North Access Corridor.

SURFACE COLLECTIONS

Site Number	Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	OTHER DEBITAGE (n)	OTHER DEBITAGE (%)	Total
26Ek3228	1	6	4	33	132	100.0	0.4	-	-	-	-	-	132
	2	4	4	88	360	100.0	0.9	-	-	-	-	-	360
26Ek3231	1	6	4	79	254	81.2	0.7	59	18.8	0.6	-	-	313
26Ek3232	1	5	4	41	77	47.2	2.3	85	52.1	3.1	1	0.6	163
26Ek3234	-	-	2	7	11	84.6	0.3	1	7.7	0.1	1	7.7	13
26EK3238	1	14	8	371	2832	95.6	0.8	103	3.5	1.4	26	0.9	2961
	-	-	2	32	60	93.8	0.8	1	1.6	24.5	3	4.7	64

SUBSURFACE COLLECTIONS

Site Number	Fea. No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	OTHER DEBITAGE (n)	OTHER DEBITAGE (%)	Total
26Ek3228	1	1 / E	20	0.10	5	100.0	0.1	-	-	-	-	-	5
26EK3238	-	1 / C	30	0.30	337	78.4	0.6	72	16.7	1.2	21	4.9	430
	-	2 / B	10	0.10	2	66.7	0.3	1	33.3	0.2	-	-	3
	-	3 / B	30	0.30	112	73.7	0.5	33	21.7	0.8	7	4.6	152

Key to Excavation Unit Type
B = 1 by 1 m, 1/4 in. screen
C = 1 by 1 m, 1/4 in. screen with 1/8 in. sample quad.
E = 50 cm by 1 m, 1/4 in. screen

Table 32. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Reduction Sites in the North Access Corridor.

Site No. (26Ek)	Fea. No.	Type	Total Area (sq m)	ARTIFACT CLASSES: Reduction						Points				Processing			Total
				OP	CR	QB	PB	SB	IB	GGS	LSN	RSG	FRG	SC	MP	GS	
3228	1	Biface Reduction: Sample Feature	6	-	-	-	-	-	-	-	-	-	-	-	-	1	1
	2	Biface Reduction: Sample Feature	4	-	-	1	-	1	2	-	-	-	-	-	-	-	4
	-	Extra-Feature	N/A	-	-	4	-	-	-	-	-	-	-	-	-	-	4
3231	1	Biface Reduction: Sample Feature	6	-	-	-	1	1	1	-	-	-	-	-	-	-	3
	-	Extra-Feature	N/A	-	-	1	-	-	-	-	-	1	-	-	-	-	2
3232	1	Biface Reduction: Sample Feature	5	-	-	2	-	1	-	-	-	-	-	1	-	-	4
	-	Extra-Feature	N/A	-	1	2	-	-	-	-	-	-	-	-	-	-	3
3234	-	Extra-Feature	N/A	-	-	1	-	1	-	-	-	-	-	-	1	-	3
3238	1	Biface Reduction: Sample Feature	18	-	-	6	-	1	1	-	-	-	-	1	-	-	9
	-	* Extra-Feature	N/A	1	1	8	-	12	4	1	1	-	3	2	1	1	35

* Includes two artifacts (a small biface and scraper) recovered from subsurface excavation in Unit 1 and an indeterminate biface fragment from non-feature Excavation Unit 3.

Key to Artifact Classes:

Reduction Tools and Artifacts
OP = Other Percussion
CR = Cores
QB = Quarry Bifaces
PB = Preform Bifaces
SB = Small Bifaces
IB = Indeterm. Biface Fragments

Projectile Points
GGS = Gatecliff Split Stem
LSN = Large Side-notched
RSG = Rosegate Series
FRG = Unclassifiable/Fragments

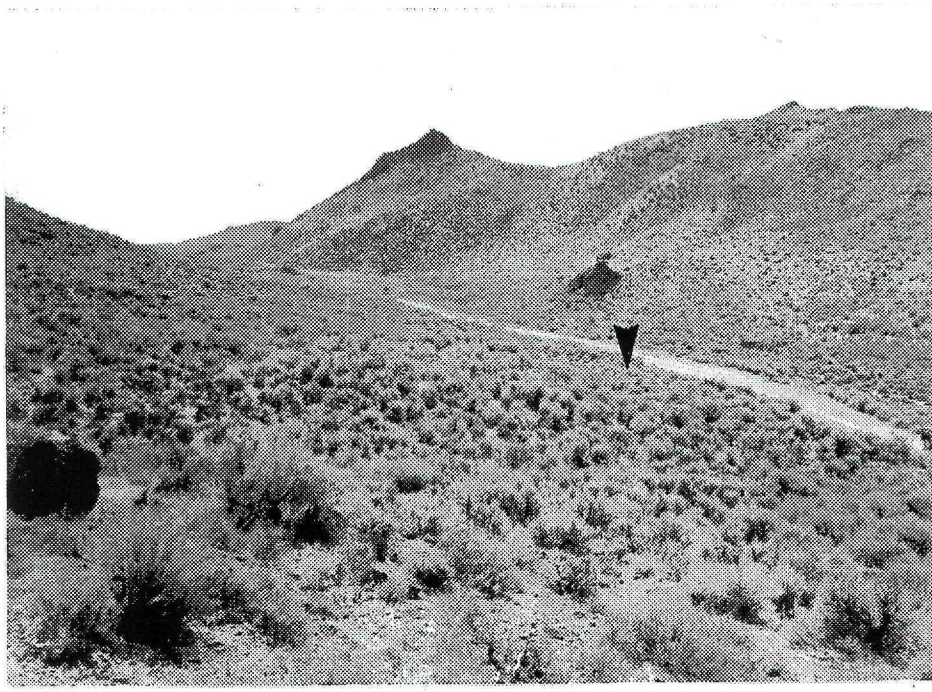
Maintenance/Processing
SC = Scrapers
MP = Multipurpose Flake Tools
GS = Groundstone

Sites 26Ek3231 and 26Ek3232

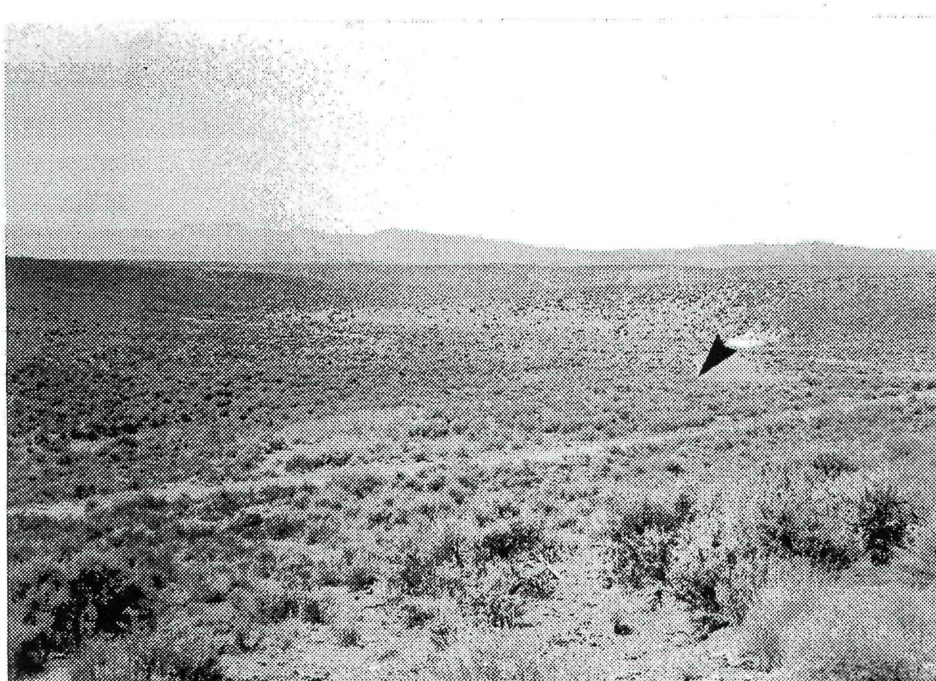
Neighboring sites 26Ek3231 and 26Ek3232 occupy a gravelly stream terrace bordering the eastern bank of Ivanhoe Creek (Figure 25a and 25b, respectively) at an elevation of approximately 5300 ft (1616 m). Each site contains a single lithic concentration characterized by a small, light density scatter of opalite debitage. Too, both sites have been disturbed in recent times; site 26Ek3231 by construction of the Ivanhoe Creek road (which embedded a Rosegate Series point in the road berm) and site 26Ek3232 by a camping sheep herder.

Figure 25. Overviews of two North Access Corridor sites.

a. Site 26Ek3231 looking southwest. Arrow locates Feature 1.
b. Site 26Ek3232 looking northwest. Arrow locates Feature 1.



a.



b.

Features were sampled at these sites (each designated as Feature 1) by shovel skimming a contiguous block of four 1 by 1 m units. Feature sample collections at 26Ek3231 returned 313 small pieces of debitage and three bifaces (see Tables 31 and 32) indicative of latter stage reduction; the toolstone is all of high quality. Conversely, early stage reduction of poor quality opalite occurred at 26Ek3232; the debitage is represented by larger items (mean wt. = 2.7 g) and there is a much higher frequency of shatter (52% as compared to 18% at 26Ek3231). In fact, the ratio of shatter to flakes at 26Ek3232 is the highest of any site tested along the North Access Corridor. Reduction artifacts (particularly the Quarry Bifaces) also reflect early stage reduction of poor quality material, most of which displays weathering cracks and large vugs.

Site 26Ek3234

Site 26Ek3234 consists of a sparse lithic scatter situated near the toeslope of a northwest finger ridge overlooking Willow Creek to the north and Ivanhoe Creek to the west. Soil is a consolidated silty loam containing abundant subangular gravels and cobbles.

Because no discrete features were identified, the site was sampled by shovel skimming eight 50 by 50 cm units at 5 m intervals along a north-south transect. Based on the paucity of debitage and formed artifacts (see Tables 31 and 32) over the large surface area, it appears the site was used for multiple (yet infrequent) short term episodes of lithic reduction and maintenance. The lack of lithic concentrations or other features and the overall scarcity of cultural items precluded further surface collections or subsurface excavations.

Site 26Ek3238

Site 26Ek3238 is a large, linear lithic scatter on the west terrace of Ivanhoe Creek and associated toeslope of a north trending inset fan. The northern portion of the site is a sparse density lithic scatter with no lithic concentrations and only a few surface artifacts. Two lithic features were recorded in the southern portion of the site, one represented by a light-to-moderate density flake concentration (Feature 1) and the other a collapsed rock cairn (Feature 2). Both features are located just south of the stream terrace on the elevated northern toe of an inset fan. Extra-feature artifacts collected from this site area include a scraper, a Gatecliff Split Stem projectile point, and Quarry and Small Bifaces.

Approximately 50% of Feature 1 was collected by shovel skimming two disjunct blocks of 2 by 2 m units. Surface collections retrieved 2961 pieces of debitage, largely represented by off-white opalite biface thinning flakes with relatively little of shatter and exotic cherts (see Table 31). Formed artifacts also reflect the reduction/manufacture of bifaces at Feature 1 as the assemblage is dominated by bifaces (89%; see Table 32), most of which are Quarry Bifaces exhibiting various manufacture failures.

Feature 2 consists of a partially collapsed rock cairn covering a 1.8 by 2.2 m area. Rocks used in its construction are all locally available large (ave. diameter ca. 35 cm), subangular rhyolitic cobbles. Based on the number of rocks present, the cairn may have been 5 to 6 courses high. Because no historic or prehistoric artifacts are directly associated, the age and function of the feature remains unknown; it may represent a prehistoric hunting feature or locational marker, or it may be a claim marker associated with historic mining activities in the Tosawihi Quarries vicinity (Zeier 1987; see also Pendleton and Thomas 1983; Schmitt 1988).

In order to examine surface and subsurface deposits on the terrace, eight 50 by 50 cm units were shovel skimmed along a baseline parallel to the terrace and three excavation units were randomly placed. Surface collections and excavations revealed the presence of cultural materials on the terrace, but found them relatively scarce (see Table 31) and largely restricted to the uppermost 20 cm of the deposits; as clays and gravels increased at ca. 15 cm below the surface, debitage frequencies dropped off considerably in excavation units 1 and 3.

Reduction/Residential Sites

Three reduction/residential site complexes were identified along the North Access Corridor; two are located in Ivanhoe Creek Valley (26Ek3237 and 26Ek3239) and one adjacent to Willow Creek (26Ek3251). Although the reduction of Quarry Bifaces and the manufacture of Small Bifaces was common at these sites, the diversity and abundance of other artifact classes suggest that these sites served as temporary residential loci where a variety of tasks was undertaken.

Site 26Ek3237

Site 26Ek3237 consists of three discrete loci situated on low stream terraces and at the toe of a north-trending finger ridge or ballena on the southwest side of Ivanhoe Creek Canyon. The ballena is one of many formed by erosion of old (probably Pleistocene) alluvial fans. Elevations in the general site area range from 5545 to 5600 ft.

Locus A occupies a low alluvial terrace of Ivanhoe Creek and is bisected by the Ivanhoe Creek and Governor Mine access roads. Locus A is bounded on the east and north by an ephemeral drainage that flows into Ivanhoe Creek, and on the west by the gentle slope of an unnamed ridgeline (Figure 26). In addition to a light density debitage scatter, the surface of Locus A yielded a scraper, a Gatecliff Split Stem point, and seven bifaces (Table 33). As evident in Figure 26, recent construction of the Ivanhoe Creek and Governor Mine roads have disturbed rather large portions of Locus A. The single piece of groundstone (a metate fragment) recovered from the site was found just north of the locus, adjacent to the Ivanhoe Creek Road.

Shovel-skimming in Locus A returned 120 pieces of opalite debitage from eight 50 by 50 cm units (Table 34). Test excavations revealed buried cultural items in the uppermost 20 cm of deposit. In Unit 1, 210 of the 243 debitage items (86%) were retrieved from levels 1 and 2; similarly, 85% of the 172 pieces of debitage collected from Unit 4 were in the first two levels excavated. Debitage types are dominated by small opalite flakes in each excavation unit aggregate (98% and 84%, respectively).

Locus B appears on the gradually sloping toe of the ridge that extends south of the site (Figure 26). Soils consist of shallow colluvial deposits comprised of gravelly silt with some cobbles. Locus B is characterized by a scatter of opalite secondary and biface thinning flakes intermixed with some obsidian and chert debitage. Formed artifacts recovered from the surface of Locus B include a Rosegate Series point, two flake tools, and an array of Small (n=9) and Quarry (n=2) Bifaces (see Table 33). Based on the light density of lithic debitage present and the colluvial depositional environment, testing in Locus B was less intensive, involving the shovel-skimming of only five 1 by 1 m units established along a linear transect. Systematic surface collections yielded 468 pieces of debitage (98% are opalite flakes; Table 34), a core, and a Rosegate Series point.

A concentration of core/biface reduction debris (Feature 1) was located midway between Locus B and the break in slope at the base of the hill (see Figure 26). The feature contained numerous large primary and secondary flakes of opalite in association with a core and three Quarry Bifaces.

Located northwest of Locus B, Locus C is situated adjacent an area where several ephemeral drainages flow into Ivanhoe Creek. Quite likely, inset alluvial fans and terraces once were present along these drainages, but flooding and down cutting have scoured out the alluvium and only the underlying resistant alluvial and colluvial deposits remain. Locus C is situated at the toe of a ridge that has been scoured of alluvial deposits, but recent colluvial deposition may obscure buried terrace remnants.

Table 33. Description of Artifact Classes by Locus, Feature, and/or Extra-Feature Contexts, Site 26Ek3237.

Site Area/ Collection Type	ARTIFACT CLASSES: Reduction							Points					Processing						
	HM	CR	AS	QB	PB	SB	IB	STM	GGS	LSN	RSG	FRG	SC	PG	MP	OF	GS	EX	Total
Locus A																			
Extra-Feature	-	2	1	3	-	4	-	-	1	-	-	-	1	-	-	-	-	-	12
Locus B																			
DSC 3	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	2
Extra-Feature	-	-	-	2	-	9	-	-	-	-	1	-	-	1	1	-	-	-	14
Locus C																			
DSC 2	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
EU 2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
EU 3	-	-	-	1	-	-	-	-	-	-	-	1	1	-	-	-	-	-	3
EU 5	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	2
Extra-Feature	1	1	-	12	1	5	-	-	-	-	-	1	2	-	-	-	-	-	23
Feature 1																			
Surface	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Non-Locus/Feature																			
Extra-Feature	-	1	-	10	3	14	-	1	-	1	-	-	3	-	-	1	1	-	35

Key: DSC = Discretionary Unit Collection
EU = Excavation Unit Collection

Reduction
HM = Hammerstones
CR = Cores
AS = Assayed Pieces
QB = Quarry Bifaces
SB = Small Bifaces
IB = Indeterminate Bifaces

Projectile Points
STM = Great Basin Stemmed
GGS = Gatecliff Split Stem
LSN = Large Side-notched
RSG = Rosegate Series
FRG = Unclassifiable/Fragments

Processing
SC = Scrapers
PG = Perforators/Gravers
MP = Multipurpose Flake Tools
OF = Other Flake Tools
GS = Ground Stone
EX = Exotic Artifacts

Table 34. Debitage from Sample Collections at Reduction/Residential Sites in the North Access Corridor.

SURFACE COLLECTIONS

Site Number	Feature (Locus)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	OTHER DEBITAGE (n)	OTHER DEBITAGE (%)	Total
26Ek3237	(A)	2	60	119	99.2	0.7	1	0.8	0.6	-	-	120
	(B)	5	94	461	98.5	0.8	7	1.5	5.5	-	-	468
	(C)	2	77	145	94.2	1.0	3	1.9	5.2	6	3.9	154
26Ek3239	1	4	339	1354	92.4	1.0	105	7.2	0.6	6	0.4	1465
26Ek3251	1	12	160	1922	91.0	0.4	182	8.6	1.3	8	0.4	2112
	2	12	598	7176	98.8	0.5	84	1.2	2.2	-	-	7260

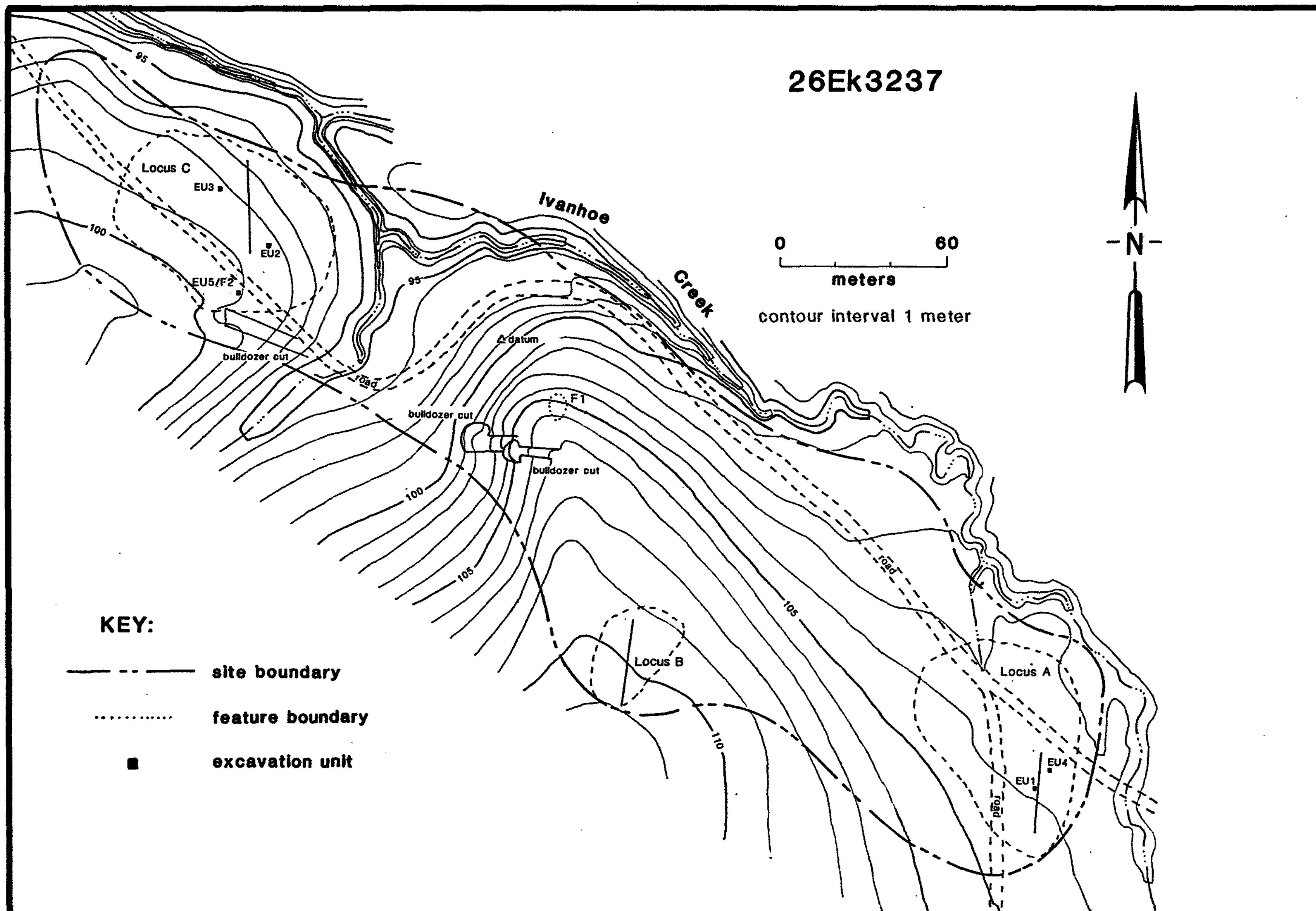
SUBSURFACE COLLECTIONS

Site Number	Feature (Locus)	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	OTHER DEBITAGE (n)	OTHER DEBITAGE (%)	Total
26Ek3237	(A)	1 / C	30	.25	239	98.4	0.6	2	0.8	1.9	2	0.8	243
	(C)	2 / B	20	.20	166	96.0	0.7	6	3.5	16.3	1	0.6	173
	(C)	3 / C	30	.25	419	94.8	0.7	17	3.8	11.9	6	1.4	442
	(A)	4 / B	30	.30	144	83.7	0.9	27	15.7	0.8	1	0.6	172
	2	5 / C	20	.20	103	89.6	0.5	10	8.7	0.9	2	1.7	115
26Ek3239	1	1 / F	20	.10	461	96.2	0.3	16	3.3	0.5	2	0.4	479
26Ek3251	1	1 / F	30	.125	1298	94.7	0.2	66	4.8	0.9	7	0.5	1371
	-	2 / B	10	.10	13	81.3	0.3	3	18.7	0.7	-	-	16
	6	3 / C	50	.50	853	91.1	0.4	28	3.0	1.3	55	5.9	936
	2	4 / B	40	.40	1015	96.1	0.4	41	3.9	1.0	-	-	1056

Key to Excavation Unit Type
B = 1 by 1 m, 1/4 in. screen
C = 1 by 1 m, 1/4 in. screen with 50 by 50 cm 1/8 in. sample quad
F = 50 cm by 1 m, 1/4 in. screen with 50 by 50 cm 1/8 in. sample quad

A total of 799 artifacts was recovered from Locus C; 155 items from shovel-skimming eight 50 by 50 cm units, 621 from subsurface excavations, and 23 isolated (i.e., extra-feature) tools (see Tables 33 and 34). An additional six formed artifacts were surface collected during reconnaissance in the vicinity immediately surrounding the locus (Figure 27), including a reworked Great Basin Stemmed point fragment near the western locus boundary.

Figure 26. 26Ek3237, site map.



26Ek3237
0
60
meters
contour interval 1 meter
N
Ivanhoe
Creek
Locus C
EU3
EU2
EU5/F2
95
100
105
110
bulldozer cut
road
datum
F1
Locus B
Locus A
EU4
EU1
KEY:
site boundary
feature boundary
excavation unit

Figure 27. 26Ek3237, Locus C map (top) and Feature 2 Hearth (Excavation Unit 5), west wall profile (bottom).

Artifact Key: 1 = Hammerstone
2 = Core
3 = Quarry Biface
4 = Preform Biface
5 = Small Biface
6 = Projectile Point
7 = Scraper

Profile Description:

1 Pale brown (10 YR 6/3) silty clay loam; slightly plastic, some gravels, high in organics, no charcoal, loosely consolidated.

2 Pale brown (10 YR 6/3) silty clay loam, friable,, 10% small gravels, high in organics, no charcoal, loosely consolidated.

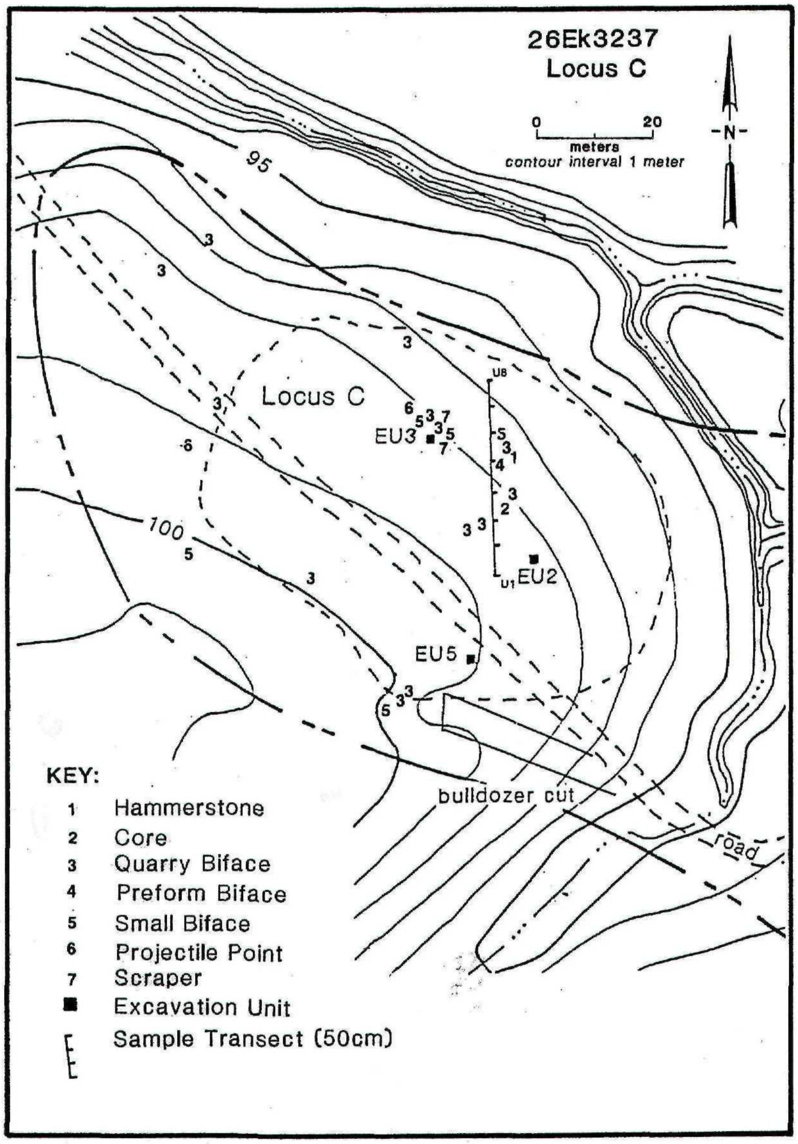
3 Brown (10 YR 5/3) silty clay loam; some small gravels, few organics, charcoal flecks, more consolidated.

4 Light brownish gray (10 YR 6/2) silt; some small gravels, few organics, no charcoal, some ash, moderately consolidated.

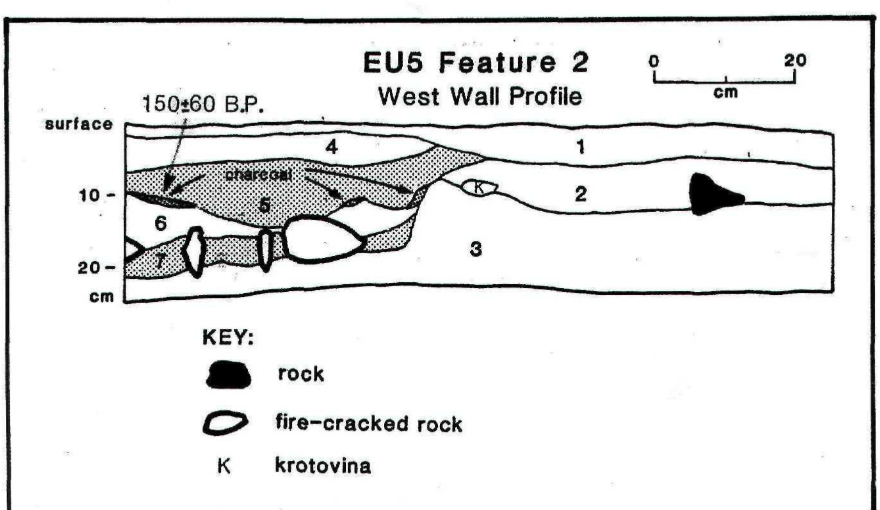
5 Dark grayish brown (10 YR 4/2) silty loam; some small gravels, high in organics and charcoal, some ash, moderately consolidated.

6 Dark grayish brown (10 YR 4/2) silty loam; some small gravels, few organics, some charcoal flecks, moderately consolidated.

7 Very dark grayish brown (10 YR 3/2) silty loam; some small gravels, some organics, high in charcoal, moderately consolidated.



26Ek3237
Locus C
0 20
meters
contour interval 1 meter
N
95
100
Locus C
EU3
EU2
EU5
U8
U1
bulldozer cut
road
KEY:
1 Hammerstone
2 Core
3 Quarry Biface
4 Preform Biface
5 Small Biface
6 Projectile Point
7 Scraper
Excavation Unit
Sample Transect (50cm)



EU5 Feature 2
West Wall Profile
0 20
cm
150±60 B.P.
surface
10 -
20 -
cm
charcoal
K
KEY:
rock
fire-cracked rock
K krotovina

Like Locus A, most of the cultural items in Locus C are found in the uppermost 20 cm of deposits. For example, 88% of the 442 pieces of debitage recovered from Excavation Unit 3 were collected from levels 1 and 2. Unlike Locus A, however, Locus C contains a higher frequency of formed artifacts and greater toolstone material diversity (i.e., opalite, chert, obsidian, and basalt). Formed tools recovered during Locus C subsurface testing included a projectile point fragment, a scraper, and three bifaces (Table 33).

Of particular interest, excavations in Unit 5 bisected a discrete, basin-shaped fire hearth (Feature 2) containing numerous fire-cracked rocks and burned opalite debitage. Two episodes of use appear to be represented; the upper and lower ash and charcoal lenses are separated by a layer of loess-like silt that contains little charcoal (Figure 27). Radiocarbon assay of the upper ash and charcoal lens returned a date of 150 $\pm$60 years B.P. Artifacts associated with Feature 2 include an obsidian Small Biface fragment, 105 flakes, 10 pieces of shatter, and a shaped chalcedony nodule.

Although testing recovered a limited range of artifact classes, the presence of a rock-lined hearth suggests that Locus C served as a residential base or field camp at which subsistence tasks (e.g., food preparation) and tool fabrication and maintenance were undertaken.

Site 26Ek3239

Site 26Ek3239 occupies the top and northern and eastern slopes of a low north-trending ballena just south of Ivanhoe Creek at an elevation of 5560 ft (1695 m). The western and northern site boundaries are marked by an ephemeral drainage that flows into Ivanhoe Creek. Located on the northern toe slope of the ridge and extending down into the drainage, surface reconnaissance in this site area identified a ca. 1600 sq m cobble field (Locus A) containing numerous reddish-brown, subangular opalite nodules. Although the material is of poor quality (e.g., most cobbles contain weathering cracks, quartzite inclusions, and/or vugs), a few assayed pieces, primarily flakes, and angular pieces of shatter were observed. Further, two hammerstones were observed, mapped and collected from the locus. The overall scarcity of culturally modified toolstone precluded systematic collections in this site area.

A single lithic concentration (Feature 1) was discovered on a flat spot near the top of the ridge. The feature is a light to moderate density scatter of opalite debitage, bifaces, and flake tools covering approximately 48 m^2. Shovel scraping a block of four 1 by 1 m units in the feature yielded 1465 pieces of debitage (mostly flakes; n=1354, 92%; see Table 34) and 14 formed artifacts (Table 35).

Table 35. Description of Artifact Classes by Feature and Extra-Feature Contexts, Site 26Ek3239.

	ARTIFACT CLASSES											
	Reduction					Points	Processing					
	OP	HM	QB	SB	IB	RSG	SC	PG	KN	OF	CE	Total
Feature 1												
Surface	-	-	2	2	-	-	1	-	-	-	-	5
SFC	-	-	2	3	7	-	1	-	1	-	-	14
EU 1	-	-	1	-	2	-	1	-	-	-	2	6
Extra-Feature												
Surface	3	2	6	5	1	2	1	1	-	1	-	22

Key: SFC = Sample Feature Collection
EU 1 = Excavation Unit 1

Reduction
OP = Other Percussion
HM = Hammerstones
QB = Quarry Bifaces
SB = Small Bifaces
IB = Indeterminate Bifaces

Points
RSG = Rosegate Series

Processing
SC = Scrapers
PG = Perforators/Gravers
KN = Knives
OF = Other Simple Flake Tools
CE = Ceramic Fragments

Feature 1 was further explored by excavation of a 50 cm by 1 m test unit placed within the scraped area. Although excavation found the deposits relatively shallow (i.e., exfoliated bedrock was encountered at 20 cm below surface), numerous pieces of debitage (n=479), four lithic tools, and two fragments of Fremont pottery were recovered (see Table 35). The recovered tool kit in association with charcoal flecks and fire-cracked rock encountered in excavation suggest Feature 1 served as a short term campsite where subsistence related activities occurred in conjunction with lithic fabrication and maintenance.

Site 26Ek3251

Site 26Ek3251 is situated in the bottom of Willow Creek Valley (elevation 5220 ft [1592 m]), occupying the second low terrace of Willow Creek. Although partially disturbed by the Ivanhoe Creek road and cattle treadage, most of the site remains intact. Surface soils are a fine, slightly consolidated wind blown silt that changes to a hard, gravelly silt at depth.

While generally flat, the site area is divided by two gullies which separate three different occupation areas. Reconnaissance of 26Ek3251 identified 6 discrete cultural features (Figure 28) and 24 extra-feature artifacts, most of which were concentrated in the flat site areas. Features 1 and 6 appear to have served multiple functions since a diverse array

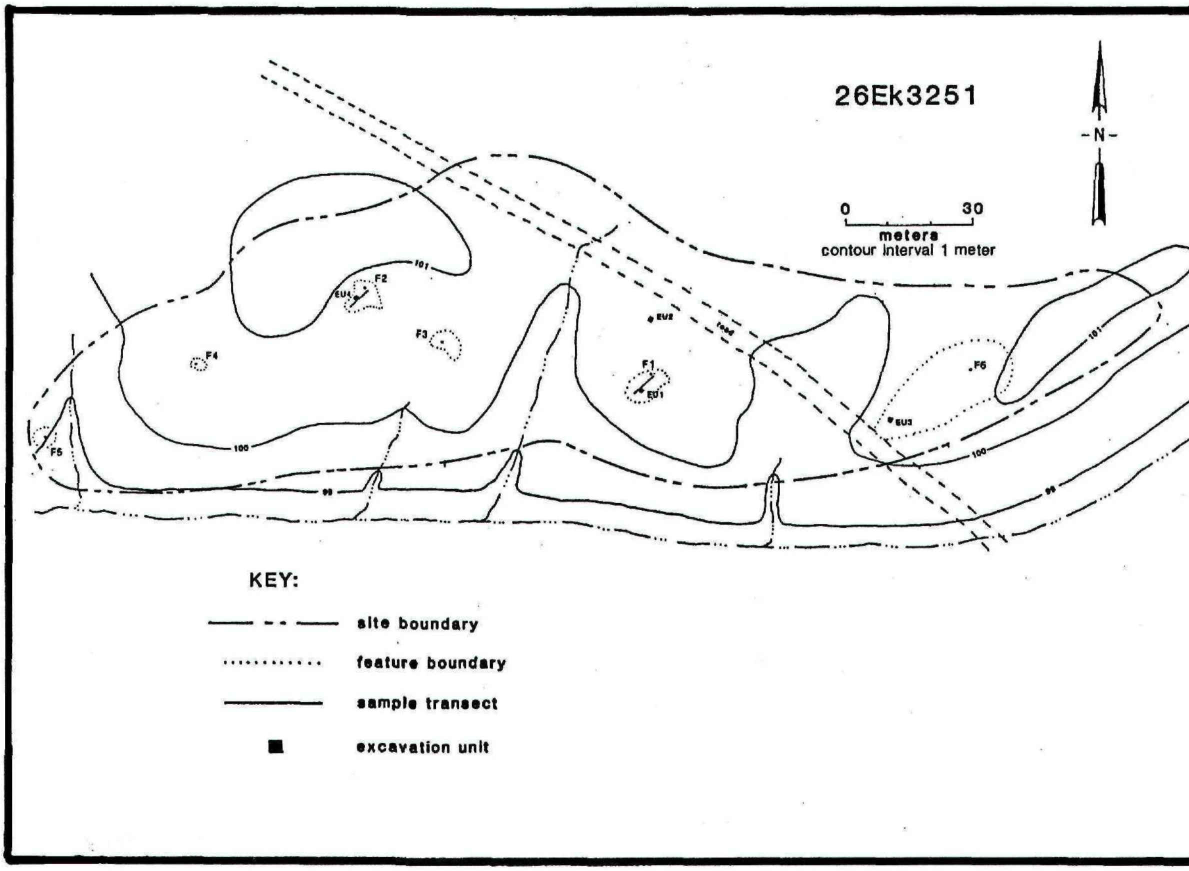
Figure 28. 26Ek3251, site map (top) and Excavation Unit 3, south wall profile (bottom).

Profile Description:

1 Grayish brown (10 YR 5/2) silty loam; some small gravels (< 1%), small roots, no charcoal, loosely consolidated.

2 Brown (10 YR 5/3) silty loam; sparse gravels, many small roots, sparse charcoal, more consolidated.

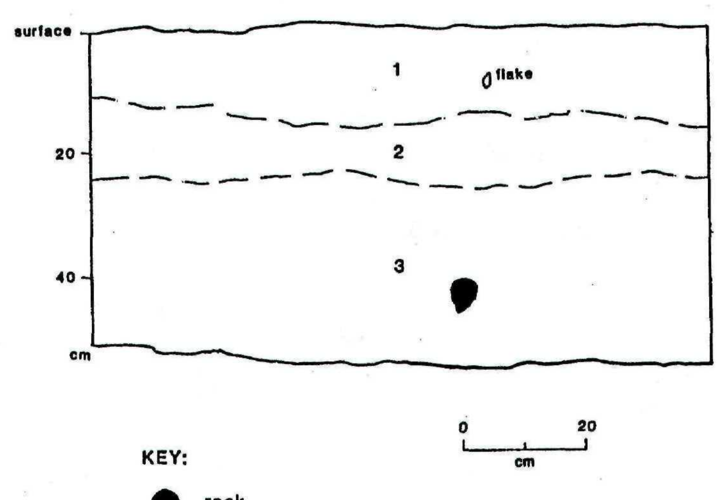
3 Pale Brown (10 YR 6/3) silty loam; increase in gravels, few roots, no charcoal, highly consolidated with cobble layer at base.



26Ek3251

South Wall Profile EU3

	Debitage n	Tools n
0-10	724	3
10-20	112	-
20-30	53	-
30-40	38	-
40-50	9	-



of artifact types (e.g., bifaces, flake tools, and ground stone) was present. Feature 3 contains a moderately dense scatter of small opalite secondary and biface thinning flakes, but may have been a multipurpose locus; the only implements observed were expedient flake tools and a Preform Biface. The remaining three features (2, 4, and 5) consist of moderate to dense lithic scatters of opalite secondary and biface thinning flakes generated during the reduction of latter stage bifaces.

Feature 1 is a dense scatter (11 by 7.5 m) of off-white opalite debitage that contained several flake tools and ground stone fragments; most of the opalite debitage has been heat treated. A 2 by 6 m grid was established near the feature center, spanning its long axis. The area was shovel-skimmed in 1 by 1 m units. An abundance of debitage (n=2112, primarily small opalite flakes [mean weight per item = 0.4 g]) and formed artifacts (Table 36) was recovered, thus prompting the decision to explore subsurface deposits by excavating a 50 cm by 1 m unit (Excavation Unit 1). The unit was excavated to a depth of 30 cm and soils were passed through 1/4 in. mesh; the north 50 by 50 cm portion of the unit was passed through 1/8 in. mesh as a control to determine the amount of small items present. Excavation revealed cultural deposits containing charcoal flecks and fire-cracked rock intermixed with opalite and obsidian debitage (n=1371; see Table 34), bifaces, and modified flakes. Although lithic debris was encountered throughout excavation, debitage was most frequent in level 2 (n=751; 55% of the total collection). These data indicate that Feature 1 served as a campsite where a diverse range of tasks was performed, including tool fabrication and food processing.

Feature 2 was an ovate debitage scatter approximately 11 by 7 m in size encompassing four debitage concentrations; no stone tools were observed in associations. The westernmost concentration was selected for examination and a 2 by 6 m surface scrape was conducted. Shovel-skimming returned numerous bifaces and biface fragments and a Rosegate projectile point (see Table 36) in association with 7260 pieces of opalite debitage (tool-debitage ratio = 1:242).

The subsurface character of Feature 2 was explored by excavation of a 1 by 1 m unit to a depth of 40 cm below surface. Excavation yielded 1056 pieces of opalite debitage (see Table 34), most of which (89%) were recovered from the uppermost 20 cm of excavated deposits. The wealth of bifaces and debitage generated from their manufacture suggests tasks performed at Feature 2 were largely, but not exclusively, related to the reduction/manufacture of bifaces.

Table 36. Description of Artifact Classes from Feature and Extra-Feature Contexts, Site 26Ek3251.

			ARTIFACT CLASSES															
Fea		Area	Reduction					Points				Processing						
No.	Type	(sq m)	OP	QB	PB	SB	IB	RSG	CTN	DSN	FRG	SC	KN	PG	MP	OF	GS	Total
1	Complex Locus: Sample Feature	68	1	1	11	16	12	-	1	-	1	3	1	-	1	-	3	51
2	Complex Locus: Sample Feature	48	-	-	4	10	11	1	-	-	1	1	-	-	-	2	-	30
3	Complex Locus	35	-	-	1	-	-	-	-	-	-	1	-	-	-	1	-	3
4	Biface Reduction	18	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
5	Biface Reduction	42	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	2
6	Complex Locus: Sample Feature	1050	-	1	1	3	-	-	-	-	-	-	-	1	-	-	2	8
-	Extra-Feature	N/A	1	4	3	7	-	-	1	1	1	-	-	-	-	-	6	24

Key:

Reduction
OP = Other Percussion
QB = Quarry Bifaces
PB = Preform Bifaces
SB = Small Bifaces
IB = Indeterm. Bifaces

Projectile Points
RSG = Rosegate Series
CTN = Cottonwood Series
DSN = Desert Side-notched
FRG = Unclassifiable/Fragment

Processing
SC = Scrapers
KN = Knives
PG = Perforators/Gravers
MP = Multipurpose Flake Tools
OF = Other Flake Tools
GS = Ground Stone

Feature 6, the largest feature noted, consists of a debitage scatter some 30 m long by 15 m wide located near the eastern site boundary (see Figure 27). In general, debitage density appeared light, but was highest in deflated and eroded areas suggesting that subsurface deposits were present. A 1 by 1 m test unit was placed centrally to a debitage concentration and was excavated to a depth of 50 cm. Excavation returned 936 pieces of debitage (including 4 obsidian flakes from a 1/8 in. screen sample quad), 3 flake tools (a perforator and 2 Small Bifaces), 3 artiodactyl molar fragments, and a marmot (Marmota flaviventris) cranial fragment. A majority of the items were encountered in the uppermost 20 cm of deposits, but debitage was present in all four levels (see Figure 28). Surface inventory of Feature 6 also resulted in the recovery of a Quarry Biface, a Preform Biface, a Small Biface, and two metate fragments, one of which displays rather extensive bifacial use. When considered collectively, items from the surface and subsurface of Feature 6 are representative of a multifunctional activity locus.

Finally, in order to sample site deposits outside the context of a surface feature, a 1 by 1 m excavation unit was dug north of Feature 1 in an area where surface items were scarce (only one opalite flake was visible). This unit was excavated to a depth of 10 cm and produced only 13 opalite flakes and 3 pieces of shatter.

Summary

Archaeological test excavations in the North Access Corridor found artifact assemblages largely dominated by biface reduction debris, but also discovered intersite variation in site function and assemblage compositions. While data collected from reduction sites 26Ek3228, 26Ek3231, 26Ek3232, 26Ek3234, and 26Ek3238 is limited in many respects, the distinct character and clarity of most of the feature concentrations offer a high degree of resolution for inquiry into the structure and content of isolated lithic reduction events. In particular, comparative analysis of tool kits and debitage from feature concentrations reveal differences in toolstone quantity and quality, stage reduction, and, in some instances, chronology as well.

Site 26Ek3237 exhibits a range of artifact classes suggesting its use as a short term residential site. A rock-lined hearth, perhaps serving for cooking and/or food preparation, attests further to domestic use of the site. Fuller exposure of the area surrounding the hearth will contribute to understanding the subsistence pursuits incidental to quarrying activities.

The site also offers data regarding toolstone transportation and reduction. Toolstone is dense and heavy; the amount that can be transported by human power alone has a fundamental limit. This fact probably accounts for much of the extensive initial processing and the presence of (biface) caches at or near the Tosawihi Quarries, as well as the fall-off in relative amount of Tosawihi opalite in assemblages, degree of reduction, and size of tools and debitage as a function of distance from the source (Elston 1988).

Although 26Ek3237 is some distance from the Quarries, it has relatively high proportions of cores and Quarry Bifaces, suggesting that either the site is too close to the Quarries for fall-off to be manifest or there may be another (undiscovered) lithic source within the foraging radius of the site. Clearly, data from additional survey in the site area and extensive comparative and actualistic studies on the economics of toolstone transportation would shed light on these issues.

Site 26Ek3237 lies on slopes and alluvial terraces of Ivanhoe Creek, just downstream from alluvial deposits containing Mazama ash. Since the site produced at least one artifact that pre-dates the Mazama eruption (i.e., a Great Basin Stemmed point fragment), the possibility exists that old deposits are present. Artifacts, organic deposits, and/or tephra in these deposits may contribute toward the development of a regional alluvial chronology.

Like 26Ek3237, data from site 26Ek3251 can address the place of the Tosawihi Quarries in the regional economy through comparisons among assemblages. Site 26Ek3251 is a non-quarrying site located some distance from the Quarries, in a riparian situation offering a much different set of resources than is available in the Quarries. The assemblage contains a wider variety of tool classes than does 26Ek3237. Cores are absent and Quarry Bifaces comprise a very small proportion of the reduction artifact assemblage.

Data collected from testing indicate that 26Ek3251 functioned as a campsite, but whether occupied for only short periods or perhaps serving as a winter camp, is not known. There is no ethnographic evidence of winter occupation along Willow Creek, but informal survey along the drainage indicates that 26Ek3251 is merely a local manifestation of a much larger streamside complex.

In many respects, the site is similar to 26Ek3095, located on the western periphery of the Tosawihi Quarries (see Chapter 12). Both sites contain a diversity of tool types, a similar range of features (short term residential and secondary lithic reduction clusters), and significant numbers and kinds of seed grinding tools. However, at site 26Ek3251, average flake tool and debitage size is small and most items appear to be heat-treated. Considered together with its unique depositional setting, 26Ek3251 provides a significant data point for comparing intersite assemblage variability and examining the economics of toolstone procurement and transport across the region.

Part IV. USX-West Study Area

Preceded by a physical description of the USX-West Study Area in Chapter 8, results of testing there are organized geographically: Rodent Valley Sites are described in Chapter 9, Red Hill Quarries in Chapter 10, Basalt Canyon Sites in Chapter 11, and Bitterroot Ridge Sites in Chapter 12.

Chapter 8. INTRODUCTION TO USX-WEST

by Elizabeth E. Budy

The USX-West project area encompasses an irregular parcel of about 600 acres situated adjacent the Tosawihi Quarries (site 26Ek3032) on the southwest. The present and following chapters are concerned with the investigation of 30 of the 36 prehistoric sites (Budy 1988) located in this study area.

The project area is located along moderately steep, dissected terrain that drains to Little Antelope Creek. Four archaeological subareas, Rodent Valley, Red Hill Quarries, Basalt Canyon, and Bitterroot Ridge are segregated for purposes of discussion (Figure 8-1). These divisions group sites according to their relative proximity to the Tosawihi Quarries, and consider similarities in topographic setting, depositional environment, and assemblage constituents.

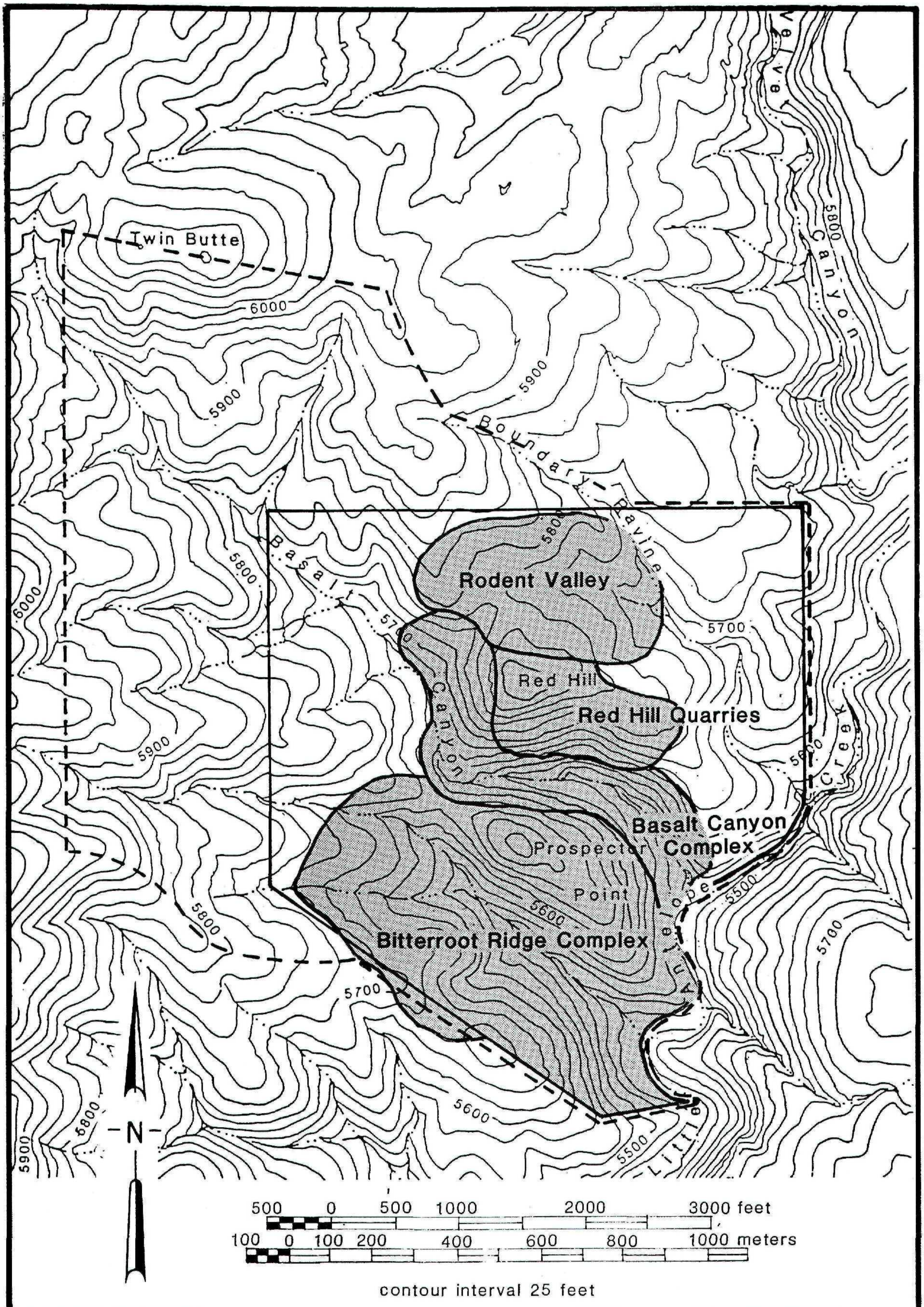
Rodent Valley is a small elevated basin just south of the drainage which marks the south edge of the Tosawihi Quarries. Its name derives from the large ground squirrel population located therein and the conspicuous effects of their turbation to archaeological deposits. Eight archaeological sites are located in the valley; seven were tested. Most sites are large, diffuse reduction scatters; one is a small outcrop quarry.

Red Hill is a prominant knoll containing gold bearing deposits that have interested miners since the early 1980s. Small opalite outcrops on the steep south slopes of the formation served as loci for prehistoric toolstone extraction. Seven quarry sites are located on Red Hill, of which six were tested.

Steep-sided Basalt Canyon divides areas of opalite bedrock north of it from unsilicified basaltic formations to the south. Both erosional transformations and alluvial deposition are evident in the canyon. Eleven sites are located on the lower canyon slopes; of nine tested, one is a stratified buried site that appears to represent a series of short term campsites, and eight are eroded sites reflecting toolstone reduction.

Bitterroot Ridge, named for the edible bitterroot plants in flower during testing, encompasses a series of ballenas or finger ridges, dissected by narrow ephemeral drainages that feed Little Antelope Creek. Eight of the ten sites located here were tested. They include several large, complex biface staging centers that saw numerous occupations and were used as short term residential sites.

Figure 29. USX-West project area and archaeological subareas.



Twin Butte
6000
5900
5900
5800
Boundary Ravine
Canyon
Basalt Canyon
Rodent Valley
5700
Red Hill
Red Hill Quarries
Creek
Basalt Canyon Complex
Prospector Point
5600
Bitterroot Ridge Complex
Antelope
Little
5500
5700
5600
5500
N
500 0 500 1000 2000 3000 feet
100 0 100 200 400 600 800 1000 meters
contour interval 25 feet

Organization of Discussion

The site descriptions which appear in the next four chapters are organized according to archaeological subarea. Nevertheless, data for each site are presented so as to allow for ready comparison among sites and subareas. Each chapter summarizes sites by type, and presents tabular compilations of testing strategies, chronological indicators, and intersite comparisons of artifact assemblages. Site specific descriptions of depositional contexts and structural arrangements of features are given.

Chapter 9. RODENT VALLEY SITES

by Elizabeth E. Budy

Rodent Valley, a small basin perched about 150 feet above and west of Basalt Canyon (Figure 30), lies between the primary Tosawihi Quarries toolstone source areas on the north and several small localized sources found on the south slopes of Red Hill. Silicified opalite in this small basin is restricted to a small outcrop at site 26Ek3104 on the extreme northeast edge of the study area.

Nonsiliceous bedrock outcrops likewise are restricted to the western perimeter of the valley where, at site 26Ek3096, they provided vantage points where several small reduction features are located. Elsewhere in the valley, sandy silts and silty loams mantle the ridge slopes and form a surface layer 80 cm thick overlying an ancient paleosol in the center of the valley. These sediments encourage fairly dense stands of big sagebrush and form good habitat for tunneling rodents.

The most obvious prehistoric activity in Rodent Valley was the reduction of opalite toolstone procured from nearby quarries. Other factors that may have conditioned prehistoric use of the valley include the abundance of small mammals, especially ground squirrels, and the absence of permanent water.

Descriptive Site Summary

Seven of the eight sites recorded in Rodent Valley were tested. They include six reduction complexes and one small outcrop quarry as listed in Table 37 below.

Table 37. Descriptive Summary, Rodent Valley Sites.

Site Number	Type	Features (n)	Maximum Site Area (sq m)
26Ek3096	Reduction Complex	7	14,250
26Ek3100	Reduction Complex	2	5,850
26Ek3101	Reduction Complex	-	11,250
26Ek3102	Reduction Complex	5	2,400
26Ek3104	Outcrop Quarry	-	600
26Ek3105	Undifferentiated Scatter [NOT TESTED]	-	3,000
26Ek3106	Reduction Complex	6	5,175
26Ek3107	Reduction Complex	5	6,750

Figure 30. Topographic setting, Rodent Valley sites.

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IN NEVADA

Note:

One or more pages have been removed from this part of the report due to sensitivity of specific archaeological site location information. Qualified persons may contact the Nevada Bureau of Land Management, Elko Field Office, to inquire about obtaining additional information.

Reduction complexes are characterized by debitage scatters whose spatial organization or extent reflect several episodes of opalite toolstone reduction. Artifact diversity (ratio of artifact types to numbers of artifacts) is low, residential features are absent or restricted to short-term hearths, and subsistence-related artifacts are limited in kind and quantity. In short, such sites are thought to represent palimpsests of specific tasks of brief duration.

Testing Strategies

Testing followed the procedures described in Chapter 1. Close interval survey recovered only a small collection of formed artifacts from the surface of each site. Most were dominated by reduction biface forms. Attention focused on recovering data from spatially discrete features, so that 14% to 50% at each site were sampled by complete surface collection (Table 38).

Table 38. Summary of Testing Procedures, Rodent Valley Sites.

Site Number	FEATURES RECORDED Total (n)	FEATURES RECORDED Sampled (n)	FEATURE CONTEXT Surface Skim Area (sq m)	FEATURE CONTEXT Subsurface Excavation Volume (cu m)	NONFEATURE CONTEXT Surface Skim Area (sq m)	NONFEATURE CONTEXT Subsurface Excavation Volume (cu m)	Trench Cross Section (n)	RECOVERED COLLECTIONS Debitage (n)	RECOVERED COLLECTIONS Formed Artifacts (n)
26Ek3096	7	1	4	-	-	-	-	814	18
26Ek3100	2	1	2	-	-	-	-	962	2
26Ek3101	-	-	-	-	2	0.70	1	2,663	27
26Ek3102	5	1	8	-	-	-	-	1,782	17
26Ek3104	-	-	-	-	-	0.03	-	2,266	18
26Ek3106	6	2	42	0.30	-	-	-	14,530	61
26Ek3107	5	1	4	-	0.13	0.13	1	1,918	6

Controlled subsurface excavation sampled two clearly organized features at site 26Ek3106, one of which was a buried hearth. Backhoe trenches were opened for stratigraphic exposure at sites 26Ek3101 and 26Ek3107, where surface patterns had been obscured by erosion and turbation but where diagnostic artifacts suggested the possibility of pre-Archaic use. Both surface skimming and subsurface excavation recovered samples from nonfeature contexts at sites 26Ek3101 and 26Ek3107. Interval samples were collected along the slope of the opalite outcrop at quarry site 26Ek3104, for comparison with toolstone from other sources.

Chronology

A summary of the time sensitive projectile points recovered from the Rodent Valley sites is presented in Table 39. The collection is notable for its small size and for the absence of Middle Archaic time markers. An early use (ca. 7000 -8000 B.C.) of Rodent Valley is signaled by a basalt Great Basin Stemmed point base recovered from site 26Ek3107. Late Archaic points (A.D. 500 to A.D. 1850) were recovered from spatially discrete features at sites 26Ek3102 and at site 26Ek3106. Charcoal preserved in a hearth (Feature 4/5) at site 26Ek3106 dates to 300 $\pm$ 70 B.P. (Beta-26827).

Table 39. Projectile Point Types from Rodent Valley Sites.

Site	Early Archaic	Late Archaic			
Number	STM	RSG	CTN	PPT	TOTAL
26Ek3096	-	-	-	-	0
26Ek3100	-	-	-	-	0
26Ek3101	-	-	-	-	0
26Ek3102	-	1	-	-	1
26Ek3104	-	-	-	-	0
26Ek3106	-	-	1	1	2
26Ek3107	1	-	-	-	1

Key:
STM = Great Basin Stemmed
RSG = Rosegate Series
CTN = Cottonwood Series
PPT = Point Rejected by Thomas (1981) Key

Assemblage Composition

Formed artifacts from the Rodent Valley sites are predominantly reduction stage forms (cores and early stage Quarry Bifaces) (Table 40). Although few specialized tools or subsistence related artifacts were recovered, projectile points signal some use of the area for hunting; a metate fragment associated with a hearth (Feature 4/5 at site 26Ek3106 suggests seed grinding coincident with camping. However, these tools were found in lithic concentrations composed largely of opalite reduction debitage, suggesting short term maintenance activities were incidental to toolstone production.

Cores and large Quarry Bifaces compose, on an average, more than 80% of lithic reduction artifacts at Rodent Valley sites. Small Bifaces, common at residential sites elsewhere in the project area (e.g., on Bitterroot Ridge) are scarce in Rodent Valley, indicating a narrow focus on toolstone reduction, and little campsite use, at these sites. As we expected, Rodent Valley sites, which are located close to the Tosawihi Quarries opalite sources, are characterized by more preliminary reduction materials than are sites more distant from toolstone sources, such as those on Bitterroot Ridge. For example, compare the relative proportion of Stage II to Stage III Quarry Bifaces from Rodent Valley (39.1% and 26.9%, respectively) to those from Bitterroot Ridge (29.% and 49.2%, respectively).

Table 40. Intersite Artifact Class Frequencies, Rodent Valley Sites.

ARTIFACT CLASS	ARTIFACT FREQUENCY PER SITE						
	Quarry	Reduction Sites					
Lithic Processing/ Reduction Tools	26Ek3104	26Ek3096	26Ek3100	26Ek3101	26Ek3102	26Ek3106	26Ek3107
Hammerstones	1	2	-	-	-	1	-
Scratched Stones	-	-	-	-	-	1	-
Other Percussion	1	1	-	1	-	-	1
Subtotal (%)	2(11.1)	3(16.7)	0(0)	1(3.7)	0(0)	2(3.3)	1(16.6)
Reduction Artifacts							
Assayed Pieces	1	-	-	-	-	-	-
Cores	9	1	2	1	4	8	-
Quarry Bifaces	6	11	-	10	9	38	3
Preform Bifaces	-	-	-	2	-	-	-
Small Bifaces	-	1	-	3	1	1	1
Indeter. Bifaces	-	1	-	4	1	4	-
Subtotal (%)	16(88.9)	14(77.8)	2(100)	20(74.1)	15(88.2)	51(83.6)	4(66.7)
Projectile Points							
Classifiable Types	-	-	-	-	1	1	1
Unclassifiable	-	-	-	-	-	1	-
Subtotal (%)	0(0)	0(0)	0(0)	0(0)	1(5.9)	2(3.3)	1(16.6)
Maintenance and/or Processing Tools							
Scrapers	-	-	-	3	1	4	-
Perforators	-	-	-	2	-	-	-
Gravers	-	-	-	1	-	-	-
Multipurpose Flakes	-	-	-	-	-	1	-
Simple Flake Tools	-	-	-	-	-	-	-
Subtotal (%)	0(0)	0(0)	0(0)	6(22.2)	1(5.9)	5(8.2)	0(0)
Plant Processing							
Manos	-	1	-	-	-	-	-
Metates	-	-	-	-	-	1	-
Subtotal (%)	0(0)	1(5.6)	0(0)	0(0)	0(0)	1(1.6)	0(0)
Site Total	18	18	2	27	17	61	6

Reduction Sites

Except for sites 26Ek3096 and 26Ek3106, reduction complexes in Rodent Valley retain little evidence of discrete use episodes, as such are inferred from surface artifact patterns. Sites average about 6,600 m^2, with few apparent features, generally small, in each (Table 41).

Site 26Ek3096

Site 26Ek3096 consists of a light density (<100 items per m^2) lithic scatter covering a ridgetop on the west side of Rodent Valley (Figure 31). Weathered, nonsilicified bedrock outcrops as boulders on the ridgetop where six spatially discrete reduction features (numbers 1-4, and 6-7) were recorded. The boulders may have provided shade or windbreak for prehistoric knappers, and these loci afford broad views of the surrounding countryside. Feature 5, located lower on the east-facing ridge slope, was disturbed by recent bulldozer scrape.

Feature 1 was completely collected by surface skimming. Debitage is dominated by opalite flakes in a range of sizes, but most appear to derive from a particular off-white material; the low density of materials (204 items per m^2) and the occurrence of three Quarry Bifaces and one Small Biface suggests the feature represents a single brief episode of biface reduction (Table 42). A mano in the feature may have been scavenged from a nearby site (or feature); no other ground stone was associated. Because bedrock outcrops at or near surface, no subsurface exploration was conducted at this site.

Site 26Ek3100

Site 26Ek3100 is composed of a sparse scatter of lithics covering a small round knoll; two small reduction features were recorded (see Figure 30). Feature 1 consists of fairly dense (481 items per m^2) core reduction debitage centered on the top of the knoll; the concentration was collected completely with two 1 by 1 m surface units (see Table 42). Preliminary reduction is indicated by two cores and by the quantity of large flakes (average weight = 3.2 g) mixed with smaller shatter fragments (average weight = 2.7 g).

Feature 2 is composed of 25 biface thinning flakes located in a small area (1 m^2) on the edge of the drainage channel on the east side of the site; this may be a remnant of a larger activity area that has eroded away. No collections were taken from Feature 2.

Table 41. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Sites in Rodent Valley.

Site Number	Fea. No.	Type	Total Area (sq m)	ARTIFACT CLASSES: Reduction HM	OP	SS	CR	QB	PB	SB	IB	Points PT	FG	Processing SC	PG	MP	GS	Total
26Ek3096	+1	Biface Reduction	4	-	-	-	-	3	-	1	-	-	-	-	-	-	1	5
	2	Core & Biface	10	-	1	-	1	2	-	-	-	-	-	-	-	-	-	4
	3	Biface Reduction	10	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
	4	Biface Reduction	12	1	-	-	-	1	-	-	-	-	-	-	-	-	-	2
	5	Disturbed Locus	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	6	Biface Reduction	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	7	Core & Biface	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	-	Extra-Feature	N/A	1	-	-	-	4	-	-	1	-	-	-	-	-	-	6
26Ek3100	+1	Core Reduction	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2
	2	Biface Reduction	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
26Ek3101	-	Extra-Feature	N/A	-	1	-	1	10	2	3	4	-	-	3	3	-	-	27
26Ek3102	+1	Core & Biface	8	-	-	-	3	1	-	-	1	-	-	-	-	-	-	5
	2	Biface Reduction	7	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
	3	Biface Reduction	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	4	Core & Biface	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	5	Biface Reduction	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	-	Extra-Feature	N/A	-	-	-	1	7	-	1	-	1	-	1	-	-	-	11
26Ek3104	-	Extra-Feature	N/A	1	1	-	10	6	-	-	-	-	-	-	-	-	-	18
26Ek3106	+1	Core & Biface	6	-	-	-	-	18	-	-	-	1	1	1	-	-	-	21
	2	Core Reduction	3	-	-	-	1	1	-	-	-	-	-	-	-	-	-	2
	3	Core & Biface	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	4/5	Complex Locus: Sample Feature	36	1	-	1	7	15	-	1	4	-	-	3	-	1	1	34
	6	Core Reduction	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	7	Biface Reduction	25	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2
	-	Extra-Feature	N/A	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2
26Ek3107	+1	Core & Biface	4	-	1	-	-	1	-	-	-	-	-	-	-	-	-	2
	2	Biface Reduction	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	3	Core & Biface	5	-	-	-	-	1	1	-	-	-	-	-	-	-	-	2
	4	Biface Reduction	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	5	Disturbed Locus	105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	-	Extra-Feature	N/A	-	-	-	-	1	-	-	-	1	-	-	-	-	-	2

* (All features are lithic reduction features)
\+ 100% surface collection

Key to Artifact Classes

Reduction Tools and Artifacts
HM = Hammerstones
OP = Other Percussion
SS = Scratched Stone
CR = Cores and Assayed
QB = Quarry Trajectory Bifaces
PB = Preform Bifaces
SB = Small Trajectory Bifaces
IB = Indeter. Biface Fragments

Maintenance/Processing
SC = Scrapers
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
GS = Ground Stone

Projectile Points
PT = Classifiable Points
FG = Unclassifiable/Fragments

Figure 31. Site map, 26Ek3096.

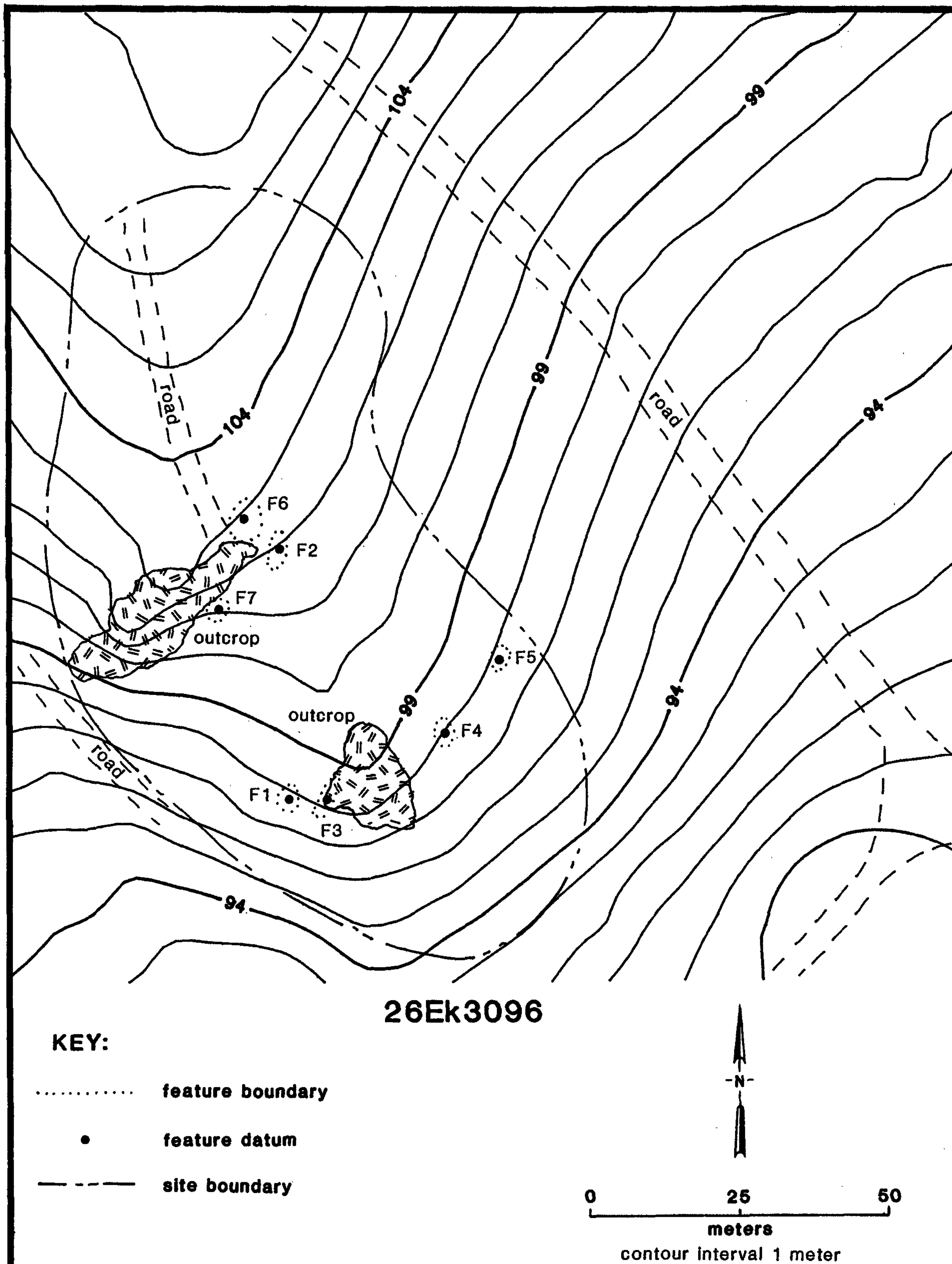

104
104
99
99
99
94
94
94
road
road
road
F6
F2
F7
outcrop
F5
outcrop
F4
F1
F3
26Ek3096
KEY:
feature boundary
feature datum
site boundary
N
0
25
50
meters
contour interval 1 meter

Table 42. Debitage from Rodent Valley Sites.

SURFACE COLLECTIONS

Site Number	Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	OTHER DEBITAGE (n)	OTHER DEBITAGE (%)	Total
26Ek3096	1	4	4	204	790	97.0	1.3	24	2.9	0.9	-	-	814
26Ek3100	1	2	2	481	844	87.7	2.9	118	12.3	5.0	-	-	962
26Ek3101	-	-	2	133	221	83.4	0.9	44	16.6	1.1	-	-	265
26Ek3102	1	8	8	223	1,362	76.4	4.2	412	23.1	2.8	8	0.4	1,782
26Ek3106	1	6	6	546	2,878	87.9	2.8	397	12.1	2.4	1	<0.1	3,276
	4/5	36	36	213	6,267	81.6	1.7	1,383	18.0	1.7	31	0.4	7,681
26Ek3107	1	4	4	401	1,393	86.9	3.3	200	12.5	5.6	10	0.6	1,603

SUBSURFACE COLLECTIONS

Site Number	Fea No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	OTHER DEBITAGE (n)	OTHER DEBITAGE (%)	Total
26Ek3101	-	1 / A	70	0.70	1,847	77.0	0.9	499	20.8	1.7	52	2.2	2,398
26Ek3104	-	1 / J	10	0.006	249	63.7	2.3	142	36.3	32.4	-	-	391
	-	2 / J	10	0.006	477	61.9	4.5	294	38.1	5.5	-	-	771
	-	3 / J	10	0.006	315	55.7	0.9	250	44.2	9.2	-	-	565
	-	4 / J	10	0.006	287	53.2	2.9	252	46.8	11.2	-	-	539
26Ek3106	1	1 / D	30	0.15	2,869	91.3	2.1	271	8.6	3.2	1	<0.1	3,141
	4/5	2 / A	10	0.10	242	82.0	3.2	51	17.3	8.1	2	0.6	295
	4/5	3 / G	10	0.025	124	90.5	0.9	12	8.8	2.5	1	0.7	137
26Ek3107	-	1 / J	10	0.006	97	49.7	0.7	34	17.4	0.8	64	32.8	195
	-	2 / J	10	0.006	30	25.0	0.9	32	26.7	0.5	58	48.3	120

Key to Excavation Unit Types
A = 1 by 1 m, 1/8 in. screen
D = 50 cm by 1 m, 1/8 in. screen
G = 50 by 50 cm, 1/8 in. screen
J = 25 by 25 cm, 1/8 in. screen

Site 26Ek3101

Site 26Ek3101 is a rather large, but quite diffuse lithic scatter on a saddle on the west side of the valley (see Figure 30). The western half of the site once served as some sort of containment pond which subsequently was filled and seeded with grasses (Mark Bartlett, personal communication, 1988); today, this zone and the softer sediments at site center provide habitat for a very active ground squirrel population.

Artifacts were distributed uniformly over the center of the saddle to the extent that no concentrations were discerned. Two 1 by 1 m surface units recovered sparse debitage (133 items per m^2) comprised of small flakes (78.3%) and shatter (21.7%); however, the shatter appears to include numbers of broken flakes (hence unclassifiable as such) indicating post-depositional disturbance. This may be the result, in part, of historic mining activity presently obscured by revegetation. On the other hand, the general absence of spacial organization in conjunction with a rather homogeneous surface artifact density may be the result of a long period of exposure coincident with recurrent rodent turbation.

A distinct early component at 26Ek3101 could not be distinguished, however. A backhoe trench exposed about 80 cm of silty loam overlying an ancient paleosol; controlled subsurface excavation indicated cultural materials similar in composition to surface debitage (see Table 42); and rodent turbation had homogenized the sediments so that discrete cultural layers could not be distinguished.

Site 26Ek3102

Site 26Ek3102 consists of a very light density scatter (1-10 items per m^2) on the gentle southeast facing slopes at the toe of a ridge. Numerous small rills and shallow erosion channels cross the site. A central zone of slightly higher flake density (5-10 items per m^2), where deeper soils form habitat for big sagebrush and ground squirrel, surrounds five small reduction features. Artifacts collected from the surface are dominated by large Quarry Bifaces (see Table 40), although few were recovered from feature contexts (see Table 41). A Rosegate Series projectile point signals occupation during the Late Archaic; any earlier components have been obscured by erosion and rodent turbation.

Systematic surface collections from Feature 1 sampled the most visibly discrete debitage concentration at the site. Three cores, one Quarry Biface, and an indeterminate biface fragment were recovered mixed in with large flakes (average weight = 4.4 g) and abundant shatter (17.8%). Debitage composition is similar that noted elsewhere in the valley where cores were reduced to large Quarry Bifaces (see tables 31 and 32) and provides a good example of early stage reduction close to Tosawihi Quarry source areas.

Site 26Ek3106

Site 26Ek3106, located along the east slopes of a small ridge (Figure 32), is notable among Rodent Valley sites for good preservation of spatially discrete debitage concentrations. Six debitage features were scattered on the east side of a ridge slope overlooking Boundary Ravine; few cultural materials occur on the slope intervals between features.

Two features (numbers 1 and 4/5) were sampled by complete surface collection and limited subsurface excavation. Both contain the residue of Quarry Biface production, but they differ in the range of staging activities reflected in the debitage.

Feature 1 is composed of dense debitage (546 items per m^2) confined to a small bench above, but nearly contiguous with, another concentration recorded as Feature 2. Most (61.1%) of the 18 Quarry Bifaces recovered are Stage II types. Although no cores were present, large flakes and shatter fragments (average weight = 2.8 g) indicate production of Stage II Quarry bifaces from core-like pieces (see Table 42). Two small projectile points were recovered in the subsurface excavation unit. One is a Cottonwood type, the other is unclassifiable but looks like a Desert Series variant.

Feature 4/5 is a large debitage scatter (36 m^2) located on another bench higher up the slope. Collection recovered a comprehensive assemblage of reduction tools and artifacts, including 7 cores, 15 Quarry Bifaces, 1 Small Biface, 4 indeterminate biface fragments, 1 hammerstone, and 1 scratched stone likely used to prepare platforms. Unlike Feature 1, which lacks cores and is dominated by Stage II Quarry Bifaces, Feature 4/5 contains numerous cores and is dominated by Stage III (n=7) and Stage IV (n=4) Quarry Bifaces. Surface skimming exposed a small hearth central to the concentration, but the only associated food processing tools were a burned groundstone fragment included among the hearth rocks, three scrapers and a multipurpose flake tool (Figure 33). Charcoal from the near surface hearth feature was radiocarbon dated to 300 $\pm$ 70 B.P. (Beta-26827), indicating use in the latter part of the Late Archaic period (ca. A.D. 1650).

The spatial integrity of features sampled at site 26Ek3106 is in strong contrast to undifferentiated scatters at most other sites in Rodent Valley. The site appears to contain several discrete activity areas whose spatial integrity is related to their limited time of exposure at the surface. Late Archaic use is attested by chronological indicators from both features

Figure 32. Site map, 26Ek3106

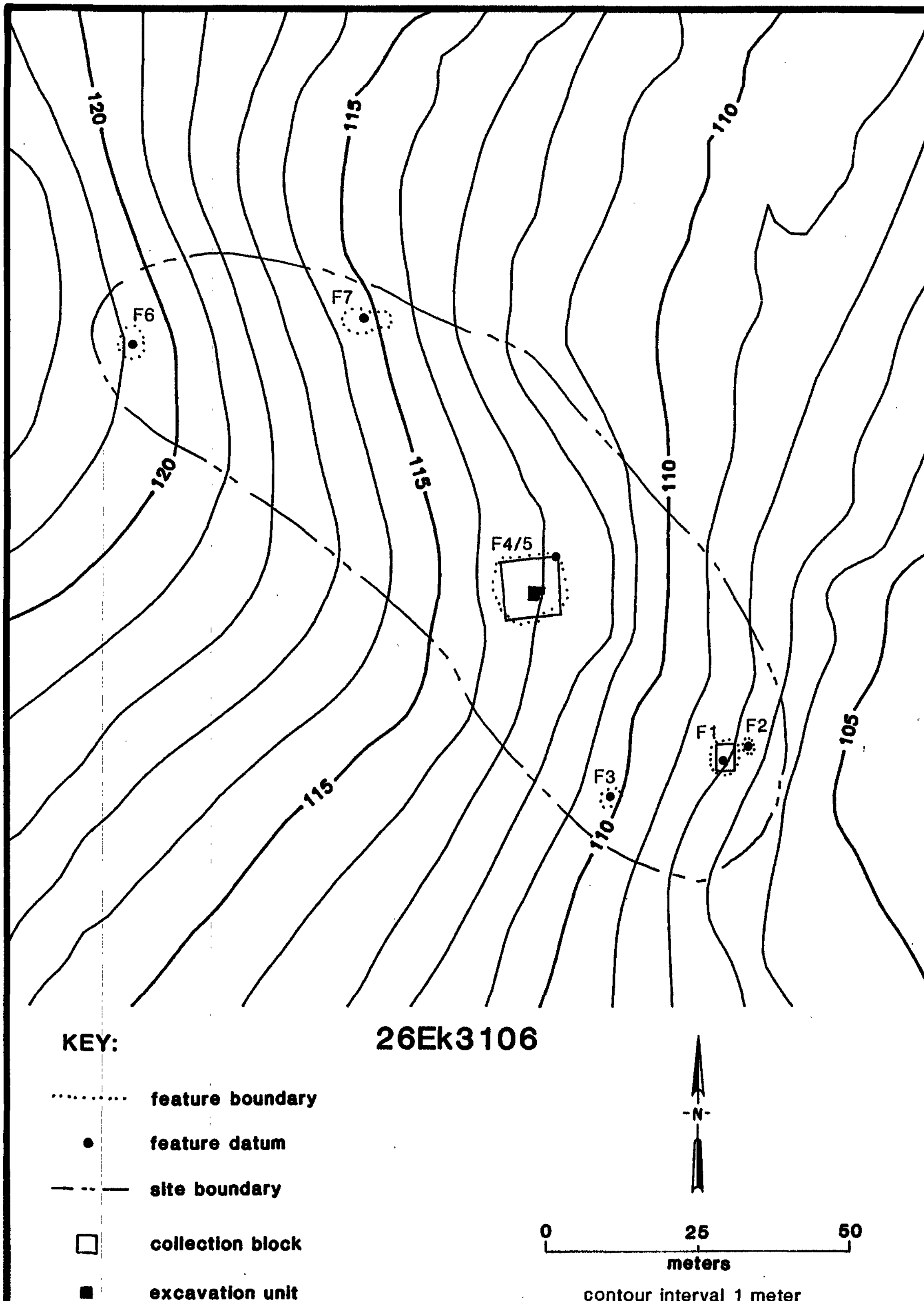
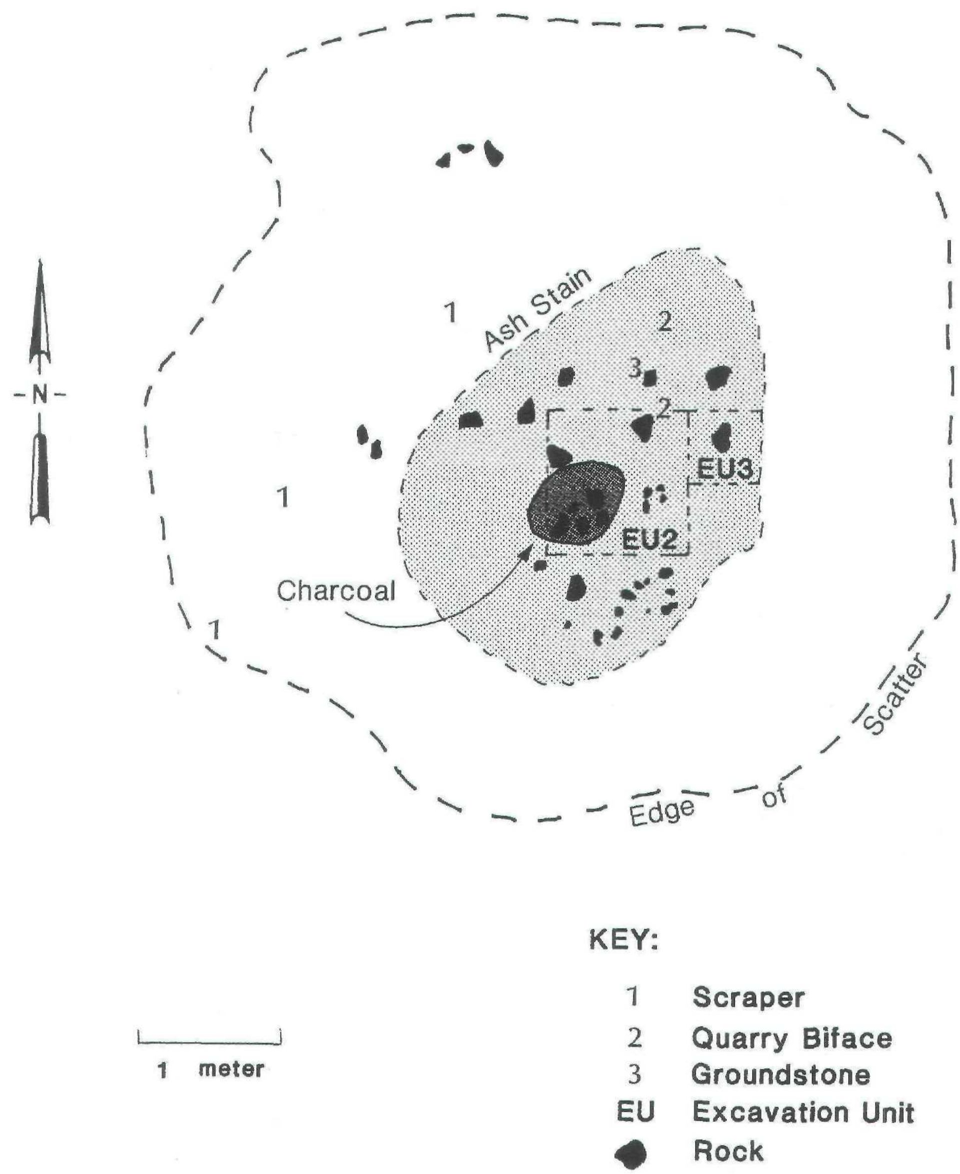

120
115
110
120
115
115
110
110
105
F6
F7
F4/5
F3
F1
F2
KEY:
26Ek3106
feature boundary
feature datum
site boundary
collection block
excavation unit
N
0
25
50
meters
contour interval 1 meter

Figure 33. Plan of Feature 4/5, site 26Ek3106.

26Ek3106

Feature 4/5



sampled; the high visibility and small area of the remaining features suggest a similar short period of surface exposure. Especially significant in light of future investigations is the small hearth found in the lithic reduction concentration at Feature 4/5. Such arrangements were expected to be common in the landscape surrounding the Tosawihi Quarries (Elston 1988), but we are finding that rapid deflation and erosion are affecting near surface hearths elsewhere in the project area.

Site 26Ek3107

Site 26Ek3107 consists of a scatter of debitage and naturally shattered, multi-colored opalite extending along the west slopes of the ridge hosting site 26Ek3106 (see Figure 30). Five surface debitage concentrations were recorded; three (features 2, 3, and 4) are visible as a consequence of erosion and form small "flake rills" parallel to the slope. Feature 5, a small flaking station located near the top of the ridge, had been disturbed by a bulldozer scrape; it is of interest because the base of a finely crafted Great Basin Stemmed point was exposed as a consequence of accelerated erosion caused by the bulldozer activity.

Only Feature 1, a small biface reduction station located on a soil mound formed at the toe of the slope, retained a degree of spatial integrity suggestive of its original deposition; this feature was sampled by complete surface collection. A backhoe trench was located through the soil mound in the center of the feature, but no buried cultural layers were noted and no controlled subsurface collections were made.

Surface debitage collections from Feature 1 reflect the reduction of cores to large Quarry Bifaces (see tables 41 and 42). Opalite from this feature, as from all surface feature concentrations at this site, is an off-white material likely procured from a nearby locality in the Tosawihi Quarries. The colorful opalite shatter natural to the site is of unknown origin, perhaps deriving from redeposit of a weathered source area higher on the ridge north of the site; however, as evident in nonfeature sample excavation units, some of this material was used for toolstone.

Quarry Site 26Ek3104

Site 26Ek3104 is a small outcrop quarry on the south edge of Boundary Ravine directly opposite several high quality, intensively quarried localities in the Tosawihi Quarries site on the north side of the ravine. A small, near surface opalite exposure at site 26Ek3104 served as the locus for toolstone assay and limited biface and core production; sample collections along the east slope of the exposure are dominated by large shatter (see Table 42). The absence of extraction features apparently reflects the poor quality of the source.

Summary

Sites in Rodent Valley reflect short term episodes of toolstone reduction over several thousand years. A sparse background scatter is characteristic of most sites in the valley, and most evidence past and recent rodent turbation. Though chronological indicators are few, site 26Ek3107 contained a Great Basin Stemmed point indicating use of this area as early as 8000 B.C. Furthermore, the absence of discrete features and the dispersed nature of the surface scatters at nearby site 26Ek3101 suggest the effects of geological processes and bioturbation over a relatively long period of time. Late Archaic diagnostics were recovered from sites 26Ek3102 and 26Ek3106 where several spatially contained features likewise support recency of deposit. The exposure of a hearth central to reduction feature 4/5 at 26Ek3106 provides one example of short term campsite use (apparently quite ephemeral) incidental to toolstone procurement and reduction. This will provide useful comparative data when a larger sample of hearths, and their associated activities, are available from sites in the Tosawihi vicinity.

Chapter 10. RED HILL QUARRIES

by Elizabeth E. Budy

Red Hill forms the irregular, east-trending knoll defining the south edge of Rodent Valley. The focus of minerals exploration since 1980, the hill is terraced by drilling access roads. Red Hill is so named for the distinctive red-orange color of its fill, a result, in part, of hydrothermal alteration of tuff and undifferentiated tuffaceous sediments. The top of the formation consists of a series of stepped flats gradually decreasing in elevation from the high point at 5865 ft to about 5650 ft at the lowest flat on the east. The south side of Red Hill is a steep slope (25-45%) which descends about 250 ft to the channel of Basalt Canyon (at about 5525 ft in elevation). Small opalite exposures occur in several areas along the upper portion of the slope and these outcrops were loci of prehistoric toolstone quarrying (Figure 34).

Vegetation on the severe south aspect of the knoll consists of a thin cover of grass (mainly cheatgrass with some wheatgrass and Great Basin wild rye) interspersed with shrubs such as rabbitbrush and horsebrush. Tumble mustard and fiddleneck are conspicuous along roads and in other disturbed places. Deeper soils on the top and north side of the knoll harbor a big sagebrush-grass community.

Red Hill forms a prominent local landform marking the southern margin of the silicified opalite zone. In contrast to toolstone source localities recorded in the Tosawihi Quarries to the north, Red Hill sites are fewer, more localized, and smaller. Rock formation types, and their degree of silicification, are quite variable on Red Hill.

Descriptive Site Summary

Seven small quarries were recorded originally on the south slopes of Red Hill (Table 43); six were tested. Sites 26Ek3208 and 26Ek3085, recorded at different times (Elston et al. 1987; Budy 1988) and thought to be distinct and separate sites, were found during testing to be contiguous complexes exploiting the same geologic formation. The separate site numbers are retained, but the two are treated as components of the same quarrying phenomena in this report.

Three sites (25Ek3082, 26Ek3083, and 26Ek3207) are small outcrop quarries evidencing minimal exploitation. Sites 26Ek3084 and 26Ek3208/3085, on the other hand, contain evidence of focused toolstone extraction in the form of pit features and thick accumulations of quarry debris. The level of effort expended at each site, as evidenced by the kinds of extraction features, or lack of them, appears commensurate with the quality and abundance of silicified materials expressed at or near site surface.

Figure 34. Topographic setting, Red Hill quarries.

TOSAWIHI QUARRIES:
ARCHAEOLOGICAL INVESTIGATIONS AND ETHNOGRAPHIC STUDIES
IN NEVADA

Note:

One or more pages have been removed from this part of the report due to sensitivity of specific archaeological site location information. Qualified persons may contact the Nevada Bureau of Land Management, Elko Field Office, to inquire about obtaining additional information.

Table 43. Descriptive Site Summary, Red Hill Quarries.

Site Number	Type	Features (n)	Maximum Site Area (sq m)
26Ek3082	Outcrop Quarry	3	300
26Ek3083	Outcrop Quarry	-	2,000
26Ek3084	Quarry Pit	2	4,250
26Ek3207	Outcrop Quarry	-	1,200
*26Ek3208/ *26Ek3085	Quarry Pit Complex	**8	13,200
26Ek3270	Disturbed Quarry [NOT TESTED]	-	8,500

* adjacent sites treated as one
** 10 additional historic mining features were recorded here by Zeier (1987)

Testing Strategies

Quarry loci generally are expressed by thick accumulations of toolstone extraction and reduction debris which overwhelm standard surface collection and excavation techniques. Methods developed for quarry assessments in the Tosawihi vicinity were designed to collect data sufficient to distinguish among various prehistoric toolstone extraction techniques and reduction strategies while minimizing recovery of redundant collections. Testing procedures and yields are summarized in Table 44, below.

Table 44. Summary of Testing Procedures, Red Hill Quarry.

	FEATURES RECORDED		FEATURE CONTEXT				NON-FEATURE CONTEXT	RECOVERED COLLECTIONS	
Site Number	Total (n)	Sampled (n)	Surface Skim Area (sq m)	Trench Cross Section (n)	Strati-graphic Profile (n)	Column Sample (n)	Surface Skim Area (sq m)	Debitage (n)	Formed Artifacts (n)
26Ek3082	3	1	0.06	-	-	-	-	15	0
26EK3083	-	-	-	-	-	-	-	1	0
26EK3084	2	2	0.50	1	1	28	-	645	7
26EK3207	-	-	-	-	-	-	0.06	20	1
26EK3208/ 26EK3085	8	1	-	1	1	17	-	0	4

Initially, each site was subjected to intensive surface survey to identify discrete extraction features and to locate specialized tools and time-sensitive artifacts. Geologic parameters, physical characteristics, and areal extent of the toolstone source exposure, were observed; size, density, and composition of cultural debris scatters, as well as extraction feature loci, were recorded and mapped. Specialized tools and exotic artifacts were collected; toolstone samples were taken for quality assay and future chemical sourcing studies.

Subsequent to this, a preliminary evaluation addressed the kinds and intensity of prehistoric quarrying at the site. Sites with little surface variability and limited potential for subsurface accumulations, such as 26Ek3082, 26Ek3083, and 26Ek3207, were not assessed further.

Sites with quarry pit features and thick accumulations of debris were sounded by subsurface probes. At 26Ek3084 and 26Ek3208/3085, a pit feature was selected for vertical cross-section by trenching. After exposure, the stratigraphy of cultural and natural deposits was recorded in profile drawings. Where present, charcoal was collected for C^{14} assay; bulk debitage samples (1 to 5 liters) were taken, as feasible, from each discrete layer for mass debitage studies.

Chronology

The Red Hill quarries, unlike sites used as biface staging centers and campsites that contain time-sensitive projectile points, diagnostic pottery, and dateable obsidian items, yielded few stylized artifacts and only one that provides tentative chronological information. A small basalt biface found on the surface at site 26Ek3208/3085 appears to be preform to a Great Basin Stemmed point. If it is, early use (ca. 7000 - 8000 B.C.) of this source area is suggested.

Tests at Red Hill demonstrate that some quarries, notably 26Ek3084 and 26Ek3208/3085, contain deeply stratified deposits of quarry waste and colluvium that document periods of quarry pit use and abandonment. Charcoal often is present in these buried extraction features and, where sufficiently abundant, provides material suitable for radiocarbon assay. At site 26Ek3208/3085, charcoal was concentrated in the basal strata of a quarry pit, particularly along the face of the massive bedrock outcrop. From this we assume that fire was used to break up the formation to facilitate extraction of toolstone. The charcoal provided two radiocarbon dates, 650 $\pm$ 60 B.P. (Beta-26755) and 800 $\pm$ 60 B.P. (Beta-26754).

Assemblage Composition

The Red Hill quarries provide little evidence of on-site activities other than toolstone extraction. In addition to quantities of debitage and shatter, most quarries contain numerous assay pieces, cores, and hammerstones. Good quality sources that were exploited intensively also contain biface blanks and other early stage Quarry Biface fragments. The handful of formed artifacts collected from the Red Hill quarries sample units (see Table 44) are discussed with the sites from which they were recovered.

Outcrop Quarries: Context and Structure

Three outcrop quarries (26Ek3082, 26Ek3083, and 26Ek3207) are characterized by rather amorphous zones of quarry debitage surrounding small, localized opalite exposures. As good toolstone material is either distributed sparsely in surface cobbles or embedded in extensively weathered near-surface formations which require considerable extractive energy investment, use of these quarries appears to have been largely exploratory and/or expedient; no extraction pit features were present.

Sample surface debitage collections (25 by 25 cm units) were used to characterize the scatters composing sites 26Ek3082 and 26Ek3207. As illustrated in Table 45, these sites contain high (> 65%) proportions of shatter relative to controlled reduction flakes and so reflect primarily material assay and preliminary core reduction.

Table 45. Debitage Sample Collections from Site 26Ek3082 and 26Ek3207.

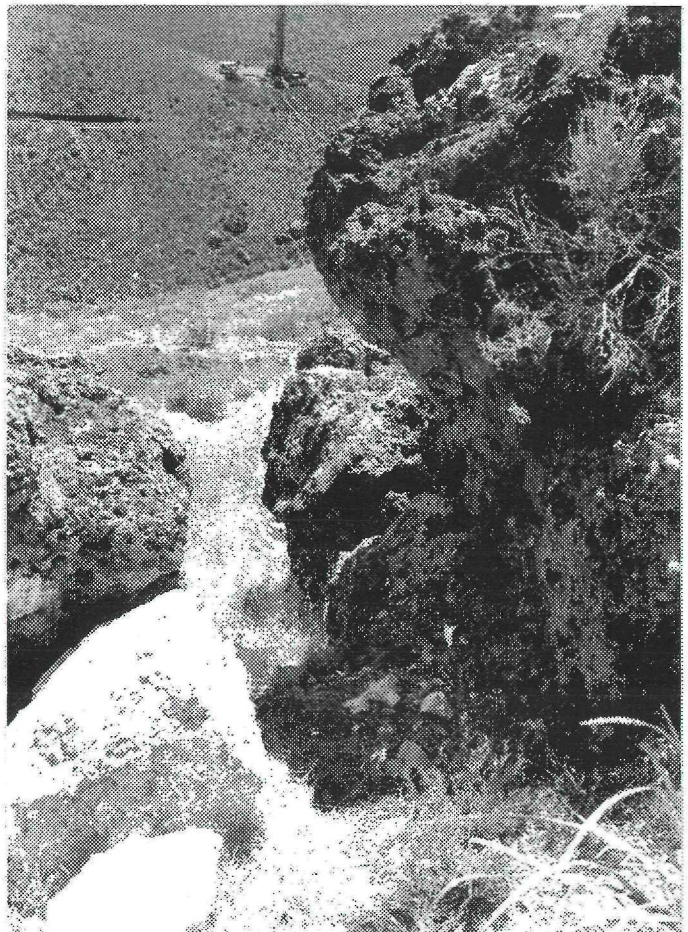
Site Number	Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	Cores
26Ek3082	4	(26.7)	4.5	11	(73.3)	137.6	-
26Ek3207	7	(35.0)	26.4	13	(65.0)	67.8	1

Site 26Ek3082

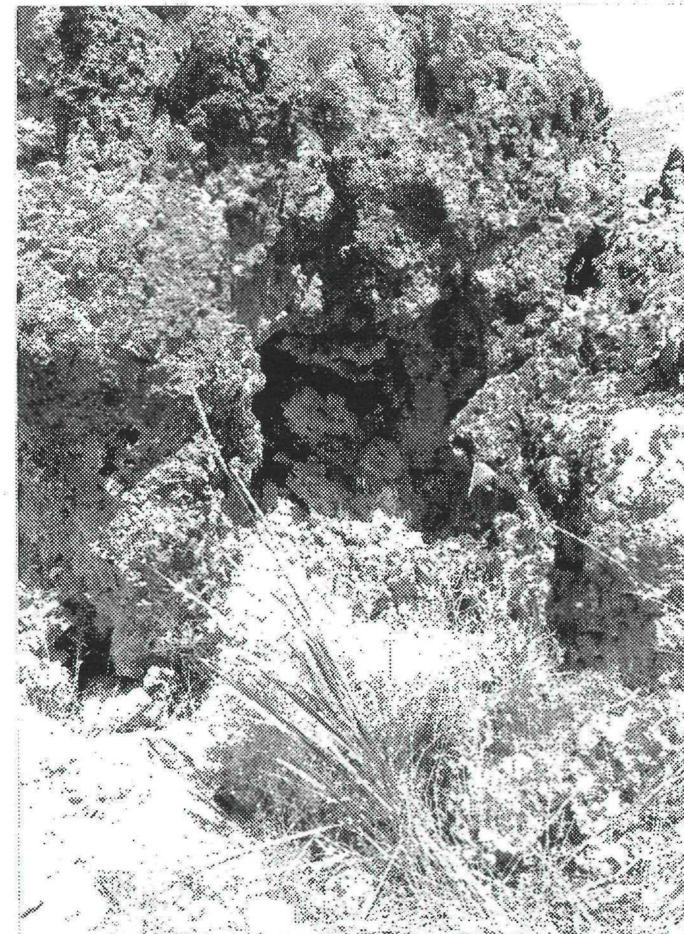
Site 26Ek3082 consists of a small, light density (< 100 items per m^2 each) scatter of material assay and core reduction debitage surrounding a nonsiliceous tuff boulder outcrop (Figure 35a). Three small (< 2 m^2) core reduction accumulations (<200 items total) along the outcrop were recorded as features 1 through 3; given the steep (35%) slope of the site, these accumulations may be the result of natural slope movement. Feature 3 consists of about 50 large primary flakes and coarse chunks of shatter accumulated below a shallow (1 m deep), adit-like excavation in the outcrop (Figure 35b). This suggests that a large siliceous nodule was extracted from the tuff matrix.

Figure 35a. Nonsiliceous outcrop at site 26Ek3082, view southwest.

Figure 35b. Adit-like Feature 3 at site 26Ek3082, view northeast.



a.



b.

Small nodules (<50 by 50 cm) of siliceous opalite are embedded in the tuff matrix of the boulder outcrop, indicating the probable source of the material assayed and reduced at the site. As pockets of siliceous opalite weathered out of the matrix, nodules of potentially useful toolstone became available on the surface or were loosely incorporated in the colluvium on the steep slope surrounding the outcrop. As can be seen in the roadcut on the south side of the site, naturally shattered and culturally modified opalite clasts have accumulated on the downslope side of the outcrop and are mixed in the colluvium to a depth of about 50 cm below present ground surface.

Site 26Ek3083

Site 26Ek3083 also is characterized by a light density scatter (< 50 items per m^2) of quarry debitage containing several assayed pieces and cores, and a few large biface fragments. The source area is similar to that at site 26Ek3082 in that opalite nodules appear to have weathered out from small pockets contained within a nonsiliceous tuff matrix. The exposure differs, however, in that the tuff formation at site 26Ek3083 has weathered to the extent that only small (1 by 1 m) boulders remain scattered along the slope. Silicified nodules, most of which evidence assay and/or reduction, occur intermittently along the slope of the scatter where they have become incorporated in the surface colluvium. A red-colored tuff outcrop forms a bench on the lower, south edge of the site, but the nonsiliceous characteristics of this formation render it unsuitable for toolstone. All evidence of purposeful toolstone processing reflects the reduction of white-grey colored materials similar to the nodules which occur naturally higher on the slope. The red tuff is of interest because of its surficial similarity to a colorful source located about 250 meters to the east at site 26Ek3084; these may be isolated expressions of an underlying geologic formation.

Site 26Ek3207

Site 26Ek3207 is distinguished from the other outcrop quarries on Red Hill by the better quality and somewhat greater availability of its toolstone. Opalite is exposed along a series of stepped bedrock benches, the tops of which protrude for no more than 20 cm above ground surface. The underlying bedrock apparently forms tabular sheets which break up where exposed along the slope, hence the terrace-like steps. Site 26Ek3207 contains no extraction features or substantial accumulations of quarry refuse. This may reflect the limited utility of the source (which appears generally fractured where exposed at the surface) or perhaps the road (which cut the upper edge of the site) removed an exposure of higher quality toolstone.

Summary

The low density scatter, absence of extraction features, and small amounts of core reduction debitage at 26Ek3082 suggest little energy investment in toolstone procurement at this site. Contributing factors are probably the scarcity of suitable nodules and/or high energy required to extract and reduce the stone. In spite of this, most of the readily available toolstone was used up and only assay residue and unsuitable interior core-like pieces remain. At site 26Ek3083, a similar situation obtains but the slightly more abundant evidence of successful core reduction, and some residue of early stage biface manufacture, indicate that rather better and/or more easily obtained toolstone was present, likely as large cobble to small boulder sized pieces embedded in surface colluvium. At site 26Ek3207, a greater abundance of controlled reduction flakes attest to a source of higher quality toolstone, but again, the scatter forms only a thin veneer on a bedrock-controlled surface.

Quarry Pit Sites: Context and Structure

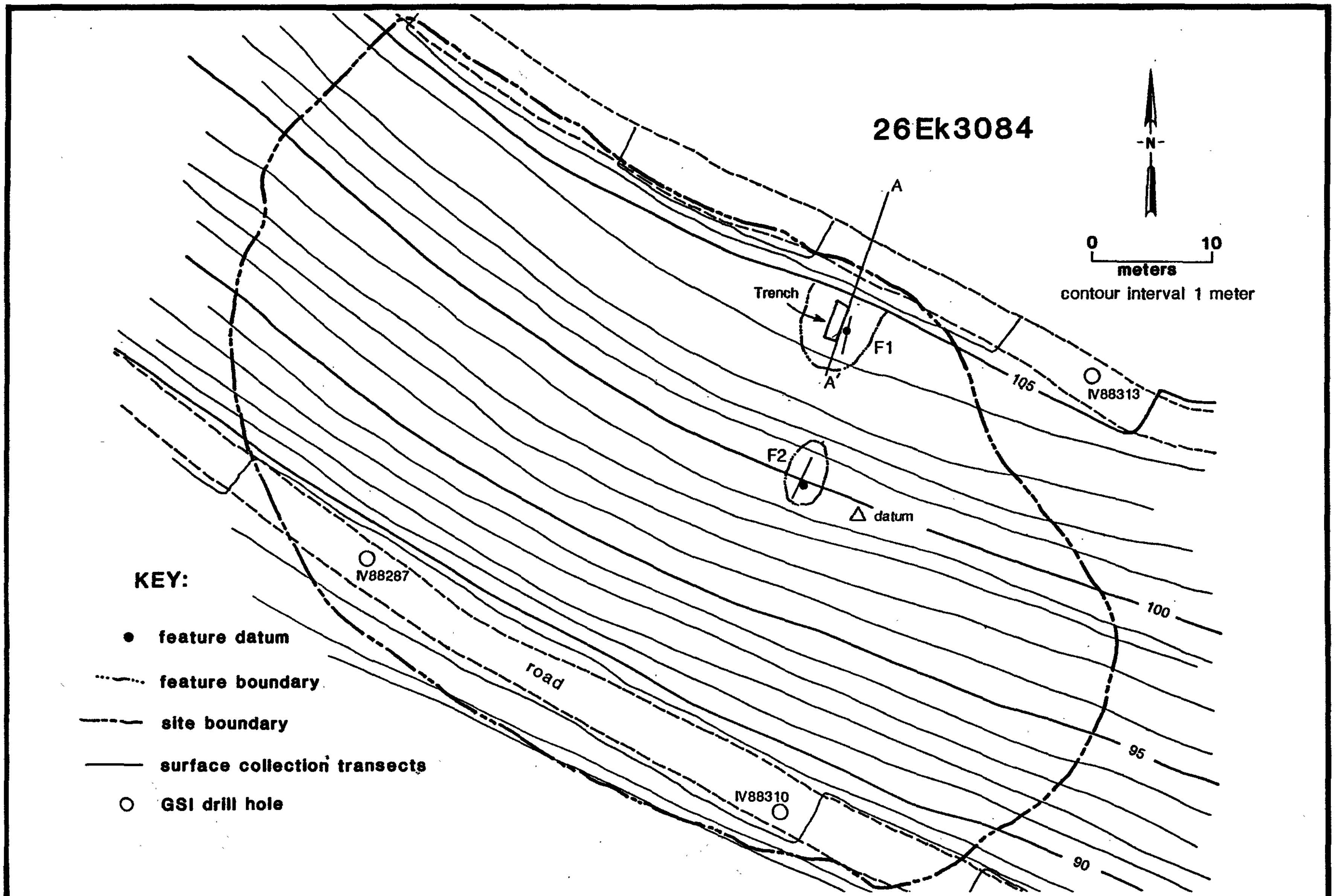
Two quarries, site 26Ek3084 and the 26Ek3208/3085 complex, represent intensively exploited toolstone sources. Both contain prehistoric extraction pits, cross sections of which provide clues to past toolstone extraction strategies and techniques.

Site 26Ek3084

Site 26Ek3084 is a small (1,350 m^2) quarry, visible on the surface as a fan-shaped scatter of cores and debitage on the steep, south-facing slope between two road cuts (Figure 36). Prehistoric toolstone procurement apparently was directed at a small exposure of very colorful, high quality stone. Most of the lithic raw material is jasper-like, including shades of brown, yellow, orange, red, maroon, and purple, but a substantial proportion of the debitage is the greenish-white opalite common elsewhere in the project area.

Two features, a quarry pit (Feature 1) and a debris pile (Feature 2), were identified on the surface. Feature 1 appeared initially as a small shallow depression at the juncture between the base of the upper road fill and the slope at the upper edge of the site. A trench excavated through the feature revealed it to be a quarry pit, now largely buried under road fill. Feature 2, located midway on the slope near the center of the site, consisted of a thick lobe of quarry rubble with no outcrop or extraction features apparent. Both features were sampled by taking small (25 by 25 cm) surface collections at intervals along the slope (Table 46).

Figure 36. 26Ek3084, site map.



26Ek3084
N
0
10
meters
contour interval 1 meter
A
A'
Trench
F1
F2
datum
105
100
95
90
IV88313
IV88287
IV88310
road
KEY:
feature datum
feature boundary
site boundary
surface collection transects
GSI drill hole

Table 46. Comparison of Debitage from Sample Feature Collections, Site 26Ek3084.

Unit No.	Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	Total
Feature 1							
1	6	54.5	1.8	5	45.5	4.2	11
2	55	35.5	4.4	100	64.5	5.1	155
3	51	43.2	9.0	67	56.8	7.1	118
4	40	51.3	2.0	38	48.7	2.0	78
Feature 2							
1	3	30.0	117.9	7	70.0	167.6	10
2	21	52.5	31.2	19	47.5	31.1	40
3	65	60.2	4.4	43	39.8	5.1	108
4	58	46.4	10.6	67	53.6	16.2	125

Debitage from both quarry features is dominated by shatter produced during initial toolstone reduction, but heavier items are concentrated in the Feature 2 debris pile where four percussion tools were collected. Feature 2 may represent a colluvial deposit of heavier items formerly edging or thrown from the quarry pit higher on the slope. On the other hand, it is possible that Feature 2 represents a separate, extraction related feature centered on a low outcrop buried by the rubble pile. Similar rubble piles consisting of large pieces of shatter, cores, and crude bifaces often occur at the bases of outcrops where they form open work talus cones. Smaller items tend to sift downward in these deposits and surface collections from this type of talus feature are dominated by large pieces of debitage.

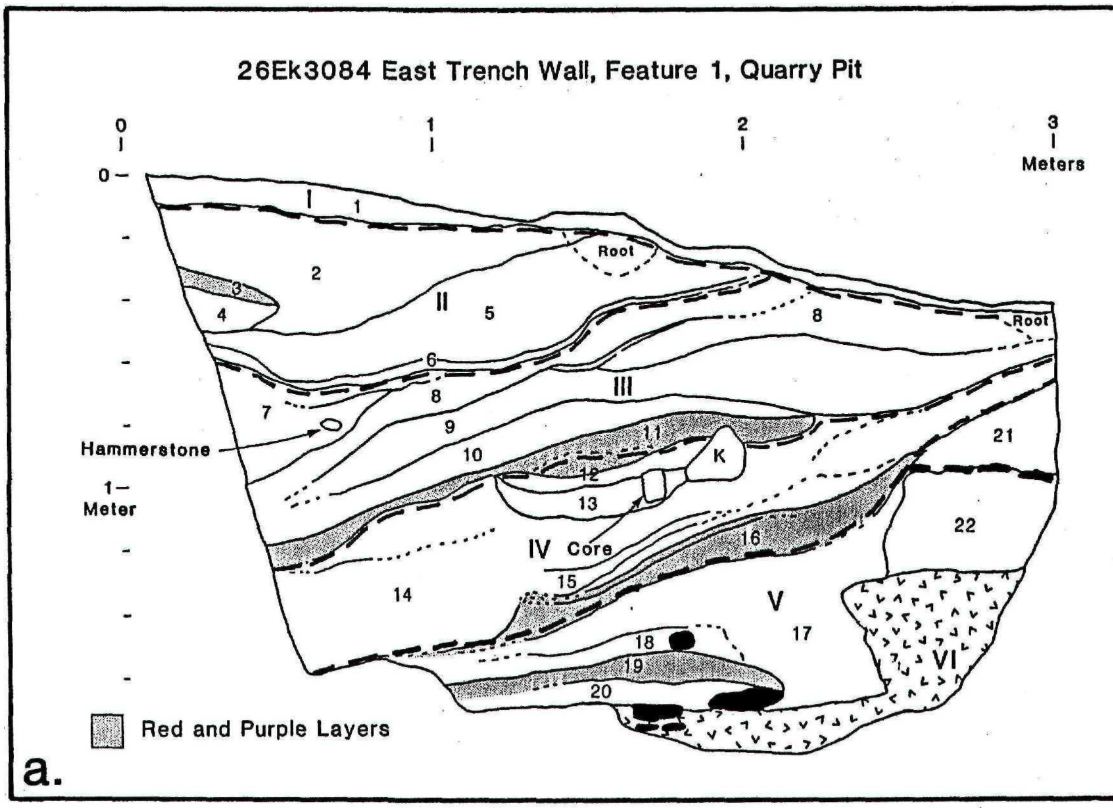
Quarry Pit Stratigraphy

The trench cross section through the Feature 1 quarry pit cut through several north-sloping strata not conforming with the present south-sloping surface (Figure 37a). However, the trench intersected only the downhill margin, or berm, of the quarry pit and the central extraction pit and toolstone source area are located under the road fill (Figure 37b).

The following description of the stratigraphy of the east wall trench profile provides definition of the strata as grouped tentatively by major horizons (Table 47). Particle size, artifact content, and sediment color often change within a few centimeters, but it is possible to organize groups of strata into tentative horizons, each a broad time-stratigraphic unit including one or more related events marked by surfaces and conformable strata. The reader should note that this unit-horizon connection is used whenever possible in subsequent stratigraphic descriptions.

Figure 37a. 26Ek3084, Feature 1, east wall trench profile.

Figure 37b. 26Ek3084, Feature 1, road fill cross section.


26Ek3084 East Trench Wall, Feature 1, Quarry Pit
0
1
2
3
Meters
1—
Meter
I
II
III
IV
V
VI
Root
Hammerstone
K
Core
Red and Purple Layers
a.

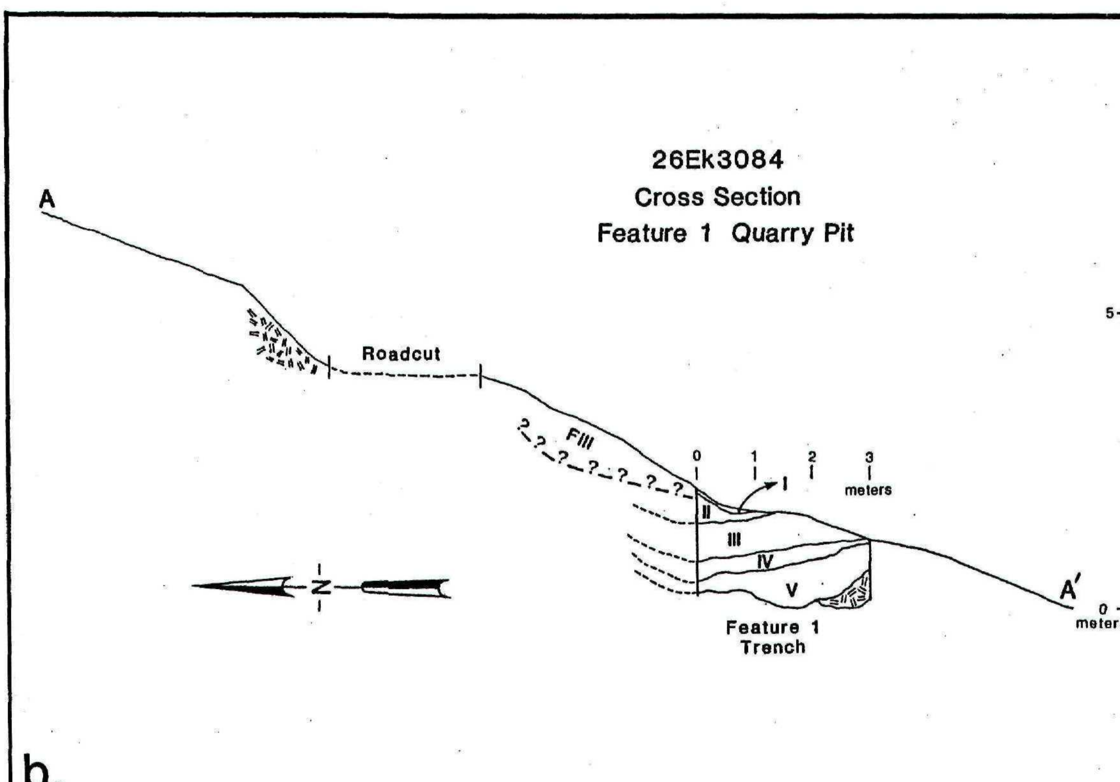

26Ek3084
Cross Section
Feature 1 Quarry Pit
A
A′
Roadcut
FIII
Feature 1
Trench
meters
5
0
meters
N
b.

Table 47. Description of Stratigraphic Units by Horizon, East Wall of Trench through Feature 1, 26Ek3084.

Horizon	Stratum	Description
I	1	Very dark grayish brown (10YR 3/2) cobbly gravelly sand; contains abundant jasper-like flakes, chunks and cores.
II	2	Dark brown (7.5YR 3/2) loamy sand with abundant flakes and cores.
	3	Very dusky red (10R 2.5/2) sandy loam; abundant charcoal in upper 0.5 cm.
	4	Brown (10YR 4/3) sandy loam with small flakes and angular white opalite waste.
	5	Dark brown (7.5YR 3/3) clay loam; large clasts and flakes sparse.
	6	Light brown (7.5YR 6/4) sandy loam; abundant flakes.
III	7	Openwork large flakes and cores with little or no matrix at top; basalt hammerstone, smaller flakes and cores with angular shatter and brown (10YR 4/3) sandy loam matrix in lower portion.
	8	Dark brown (7.5YR 4/2) sandy loam with sparse angular opalite waste and few flakes, although a flake line parallel to Unit 6 is within Unit 8.
	9	Yellowish brown (10YR 5/4) angular tuff rubble with few flakes.
	10	Light brown (7.5 YR 6/4) gravelly sandy loam gravelly tuff with small flakes; effervescent to strongly effervescent.
	11	Weak red (10R 5/3) sandy loam; weakly effervescent to non-effervescent; sparse flakes.
IV	12	Brown (7.5YR 5/4) (lower) to reddish brown (5YR 5/3) (upper) sandy loam matrix with large angular opalite chunks and flakes.
	13	Brown (10YR 5/3) sandy loam with few or no flakes.
	14	Pale brown (10YR 6/3) sandy loam with angular, unmodified opalite chunks; little, if any cultural material on north; becoming coarser toward north with openwork very large flakes and chunks at south end of trench; strongly effervescent.
	15	Brown (7.5YR 5/4) sandy loam with small flakes.
	16	Weak red (10R 4/3) sandy loam with few flakes.
V	17	Light brown (7.5YR 6/4) sandy loam with few flakes.
	18	Brown (7.5YR 5/4) sandy loam with small flakes.
	19	Weak red (10R 5/3) sandy loam with few or no flakes.
	20	Brown (10YR 4/3) sandy loam with few or no flakes.
	21	Light brown (7.5YR 6/4) sandy loam with flakes; non-effervescent.
VI	22	Light brown (10YR 4/3) sandy loam with no flakes; capped with fist-sized chert and tuff cobbles; effervescent to strongly effervescent at bottom.
	Bedrock	Pink (7.5YR 7/4) to reddish yellow (7.5YR 6/6) weathered and/or altered tuff with tabular (flaggy) pieces of jasper-like toolstone at upper contact which probably were the target resource.

The duration of stratigraphic events probably varies considerably. For instance, surfaces were created through excavation (pit floors) and by deposition (surfaces of depositional units). Cultural surfaces and strata (pit floors and slopes, strata deposited through waste disposal) were created instantaneously in archaeological terms, while strata created through natural processes (colluviation, slope wash, eolian deposition) no doubt took longer to accumulate.

Six horizons are identified, as described above. The lowest and uppermost horizons segregate the unmodified sediments and basal bedrock (Horizon VI) and the surface layer of colluvium (Horizon I). Horizons II through IV define one or more temporally related events, here visible as four large pit excavations and their constituent layers of fill. Strata and horizons are numbered consecutively from the surface, but the description proceeds from bottom up to facilitate understanding the sequential order of events.

Horizon VI comprises the oldest deposits which are visible as the bedrock and soil stratum (Unit 22) in the southern end of the trench that have been truncated by quarry pit excavation. Bedrock exposed in the trench bottom is soft, altered tuff in shades of pink, orange, and yellow. Tabular cobbles of jasper-like toolstone occur at the contact. Unit 22 overlies the bedrock and appears to be colluvial soil mantling the slope prior to use of the site as a quarry; it apparently contains no flakes. Unit 22 is capped with a layer of opalite and tuff cobbles.

Horizon V has five units (21 through 17) which compose the fill of the deepest pit visible. The pit was excavated through Unit 22 and along the north face of the bedrock, producing an overhanging pit wall on the south. Unit 21 may represent soil and waste material from this pit. Units 20, 19, 18, and 17 fill this lowermost pit, and are parallel to the underlying tuff bedrock. Red colored Unit 19 is probably backdirt from excavation into the altered tuff bedrock. The brown units (20, 18 and 17) are most likely derived from slope wash.

Horizon IV is comprised of units 16 through 12 which fill a pit that truncated Unit 21 on the south and Unit 17 on the north. Unit 16 is the lowest in a stack of strata that slope to the north at a steeper angle than those of Horizon VI, and appear to fill a larger pit, the bottom of which is located further north (under the road fill). Red unit 16 probably marks altered tuff bedrock waste at the bottom of the horizon; sparse flakes in brown Unit 15 suggest it may have accumulated through slopewash, while the abundant large flakes and cores in Unit 14 suggest quarry waste and processing debris.

Filling a small pit inset into Unit 14 are units 12 and 13. When observed in the field, the shape of this small pit suggested the possibility of a hearth, but neither Unit 12 nor Unit 13 contained charcoal. Unit 12 is comprised of two lenses, of two different colors. A large core was embedded in Unit 13.

Horizon III contains units 11 through 7; the pit they fill has a configuration similar to the one containing Horizon IV strata, but its bottom is located further north. This is visible in the orientation of strata 8 through 10 which have a "berm-like" conformation extending under and outward from the thick openwork of stratum 7. Unit 11 is red sandy loam from the excavation of altered tuff bedrock at the bottom of the pit, and units 10, 9 and 8 are sandy loams probably derived from slope wash. Unit 7 is a wedge of openwork large flakes, cores and angular cobbles, probably debris created by processing quarried toolstone.

Horizon II is comprised of units 6 through 2, filling a relatively shallow pit. The outline of this pit is given by Unit 6, a thin flake layer; the pit bottom is visible in the profile near the northern end of the trench. Unit 5 is a sandy deposit with few flakes, probably derived from slope wash; Unit 2, containing abundant flakes and chert cobbles, is probably quarry waste. Only the edge of units 4 and 3 can be seen at the northern edge of the trench. The red colored Unit 3 has abundant charcoal in its upper portion; whether it is red because it contains altered tuff or because of oxidation from a hearth fire cannot be said at this point.

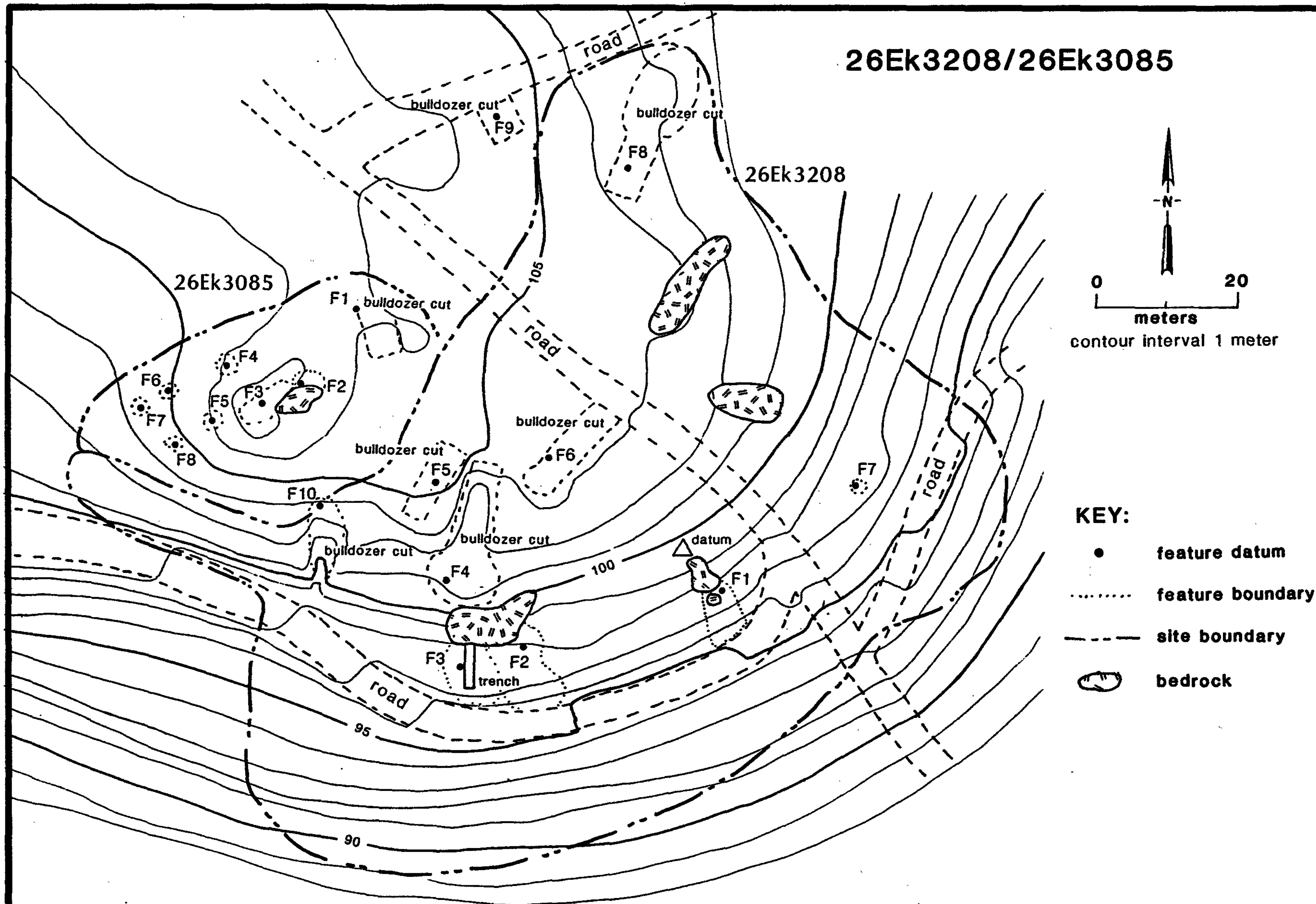
Horizon I is comprised of a single stratum, the surficial layer, Unit 1. Unit 1 slopes south and unconformably overlies and/or truncates several lower units. This suggests that the unconformity is largely the result of erosion.

Presently, the larger portion of the quarry pit is buried under road fill so that neither its horizontal extent nor its maximum depth are known. For the same reason, we have no direct evidence of whether the pit was excavated to exploit a vertical bedrock outcrop or a more or less horizontal layer of bedrock covered with colluvium, or both. The size and shape of some of the quarry shatter, and the tabular structure of the bedrock in Horizon VI, suggests that, whatever the nature of the formation, opalite occurs in tabular pieces. If true, this may account for the relative absence of charcoal in the deposits because the use of fire would not be necessary to extract it. However, the apparently oxidized red soil in stratum 3 must be explored further before the use of fire can be discounted. These questions illustrate certain significant data gaps which are fundamental to addressing defined research issues. A fuller exposure of the quarry pit, subsequent to removal of the road fill, will be necessary to understand the nature of the formation and the extractive strategies employed.

Site 26Ek3208/26Ek3085

Sites 26Ek3208 and 26Ek3085 are adjacent quarry pit complexes (Figure 38). The bedrock is exposed discontinuously at the surface so that the pit complexes appeared to be spatially discrete when they were recorded. In actuality, the outcrops are

Figure 38. 26Ek3208/3085, site map.



26Ek3208/26Ek3085
26Ek3208
26Ek3085
road
road
road
road
bulldozer cut
bulldozer cut
bulldozer cut
bulldozer cut
bulldozer cut
bulldozer cut
bulldozer cut
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
datum
trench
105
100
95
90
N
0
20
meters
contour interval 1 meter
KEY:
feature datum
feature boundary
site boundary
bedrock

slightly different, but contiguous manifestations of the same geologic formation and the pit complexes are elements of the same archaeological phenomenon.

The 26Ek3208 quarry pit complex is centered on a prominent opalite ledge outcrop exposed along the southeast edge of the ridgeline. Two large pits (features 2 and 3) are visible on the surface at the base of the steep outcrop face; another smaller pit (Feature 1) is situated nearby. The top of the exposure, on the ridgeline, has been the focus of more recent mining exploration; five historic mining features (pits, bulldozer scrapes, trenches) were recorded (features 4 through 10); all five were excavated in areas of thick prehistoric quarry deposits, one of which (Feature 5) exposed a basalt biface which appears to be a Great Basin Stemmed Point preform.

Site 26Ek3085 is a small pit cluster composed of five shallow prehistoric quarry pits (features 3, and 5 through 8), two large historic pits (features 1 and 4), and one pit of uncertain origin (Feature 2). The quarry pits are associated with a low extrusion of opalite bedrock centered on the top of the saddle and west of the prominent outcrop at 26Ek3208.

Surficial distinctions in the size of the quarry pits and the quality of the exposed opalite suggest differences in the degree of energy expended at 26Ek3085 as opposed to 26Ek3208; quarry pits at 26Ek3085 are smaller (2 to 4 m maximum dimension), shallower (ca. 30 cm deep), and associated with restricted debris scatters. Few formed artifacts were located in these pits; one Quarry Biface was collected from Feature 5 and one basalt percussion tool was collected from Feature 8. Flakes and other quarry products are visible in pit berms and debris cones, but a thick layer of matted grass covers the features and obscures all but their general surface conformation.

Unlike the large pits (features 2 and 3) at adjacent 26Ek3208 which exploit a massive ledge, the prehistoric pits at 26Ek3085 were excavated into narrow colluvial pockets which have formed between low bedrock ledges. These pockets likely contained fractured opalite bedrock, some of which would have been suitable for toolstone reduction. The small size of the pits, and the restricted area of associated extraction debris, suggest a lesser quality toolstone available for extraction than at 26Ek3208.

At 26Ek3208, a dense layer of reduction debris covers the top of the outcrop and extends down the south slope, below its steep face, to form a thick debris cone. This talus is largely cultural in origin and includes great numbers of rejected bifaces, large pieces of shatter, and crude cores as well as many basalt and rhyolite hammerstones in a range of sizes. One of the two surface depressions, Feature 3, at the base of the outcrop was sectioned by backhoe trench; its complex stratigraphy is described below.

Quarry Pit Stratigraphy

The cross section of Feature 3 reveals deposits composed of numerous intercalating layers extending more than two meters below surface (Figure 39). Horizons and strata are numbered consecutively from the surface. In the following discussion, horizons and strata are presented in reverse order, from bedrock to the surface. Munsell colors (wet) are given for most strata, but soil descriptions are not, since the highly mineral deposits are all gravelly sands with few or no fines (Table 48).

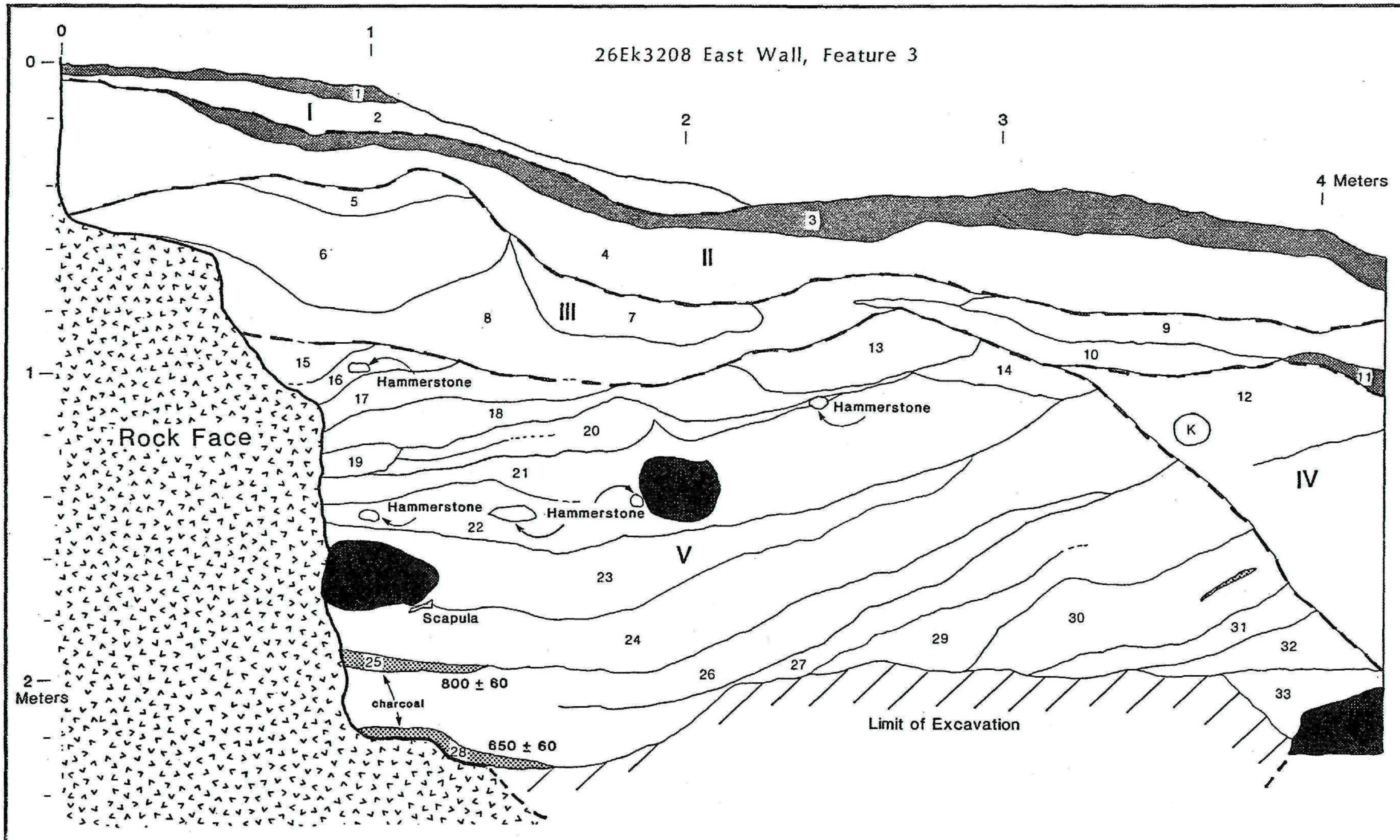
Horizon V is a thick deposit comprised mostly of conformable strata appearing to represent sequent episodes of filling a large pit excavated at the face of the outcrop. We did not observe the bottom of this pit and do not know if it bottoms out on bedrock.

Excavation of pits in Horizon III and Horizon IV truncated several units (15 through 13) in Horizon V; consequently, the original surface is gone and the extent of pit berms cannot be determined. Units 13 through 17 may not be part of Horizon V, but may be more closely related to Horizon III or Horizon IV. Still, these units seem to be more conformable to Horizon V than to any other. It appears there has been some retreat of the face of the opalite outcrop as it was mined, and this helps account for the order and morphology of strata in Horizon V. Indeed, an adit may extend into the face of the outcrop just east of the profile, since the bedrock outcrop can be seen to bend around to the north on the east side of the trench.

Charcoal is common in Horizon V, increasing in abundance with depth, suggesting that fire setting against the face of the outcrop was used to weaken the tuff and dislodge chunks of toolstone. This is supported by the presence near the bottom of the profile of two lenses of charcoal-rich sediment containing fragments of burned tuff and opalite. A Bison sp. scapula fragment, found on the contact between units 23 and 24, probably was used as a shovel to help remove quarry waste from the pit. Radiocarbon dates from strata 25 and 28 bracket the basal deposits in Horizon V between ca. A.D. 1150 and 1300 (Table 49). The order of the dates is reversed; however, since they are within two standard deviations of each other, they may be considered the same date.

The strata in Horizon V tend to alternate in coarseness between layers of sandy decomposed tuff and layers of tuff and opalite rubble. The latter usually are more extensive, while the finer grained deposits often pinch out on the interior slope of the pit they partially fill. Perhaps the rubble layers represent episodes of quarry activity when rock was removed from the face of the outcrop and waste discarded in the pit and on the berm. The finer sediments may be material accumulated in the pit bottoms through natural processes such as slope wash between quarrying episodes. The fact that coarse layers overlie both charcoal lenses supports this hypothesis if the lenses are relics of the firesetting technique and not natural accumulations of charcoal from wildfires.

Figure 39. 26Ek3208, Feature 3 quarry pit cross section, east wall trench profile.



26Ek3208 East Wall, Feature 3
0
1
2
3
4 Meters
0
1
2
Meters
I
II
III
IV
V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
K
Hammerstone
Hammerstone
Hammerstone
Hammerstone
Rock Face
Scapula
800 ± 60
charcoal
650 ± 60
Limit of Excavation

Table 48. Description of Stratigraphic Units by Horizon, East Wall of Trench through Feature 3, 26Ek3208.

Horizon	Stratum	Description
I	1	0-5 cm but extends only to one meter beyond the base of the outcrop; very dark brown (10YR 2/2); essentially an A1 horizon or humic accumulation containing a little silt in the upper portion of Unit 2. Flakes and cores are present but sparse.
	2	5-10 cm; lobe of mostly open-work talus of greenish white (5GY 9/1) opalite with very dark grayish brown (10YR 3/2), very sparse sandy matrix. Particle size is 1-3 cm within one meter of the outcrop, increasing to fist-size at toe of lobe. Flakes and cores are present but sparse.
II	3	10-30 cm; buried by units one and two to 2.2 meters from the face of the outcrop, thereafter at surface; black (10YR 2/1); possibly an A1 horizon developed in the upper portion of Unit 4. An accumulation of organic material containing abundant tiny flakes between 3.0 and 3.3 meters from the outcrop is probably an old harvester ant midden. Flakes are abundant throughout.
	4	Very dark brown (10YR 2/2), fist-size or larger angular chunks of opalite in a sandy matrix; flakes less abundant than in Unit 3 above. Perhaps most of the dark color is derived from infiltration of humic material from Unit 3. The upper surface of Unit 4 is roughly parallel to the present surface; the lower boundary suggests that Unit 4 is unconformable over berms and in pits forming the surface of underlying units of Horizon II. The large size of opalite clasts in Unit 4 suggests its origin as waste from unobserved quarry pits located further to the east.
III	5	Brown (10YR 5/3) sandy deposit comprised mostly of decomposed tuff with few flakes.
	6	Light colored openwork tuff and poor quality opalite rubble; clasts 10-15cm diameter; sparse dark grayish brown sandy matrix.
	7	Angular openwork rubble with matrix similar to Unit 5.
	8	Dark grayish brown (10YR 4/2) decomposed tuff near the base of the outcrop, coarsening and becoming lighter in color with distance to south; contains large flakes.
	9	Grayish openwork tuff rubble with relatively few flakes.
	10	Decomposed tuff with angular chunks of rubble; darker color than Unit 9; possibly a facies of Unit 11.
	11	Black (10YR 2/1) organic layer with no free charcoal.
IV	12	Dark grayish brown (10YR 4/2) sandy matrix with small particles of tuff; flakes are relatively scarce. No internal stratification is obvious.
V	13	Greyish brown sandy matrix with few obvious flakes.
	14	Greyish brown sandy matrix with big pieces of tuff and poor quality toolstone shatter.
	15	Light colored, fine grained sediment filling small pit against the outcrop; truncated by Unit 8.
	16	Darker gray sandy sediment with large flakes; truncated by Unit 8.
	17	White (10YR 8/2) decomposed tuff containing large chunks of good quality opalite and medium to large opalite flakes.
	18	Openwork layer of high quality greenish white (5GY 9/1) opalite flakes of all sizes from very large to small. Appears to be core reduction debris.

Table 48, continued.

Horizon	Stratum	Description
(V, cont.)	19	Light colored, angular, gravel-sized decomposed tuff.
	20	Dark grayish brown (10YR 4/2) silty sand matrix with abundant flakes; flakes are larger in upper portion, smaller below but form open work at bottom of unit.
	21	Dark gray (10YR 4/1) silty sand with abundant small charcoal flecks; merges with Unit 22.
	22	Dark grayish brown (10YR 4/2) openwork opalite flakes and cobbles with sandy matrix and abundant charcoal; contains large (20 x 25 cm) rhyolite boulder and hammerstones. Boundary between units 21 and 22 becomes indistinct about 80 cm. south of the outcrop, as Unit 22 becomes a stack of intercalated lenses of coarser material alternating with light and dark colored decomposed tuff.
	23	Grayish brown (10YR 5/2) to pale brown (10YR 6/3) decomposed tuff and angular rubble containing abundant charcoal. Unit is coarser on bottom and nearest outcrop fining toward the south; unit is darker in color nearest outcrop, becoming lighter toward south; unit contains a large (20 x 35 cm) rhyolite boulder; a bison scapula was found in Unit 23 at contact with Unit 24.
	24	Dark grayish brown (10YR 4/2) sandy matrix with abundant charcoal, but mostly large, loose chunks of angular, cobbly opalite and tuff rubble becoming more sandy to the south.
	25	Very dark gray (10YR 3/1) opalite sand with very abundant charcoal; contains small chunks of burned opalite and tuff.
	26	Pale brown (10YR 6/3) sparse sandy matrix in coarse cobbly deposit near outcrop becoming very dark grayish brown (10YR 3/2) decomposed tuff sand with flakes toward south.
	27	Light brownish gray (10YR 6/2) decomposed tuff with angular opalite chunks and flakes; differentiated from Unit 26 about 65 cm south of outcrop; most cobbly nearest outcrop, fining southward.
	28	Very dark gray (10YR 3/1) opalite silty sand with very abundant charcoal in contact with opalite bedrock; contains small chunks of burned opalite and tuff.
	29	Dark gray (10YR 4/1) large, angular rubble; distinction between Unit 27 and Unit 29 lost about 2.2 meters south of outcrop.
	30	Dark grayish brown (10YR 4/2) decomposed tuff with small angular chunks; contains a narrow band or lens of charcoal.
	31	Large rubble.
	32	Dark gray (10YR 4/1) silty sand with charcoal.
	33	Light gray (10YR 7/2) decomposed tuff with few flakes but some charcoal.
	Bedrock	At the outcrop, bedrock is banded opalite and tuff; large tuff boulder at south end of profile may also be bedrock.

Table 49. Provenience of Radiocarbon Samples from 26Ek3208.

Reference Number	Laboratory Number	Date (Years B.P)	Provenience
2500-2/4	Beta-26754	800 +/- 60	Stratum 25; 1.80-1.85m BS
2500-4/5	Beta-26755	650 +/- 60	Stratum 28; 2.05-2.10m BS

Horizon IV is comprised of the fill of a single large pit, Unit 12, at least 90 cm deep. The pit may have been excavated to exploit previously quarried opalite material in older pit fills and berms of Horizon V, but it may have penetrated to bedrock as well. It is overlain by units 10 and 11 of Horizon III. Only the northernmost portion of Unit 12 was observed.

Horizon III contains strata that seem to relate to the last episodes of quarry pitting visible in the profile. The quarry activity appears to have been oriented as much toward reworking older quarry waste in berms and pit fill as with working the outcrop. Consequently, pits, berms and fills intercut each another and vary in distance from the outcrop. Actually, all the pits in Horizon III and the single large pit in Horizon IV (filled with Unit 12) may be related to the same horizon.

Unit 8 fills a larger pit, extending to 2.5 m south of the outcrop; units 9 and 10 probably are layers of waste from this large pit. Unit 11, possibly an extension of Unit 10, is probably a buried humic horizon similar to Unit 3. Unit 7 fills a small pit between 1.5 and 2.5 m south of the outcrop; units 5 and 6 fill a pit between the face of the outcrop and 1.5 m south. Both these units have been truncated on the south by the pit filled with Unit 4.

Horizon II is comprised of two units that run the length of the trench, forming, in part, the present ground surface. Large flakes and cores are more abundant in these units than in those of Horizon I.

Horizon I is comprised of two strata that are parallel to the present ground surface, but limited in horizontal extent. Flakes and cores, though relatively scarce, are thought to be included through such natural processes as slope wash from above. Horizon I therefore includes material deposited through natural processes since the last major episode of toolstone extraction at the site.

In summary, five major kinds of deposits have accumulated in the quarry pit deposits. Fine grained, tuff sand and silty tuff sand strata (cf. units 33, 30, 27, 23; possibly Unit 12) are probably non-cultural accumulations of material deposited through slope wash and aeolian processes during intervals when the quarry site was not in active use. These are mostly light-colored sediments. Unit 12, filling a large pit, is darker in color and somewhat more coarse in texture; it may be humic soil excavated from another pit and not have accumulated through slope wash. Charcoal and fire-altered rock form lenses that may have been deposited during episodes of fire setting to weaken bedrock. Coarse rubble, comprised of angular tuff and/or opalite, often containing abundant flakes and cores, is probably quarry waste generated by working the bedrock. Flake layers are deposits of pure opalite debitage with little or no sand or rubble. These sediments suggest toolstone processing and/or initial reduction. Colluvium is coarse material accumulating through natural processes of mass wasting of the outcrop face. In addition, humic horizons can develop on any of these strata if they are exposed long enough at the surface.

The stratigraphic record revealed in trench profile suggests that there are two types of subsurface quarry features. One type is the large pit excavated against the bedrock face in order to quarry toolstone from the face, and represents the technique used during the earliest episode of quarrying visible in the trench. Quarrying tools associated with this feature type are large (< 25 cm diameter) andesitic basalt boulders, hammerstones, and bison scapula shovels. Fire setting apparently was used to weaken rock in the outcrop, but whether fire was more effective on well silicified opalite, or on the tuff, is not known.

The second type of feature is the pit sunk into deposits of waste rock generated by exploitation of the outcrop; these pits vary in size and no quarrying tools were observed in them. The reworking of earlier quarry debris is a technique employed during the last episodes of quarry use at this site.

Summary

The three small outcrop quarries (sites 26Ek3082, 26Ek3083, and 26Ek3207) suggest brief exploration (material assay) and limited core reduction perhaps incidental to toolstone procurement elsewhere in the vicinity or for expedient toolstone manufacture while hunting or foraging in the area. These sites lack time-sensitive artifacts or other chronological indicators which might segregate episodes of use. Likewise, the lack of spatially discrete extraction features provides few clues to the organization of production at these small quarry sites.

Site 26Ek3084 is a unique opalite source locality; it is areally restricted, distinctive in color, high in quality, and was exploited intensively. It is expected that the high quality of the toolstone is related to its desirability and that this may be measured by the energy used to extract it. Furthermore, material removed from the quarry to nearby reduction sites may be traced due to its distinctive color and unusual jasper-like composition.

The 26Ek3208/26Ek3085 quarry pit complex provides a wealth of data for comparing prehistoric quarry strategies and for calculating energy investments relative to variations in material quality and abundance along the same geologic formation. The presence of dateable charcoal in stratified deposits is especially significant. Quarry features may be dated as discrete stratigraphic events, energy investments may be calculated by strata, and a cultural-chronological dimension can be added to our understanding of extractive strategies and energy investments.

Chapter 11. BASALT CANYON SITES

by Elizabeth E. Budy

Where it passes through the USX-West project area, Basalt Canyon is a narrow, steep-sided division between Red Hill and a series of southeast trending ridgelines comprising the Bitterroot Ridge Complex (Figure 40). The ephemeral stream follows a sinuous course bending around the base of Red Hill to flow into Little Antelope Canyon on the east.

Constrained by underlying bedrock, the grade of the channel varies. Along most of its extent, the relatively steep grade of the stream combined with seasonal high energy flows has not favored alluvial deposition. Sediments tend to accumulate in reaches with more shallow gradient where small terraces form; here, water is forced to the surface by underlying bedrock and is retained by the accumulated alluvial sediments. The stream channel contains seeps and pools of standing water that may persist for several weeks after the steeper reaches have dried up. For example, resistant underlying bedrock on the eastern (downstream) edge of the bend near site 26Ek3092 serves to control stream downcutting, favoring the accumulation of alluvial deposits at the bend interior. As a result, a series of small terraces, likely formed during the Late Holocene, served as loci for prehistoric occupation from about 3000 B.C. to A.D. 1850.

Intermittent water and small persistent pools provide seasonal habitat for both large and small mammals. Faunal data from alluvial terrace deposits at site 26Ek3092 suggest that bighorn sheep, possibly bison, and other deer-sized mammals were hunted in the vicinity. Basalt Canyon also provides small amounts of edible grass and sedge seeds as well as drinking water in early summer which may have conditioned, in part, site locations along the lower reaches of the canyon. Assemblage constituents at several sites likewise suggest on-site subsistence related activities as well as some limited residential use; however, as elsewhere in the project area, cultural activity centered on toolstone reduction.

Descriptive Site Summary

Eleven sites were recorded along the lower reach of Basalt Canyon (Table 50), nine of which were tested.

Tested sites, as grouped by operational field types, include five reduction stations (small scatters), one reduction/cobble assay site (scattered workshop and on-site cobble assay residue), one reduction complex (with three spatially discrete workshop features), and two reduction/

Figure 40. Topographic setting, Basalt Canyon sites.

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IN NEVADA

Note:

One or more pages have been removed from this part of the report due to sensitivity of specific archaeological site location information. Qualified persons may contact the Nevada Bureau of Land Management, Elko Field Office, to inquire about obtaining additional information.

residential complexes (where short term occupation is inferred from the variety of subsistence-related artifacts recovered). In actuality, these types provide only broad parameters for grouping sites in Basalt Canyon. As a result of streamside and/or steep slope location, artifact patterns have been rendered obscure by slopewash and/or alluvial processes. Indeed, test assessments were oriented initially towards better site definition relative to local depositional characteristics.

Table 50. Descriptive Summary, Basalt Canyon Sites.

Site Number	Type		Features (n)	Maximum Site Area (sq m)
26Ek3086	Reduction/ Cobble Assay		-	1,100
26Ek3087	Reduction Station		-	300
26Ek3088	Reduction Station		-	650
26Ek3089	Reduction Station	[NOT TESTED]	-	36
26Ek3090	Rockshelter/Reduction Station		-	150
26Ek3091	Reduction Station		-	400
26Ek3092	Reduction/Residential Complex		5	4,800
26Ek3097	Reduction Station		-	500
26Ek3098	Isolated Artifact	[NOT TESTED]	-	N/A
26Ek3099	Reduction Complex		4	750
26Ek3149	Reduction/Residential Complex		3	2,500

Testing Strategies

Each Basalt Canyon site was subjected initially to systematic close interval surface survey to locate all formed artifacts and obsidian suitable for sourcing, characterize surface debitage patterns, establish boundaries, and prepare detailed site maps. Discrete artifact concentrations were recorded as features at three sites (26Ek3092, 26Ek3099, and 26Ek3149) and all associated artifacts were plotted on plan maps and collected (Table 51). At site 26Ek3149, surface features are constrained in vertical extent by bedrock, but artifact patterns appeared to be affected minimally by slopewash. Consequently, a representative sample feature was collected completely for debitage classification and distributional studies. Such is not the case at sites 26Ek3092 and 26Ek3099 where features are located on steep slopes, and materials, though clustered, can be seen to have been redistributed by erosion. Eroded features were judged to contain little data suitable for reconstructing cultural patterns; no systematic debitage collections were taken from surface features at these sites.

Table 51. Summary of Testing Procedures, Basalt Canyon Sites.

Site Number	FEATURES RECORDED Total (n)	Sampled (n)	FEATURE Surface Skim Area (sq m)	NONFEATURE CONTEXT Subsurface Excavation Volume (cu m)	Trench Cross Section (n)	Strati-graphic Profile (n)	RECOVERED COLLECTIONS Debitage (n)	Formed Artifacts (n)
26Ek3086	-	-	-	-	-	-	3	6
26Ek3087	-	-	-	-	-	-	1	4
26Ek3088	-	-	-	-	-	-	0	4
26Ek3090	-	-	-	0.45	-	-	173	6
26Ek3091	-	-	-	-	-	-	0	8
26Ek3092	5	-	-	2.30	4	3	29,135	117
26Ek3097	-	-	-	-	-	-	0	0
26Ek3099	4	-	-	-	-	-	0	13
26Ek3149	3	1	4.0	0.25	-	-	527	25

Depth of deposit at most sites in Basalt Canyon is constrained by near surface bedrock or steep colluvial slopes that provide little opportunity for subsurface cultural accumulations. However, subsurface tests were conducted outside feature contexts at three sites (26Ek3090, 26Ek3149, and 26Ek3092) where deeper sediments were observed. At rockshelter/reduction site 26Ek3090, a 1 by 1 m test unit sampled deposits accumulated at the base of a low rock overhang. At reduction/residential site 26Ek3149, a 0.50 by 1 m unit sampled recent alluvium edging Basalt Canyon at the lower edge of the site. At site 26Ek3092, alluvial terrace deposits were cross sectioned by backhoe trenches and sampled by controlled excavation.

Site 26Ek3092 is otherwise unique among sites located in Basalt Canyon for its buried alluvial deposits and stream terraces. Tests focused on identifying any buried cultural components of the terrace sediments and on working out the relative chronology of occupation. To do this, four backhoe trenches opened cross sections for stratigraphic study. Subsequent to drawing trench profiles, three 1 by 1m test units were located so as to intersect discrete stratigraphic layers visible in three trench wall profiles.

Chronology

The chronology of prehistoric occupation in Basalt Canyon presently relies on time-sensitive artifacts recovered from only one site, 26Ek3092. The earliest evidence is a reworked obsidian projectile point, found in the basal terrace deposits (80-90 cm below surface), which is classified as a Gatecliff

Split Stem (dated between 3000 and 1300 B.C.) but which may be, in fact, a reworked Elko Series point (dated between 1300 B.C. and A.D. 700). Fremont pottery, indicating a maximum range of A.D. 400 and 1350, and Desert Side-notched projectile points (dated between A.D. 1300 and 1850) also were recovered from discrete subsurface layers in the terrace deposits. Charcoal suitable for radiocarbon assay is expected to be recovered in future investigations at this buried site.

Assemblage Composition

The small reduction sites in Basalt Canyon recovered few formed artifacts; these largely consist of Quarry Bifaces (Table 52). Greater functional diversity in artifact classes is apparent at sites 26Ek3092 and 26Ek3149 which are thought to have served as campsite locations at various times. The collection from site 26Ek3149 is not large, but it does include seed grinding stones as well as more general food getting or processing tools. Although larger, the collection from site 26Ek3092 represents only a small sample (2.30 m^3) of the culture bearing alluvium in the terrace sediments. At present, the low density of tools and high density of debitage reflects only short term uses coincident with toolstone reduction, but future investigations are expected to expose a greater range of activities in the context of buried residential features.

The section which follows describes sedimentary contexts, artifact distributions, and feature arrangements at each of the Basalt Canyon sites. The discussion groups the small eroded reduction sites for initial description followed by the two reduction/residential complexes.

Table 52. Intersite Artifact Class Frequency Comparisons, Basalt Canyon Sites.

ARTIFACT CLASS	ARTIFACT FREQUENCY PER SITE							
	Small Reduction Sites						Reduction/Residential	
Lithic Processing/ Reduction Tools	26Ek3086	26Ek3087	26Ek3088	26Ek3090	26Ek3091	26Ek3099	26Ek3092	26Ek3149
Hammerstones	-	-	-	-	-	1	1	-
Other Percussion	-	-	-	-	-	1	-	1
Subtotal (%)	0(0)	0(0)	0(0)	0(0)	0(0)	2(15.4)	1(0.9)	1(4.0)
Reduction Artifacts								
Cores	-	-	1	-	2	3	10	1
Quarry Bifaces	4	4	2	4	5	6	38	9
Preform Bifaces	-	-	-	1	-	1	1	-
Small Bifaces	-	-	-	-	1	-	11	3
Indeter Bifaces	-	-	-	-	-	1	12	-
Subtotal (%)	4(66.7)	4(100.0)	3(75.0)	5(83.3)	8(100.0)	11(84.6)	72(61.5)	13(52.0)
Projectile Points								
Classifiable Types	-	-	-	-	-	-	4	-
Unclassifiable	-	-	-	-	-	-	4	3
Subtotal (%)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	8(6.8)	3(12.0)
Maintenance and/or Processing Tools								
Scrapers	2	-	1	1	-	-	25	3
Knives	-	-	-	-	-	-	-	1
Perforators	-	-	-	-	-	-	1	1
Spokeshaves	-	-	-	-	-	-	-	1
Multipurpose Flakes	-	-	-	-	-	-	4	-
Simple Flake Tools	-	-	-	-	-	-	1	-
Abraders	-	-	-	-	-	-	1	-
Subtotal (%)	2(33.3)	0(0)	1(25.0)	1(16.7)	0(0)	0(0)	32(27.4)	6(24.0)
Plant Processing								
Metates	-	-	-	-	-	-	-	1
Manos	-	-	-	-	-	-	-	1
Subtotal (%)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2(8.0)
Miscellaneous Artifacts								
Pottery	-	-	-	-	-	-	4	-
Subtotal (%)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4(3.4)	0(0)
Site Total	6	4	4	6	8	13	117	25

Small Reduction Sites: Context and Structure

The seven small reduction sites assessed in Basalt Canyon were found to offer limited research opportunities. Located on steep slopes and/or edging the contemporary floodplain of Basalt Canyon, the sites are characterized by low density reduction scatters and demonstrate little internal spatial organization. Sites 26Ek3086, 26Ek3087, and 26Ek3088 are probably low enough to suffer periodic inundation.

Site 26Ek3086

Site 26Ek3086, a diffuse scatter reflecting cobble assay and biface reduction, is located on a gravel bar exposed at the toe of a ridge at the confluence of Basalt Canyon and Little Antelope Creek (see Figure 40). Cobble-sized pieces of opalite and sparse assay flakes are included in the gravels. Controlled reduction flakes are few, but four Quarry Bifaces were recovered along with a carefully modified end scraper and an expedient scraping tool. None of the formed artifacts appears (by color and other physical characteristics) to have been made from opalite available on the site. No features were recorded and the distribution of artifacts is unpatterned.

Site 26Ek3087

Reduction site 26Ek3087 is situated on a small terrace, about 35 m long and 15 m wide, two meters above, and on the south side of the stream bed (see Figure 40). Terrace sediments consist of a 40 cm thick layer of rocky, sandy silt derived in part from slopewash which overlies large boulders. Examination of the streamcut profile and rodent tailings revealed no evidence of buried cultural materials and none are suggested by surface artifact distributions.

Debitage is scattered thinly (1-5 items per m^2) across the terrace; no feature concentrations were identified. The small collection of formed artifacts consists of four Quarry Bifaces. Debitage material is a purple-to-brown, jasper-like opalite similar to the Red Hill quarry source at site 26Ek3084; cobble-sized pieces of this material also are available in the streambed.

Site 26Ek3088

Site 26Ek3088 is located on a small terrace (22 m wide by 25 m long) on the south side of the canyon (see Figure 40); the terrace is comprised mainly of large boulders with a thin mantle of soil. There are no discrete features on the site, and cultural material is not deeply buried. Surface debitage is relatively sparse (1 item per m^2), with a slightly higher density (5 items per m^2) along the terrace margin where it is exposed and concentrated by erosion. Collections include one core, two Quarry Bifaces, and one scraper. The site appears to be an eroded core and biface reduction locus, perhaps representing several ephemeral uses.

Site 26Ek3090

Site 26Ek3090 consists of a light density lithic scatter extending from a bedrock/boulder overhang, over a narrow bench, and downslope approximately 20 m to the streambed (Figure 41a). The north-facing overhang is two meters deep, four meters long, and less than one meter high; as such, it would provide a convenient shaded work space or a place to crouch out of the wind. An active packrat nest is located in the east end of the shelter, consisting of an elongated mound of sticks, pebbles, bones, and fresh vegetable matter. Formed artifacts on the surface totalled three Quarry Biface fragments and an end scraper; one of the bifaces was found under the lip of the overhang where a subsurface excavation unit was located.

A 1 by 1 m excavation unit (EU1) was excavated to 40 cm below surface and sediments were passed through 1/8 in. screen; the last level (40 to 50 cm below surface) was reduced to 50 cm by 1 m because wet sticky sediments made excavation and screening difficult. Only a small amount of debitage was recovered from the subsurface test; rather high average flake weight suggests most were produced during preliminary trimming of large Quarry Bifaces or as a consequence of core reduction (Table 53). Other artifacts recovered include one Preform Biface and one Quarry Biface.

Table 53. Artifact Collections from EU1, Site 26Ek3090.

Depth	DEBITAGE				
	Flakes		Shatter		
(cm BS)	(n)	(Av Wt)	(n)	(Av Wt)	OTHER ARTIFACTS
0-10	32	2.6	23	14.4	Preform Biface
10-20	36	6.5	6	51.9	none
20-30	10	6.0	4	6.6	none
30-40	29	7.8	20	9.8	Quarry Biface
*40-50	10	2.7	16	2.2	none

* converted (times two) to reflect comparable volume

The south wall profile of the excavation unit shows three major stratigraphic units (Figure 41b). Unit 1, comprising the upper 15-25 cm of deposit (thickens to the west), is a dark brown silt loam in which charcoal flecks and chunks are common.

Figure 41a. Overview southeast, site 26Ek3090.

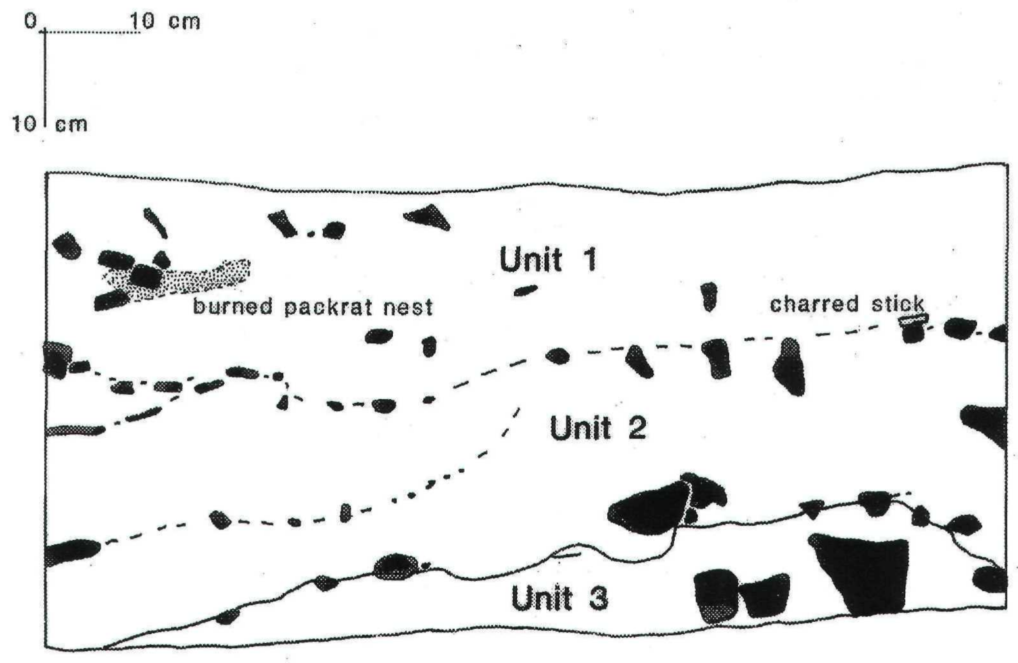
Figure 41b. South wall profile EU1, site 26Ek3090.

Key

Unit 1: dark brown silt loam (7.5YR 3/2); slightly plastic; fine roots common; charcoal present.

Unit 2: very dark brown silt loam; slightly plastic; roots and charcoal common.

Unit 3: dark reddish brown (5YR 3/4) silty clay loam; subangular blocky; plastic.


0
10 cm
10
cm
Unit 1
burned packrat nest
charred stick
Unit 2
Unit 3

A charcoal lens about 10 cm below the surface in this unit is thought to represent a burned packrat midden of the type presently on the surface; the charcoal lens has the same shape and directly underlies the surface midden. Unit 2 is a dark brown silt loam containing cobbles of opalite; charcoal is also abundant. Unit 2 is approximately 20 cm thick. Unit 3 is dark reddish brown silty clay loam containing abundant opalite cobbles and boulders and no charcoal. Unit 3 probably represents the buried paleosol that forms the virtual bedrock in the vicinity of Red Hill. The boundary between Unit 1 and underlying Unit 2 is marked by a conspicuous pebble line contact extending across the profile.

Comparison of debitage frequencies and average weight per item by level listed in Table 53 with the stratigraphic profile suggests that the pebble line contact is probably a buried surface. Note that debitage numbers decrease with increased depth to about 30 cm then increase again just below the contact. Some size grading also is apparent in the upper layers, with heavier items tending to accumulate above the pebble line at about 20cm below surface.

The alcove apparently provided temporary shelter to those reducing local toolstone. Incidental hunting is suggested during its latest use (upper surface) by a broken projectile point preform.

Site 26Ek3091

Site 26Ek3091 is among a group of boxcar-sized boulders on a steep rocky colluvial slope north of the stream channel (see Figure 40). Two large boulders form shallow overhangs, but no cultural material was observed on the surface there. A flake scatter east of the boulders has been obscured by drilling mud from recent exploration holes in the road above the site. A flake scatter located on the west side of the large boulder seems to have been concentrated by slope wash. Due to the eroded and disturbed site context, no features were identified.

Formed artifacts collected from the site totalled eight items, including two cores, five Quarry Bifaces, and one Small Biface. The boulders served as a locus for reducing cores and fabricating several large bifaces, but this use appears to have been quite ephemeral.

Site 26Ek3097

Sites 26Ek3097 is located on a moderately steep (24%) colluvial slope at the western edge of the Basalt Canyon sites. The site consists of a thin flake scatter extending downslope from a probable reduction locus cut by a road. Though some zones of higher density were observed, these appear to result from differential erosion on the slope; no features were recorded. As a consequence of the probable disturbance from road construction, and observable effects of slope movement, no collections were made from the site.

Site 26Ek3099

Site 26Ek3099 is located on the upper portion of the slope above site 26Ek3097. It retains evidence of four reduction features, but these have been moved about in recent times by heavy equipment turnabouts. The features contain evidence of both core and large biface reduction, and prior to their recent disturbance, appeared to have been only moderately affected by movement on the rather steep (> 20%) slope. As such, the features likely reflect recent prehistoric reduction episodes. Artifacts collected from the site include three cores, eight reduction bifaces, a hammerstone, and a chopper-like tool. No systematic debitage collections were made because of the disturbed contexts of the cultural deposits.

Reduction/Residential Sites: Context and Structure

Two sites in Basalt Canyon, 26Ek3092 and 26Ek3149, are inferred to be short term residential sites because tools and other materials (i.e., fauna from 26Ek3092) recovered from them reflect food processing, equipment maintenance, and other activities conducted at campsite locations. As the following descriptions indicate, however, these sites are quite distinct in their depositional characteristics.

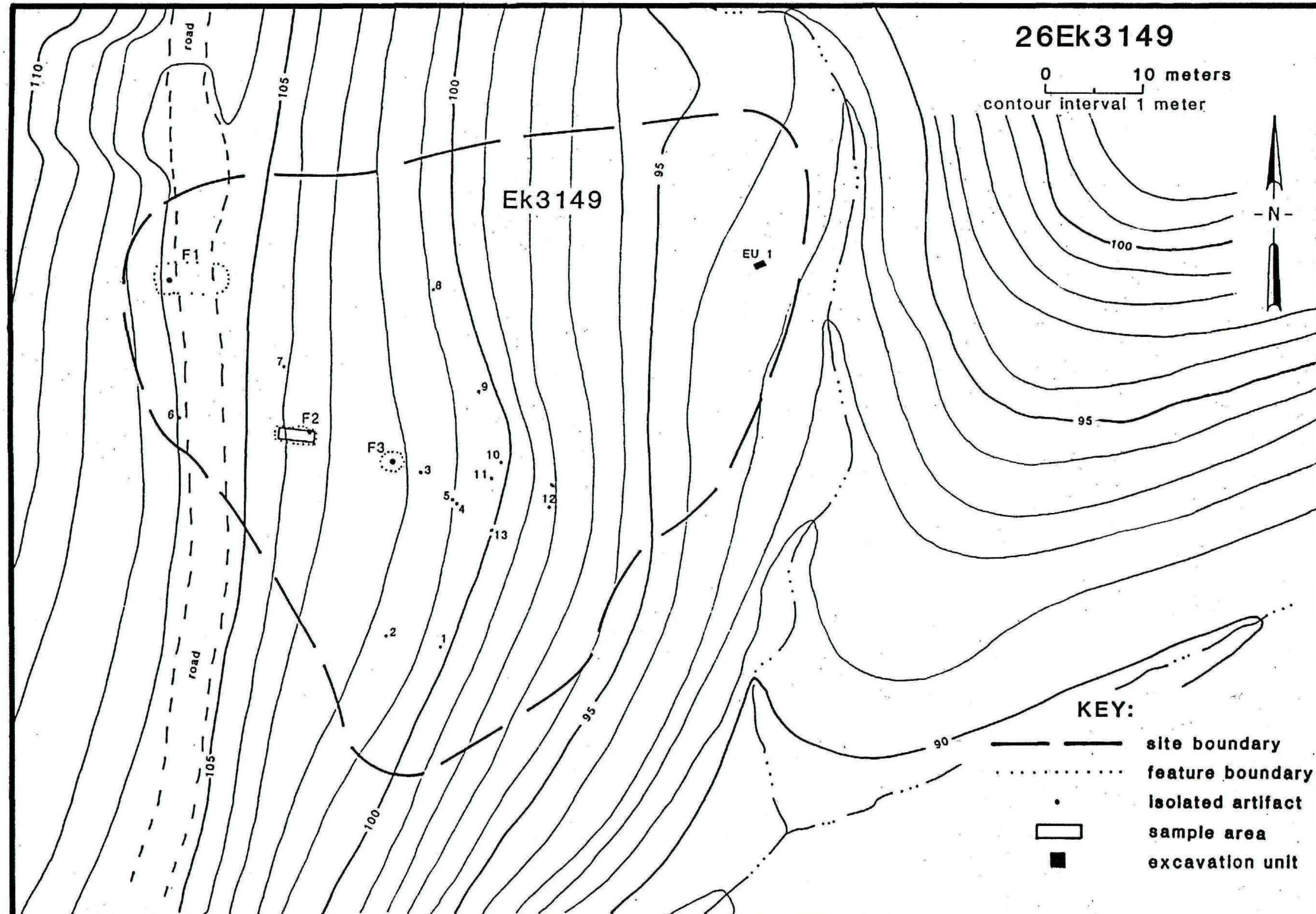
Site 26Ek3149

Site 26Ek3149 is located on a rocky east-facing slope above the confluence of Basalt Canyon and Little Antelope Creek (Figure 42). The focus of site use appears to have centered on the upper, western edge of the site, where two debitage features have been intersected by a road, and along a series of narrow bedrock benches near the center of the site, where several formed artifacts were scattered. Artifacts located on the bedrock benches (and plotted on Figure 43) include five rejected and/or broken Quarry Bifaces, three Small Bifaces that may be specialized tool preforms, an unclassifiable projectile point fragment, a spokeshave, and a scraper. Apparently, these benches served as convenient places to sit while maintaining equipment or conducting miscellaneous subsistence tasks.

Figure 42. 26Ek3149, site map.

Key to Artifact Plots

1. Quarry Biface
2. Small Biface
3. Point Fragment
4. Small Biface
5. Quarry Biface
6. Metate
7. Mano
8. Quarry Biface
9. Scraper
10. Spokeshave
11. Chopper
12. Quarry Biface
13. Quarry Biface


26Ek3149
0 10 meters
contour interval 1 meter
N
Ek3149
road
road
110
105
105
100
100
100
95
95
95
90
F1
F2
F3
EU 1
1
2
3
4
5
6
7
8
9
10
11
12
13
KEY:
site boundary
feature boundary
isolated artifact
sample area
excavation unit

The original contexts of three features recorded on the western edge of the site are obscured to some extent by road construction and slope movement. Feature 1 consists of a linear scatter (5 m by 11 m) of about 300 large to medium sized biface reduction flakes; one Stage I Quarry Biface fragment was recovered. Feature 3 is a small (4 m^2) concentration (< 50 items per m^2) composed exclusively of biface thinning flakes. Feature 2 consists of a narrow, linear debitage scatter (1 by 4 m) extending downslope below the roadcut. Small pieces of fire-cracked rock were observed in the scatter and the feature was selected for systematic sampling. Debitage totaled 313 opalite items composed of 88.8% small flakes (average weight = 0.9 g) and 11.2% shatter (average weight = 4.7 g). In addition to two Quarry Bifaces, several hunting and general maintenance tools were recovered: one Small Biface, three scrapers, and two small projectile point fragments. A mano located nearby, and a metate found on the upper edge of the roadcut, suggest a campsite locus upslope of our collection units has been cut by the road (see Figure 43).

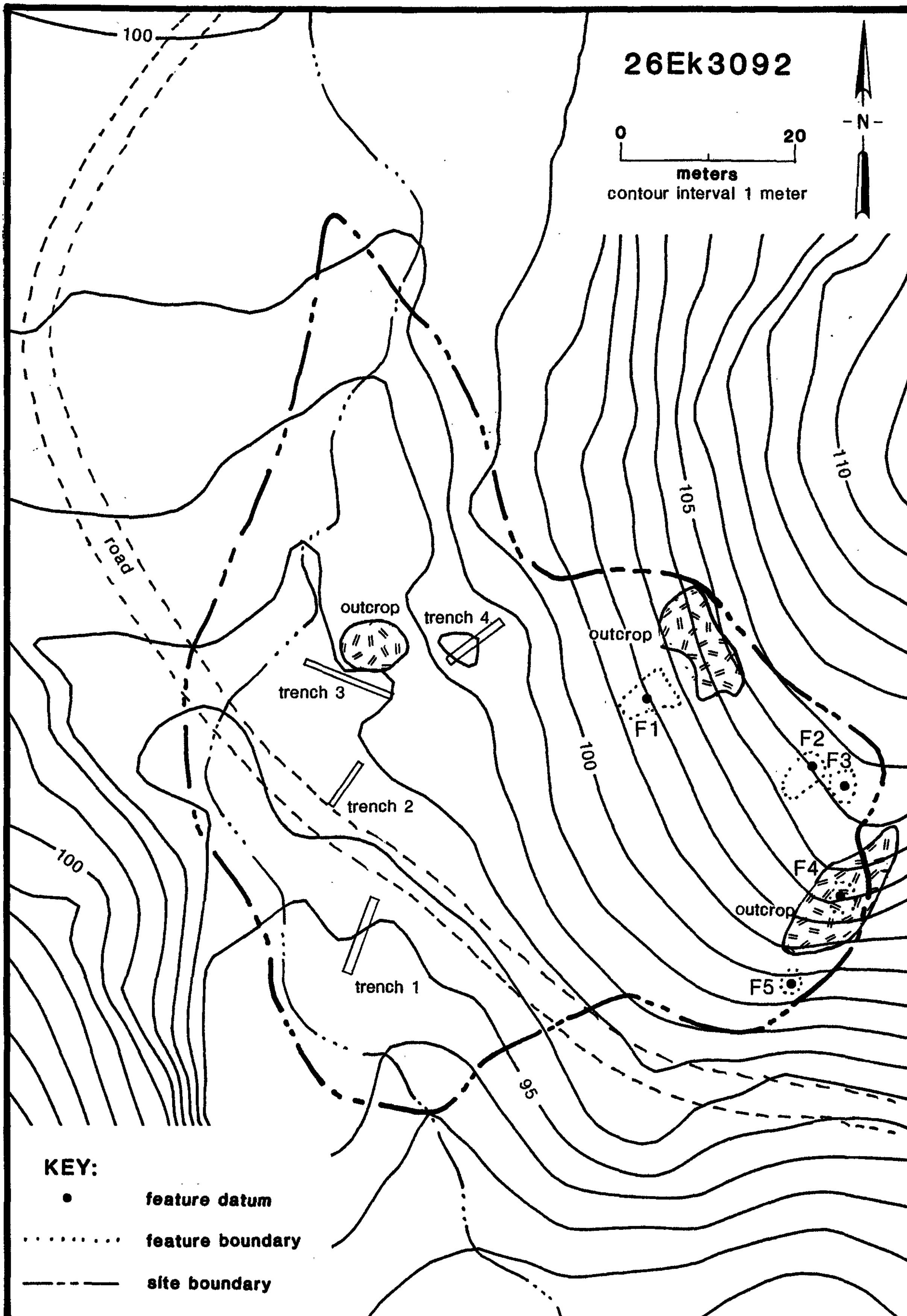
Near-surface bedrock (and road disturbance) offered little promise for subsurface explorations over the main portion of the site, but tests were conducted along a narrow streamside terrace to verify its recent formation. A 50 cm by 1 m excavation unit (EU1) probed deposits to a depth of 50 cm below surface; materials were screened though 1/8 in. mesh. A biface fragment and perforating tool were found in the upper 10 cm where debitage was most abundant (Table 54). Flakes are consistently small in size throughout all levels and decrease in frequency with depth, suggesting that cultural materials have been worked downward into the profile by bioturbation.

Table 54. Artifact Collections from EU1, Site 26Ek3149.

Depth	OPALITE DEBITAGE Flakes		Shatter		
(cm BS)	(n)	(Av Wt)	(n)	(Av Wt)	OTHER ARTIFACTS
0-10	72	0.7	9	15.0	Perforator, Biface
10-20	51	0.8	2	19.8	none
20-30	43	0.8	3	4.7	none
30-40	17	0.7	1	0.4	none
40-50	8	2.7	4	1.1	none

Severe rodent turbation was evident as numerous mottles throughout the deposit, and badger burrows pocket the extent of the terrace. The terrace serves as the modern floodplain during high energy flows and offers little opportunity to preserve a clear record of its prehistoric uses.

Figure 43. 26Ek3092, site map.


26Ek3092
0
20
meters
contour interval 1 meter
N
100
110
105
100
95
100
road
outcrop
trench 4
outcrop
trench 3
trench 2
trench 1
F1
F2
F3
F4
outcrop
F5
KEY:
feature datum
feature boundary
site boundary

In summary, the diversity of artifact types, but small numbers of each, suggest a range of rather ephemeral subsistence-related activities were conducted at site 26Ek3149. The distribution of groundstone around Feature 2 where fire-cracked rocks were found suggests this was a small campsite locus prior to its disturbance by the road. The light density of surface materials outside of the feature loci suggest a long period of exposure and several episodes of brief use at various times.

26Ek3092

Site 26Ek3092 is located on a series of low stream terraces at a sharp bend in Basalt Canyon (see Figure 43). The terraces rise about 4 m above the channel on its north side and extend for a maximum distance of 30 m to the steep slopes of Red Hill.

When the site was recorded in November 1987, a small scatter of reduction flakes was noted next to a large flat boulder and the site was classified as a small reduction station. Testing located five additional reduction scatters on the slopes above the terrace and several previously unnoticed formed tools. Rodents were active throughout the spring test investigations and flakes seen in their burrow tailings suggested of buried cultural material.

Testing opened long backhoe trench exposures across the terraces and controlled hand excavation recovered systematic samples of cultural materials. Trench 1 was located in the lowest terrace, close to the present streambed, while Trench 2 was placed in the center of the widest and flattest terrace. Trench 3 was situated along the edge of a large flat boulder and Trench 4 extended into the base of the colluvial slope edging the site. Three 1 by 1 m excavation units were used to recover a sample of the cultural materials in trenches 1 through 3. These were located so as to intersect possible cultural surfaces marked by flake and pebble lines observed in wall profiles.

Terrace Stratigraphy

Test excavations indicate that cultural materials are present in stratified alluvial deposits to about 90 cm below the surfaces of the terraces. Analysis of the trench profiles suggests that there have been at least four major episodes of terrace-building deposition at the site. Strata relating to each terrace are grouped into four time-stratigraphic horizons that are correlated tentatively across trenches 1 through 3. However, the trenches were not connected physically and correlations between depositional horizons across the site are based on soil color, texture, structure, relative position, and artifact content. In addition, a pedogenic unit, the A soil horizon, is present on all surfaces across the site.

Trench 4, located at the base of the steep slopes of Red Hill, exposed deposits of colluvial origin and without stratigraphic definition. The colluvium consists of at least 1.8 m of reddish brown, gravelly silt loam that slightly increases in chroma with depth. Some pebble lines can be traced for a few meters, but there is no difference in the sediments above or below such lines. Toward the west end of the trench, at the toe of the slope, we observed a recent depositional sequence that probably represents a common mode of deposition. A gray humic horizon about 5 cm thick containing charcoal and burned roots is buried by a layer of reddish silt that thickens downslope. These are overlain by the present brown A horizon similar to that found elsewhere on the site. This suggests that a recent wildfire denuded the slopes above, allowing reddish silty sediment to be washed down and bury the old A horizon and roots of the burned vegetation it once supported.

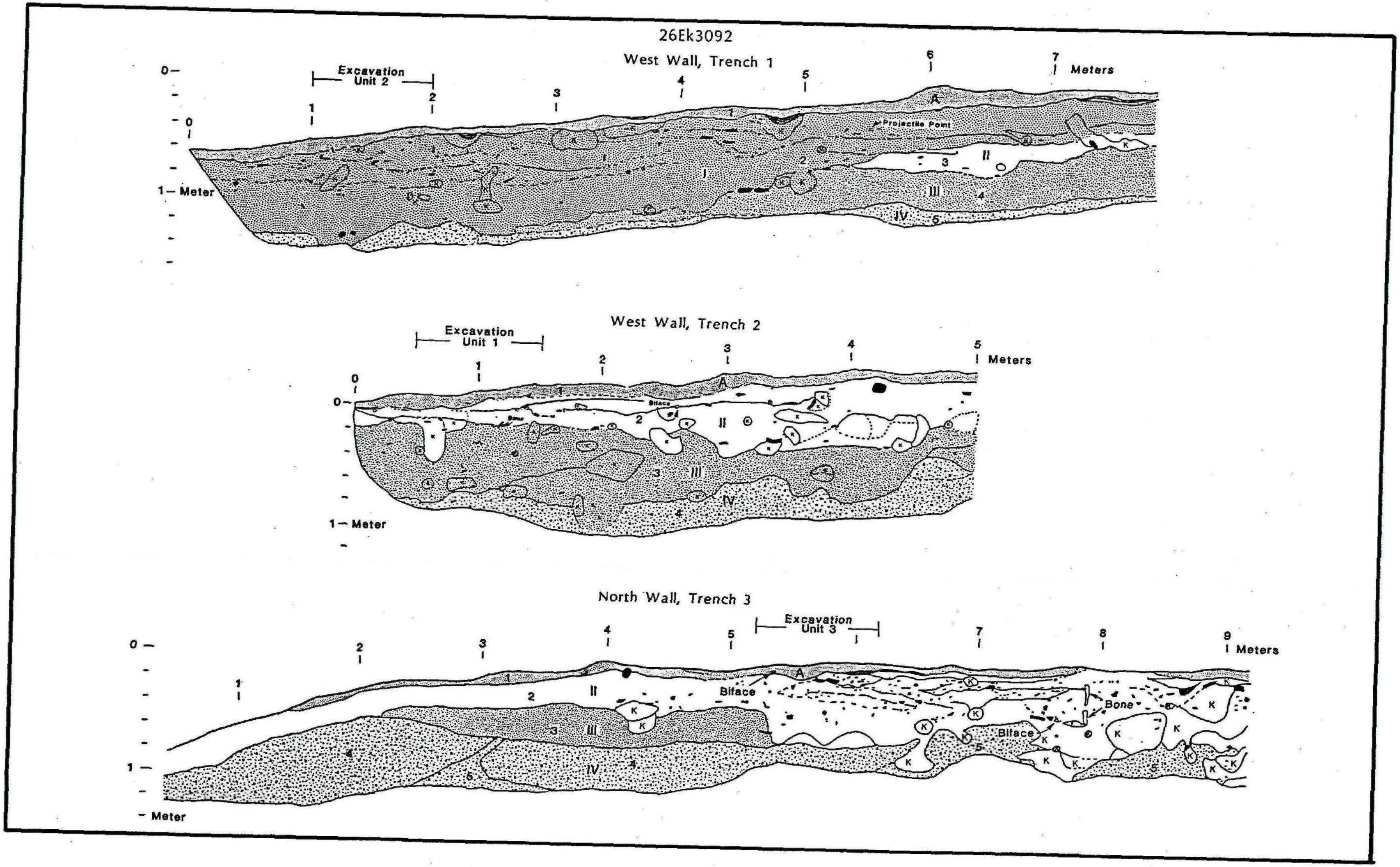
The stratigraphic units observed in each terrace trench were numbered consecutively from the top to the bottom of the profile (Figure 44). Since the number of stratigraphic units varies from trench to trench, this means that unit numbers may or may not refer to the same stratum from trench to trench. However, tentative correlations are made on the basis of time-stratigraphic horizons (also numbered from the surface down), referring as much as possible to the deposits of a particular stream terrace. The relationships between terrace stratigraphic units and horizons are summarized in Table 55.

Table 55. Stratigraphic Units and Horizons by Trench.

	Stratigraphic Units		
	Trench 1	Trench 2	Trench 3
Horizon			
(A)	A	A	A
I	1	1	1
II	2	-	-
III	3	2	2
IV	4	3	3

Horizon IV, the lowest strata revealed in all three terrace backhoe trenches, is dark reddish brown (5YR 3/2-3/4) clay with varying amounts of sand, gravel and cobbles. Because of their low position in the stratigraphic column, sediments of this horizon are poorly observed and not well understood. Some of this sediment is probably colluvial, similar to the reddish, altered soil observed in road cuts to mantle Red Hill and some adjacent ridges, while other deposits are alluvial stream gravels. For instance, the lowest strata in Trenches 1 and 2 are stream deposits. However, at Trench 3, gravels of a filled

Figure 44. 26Ek3092, Trenches 1, 2, and 3.


26Ek3092
West Wall, Trench 1
Excavation Unit 2
Meters
1 — Meter
Projectile Point
West Wall, Trench 2
Excavation Unit 1
Meters
1 — Meter
Biface
North Wall, Trench 3
Excavation Unit 3
Meters
Biface
Bone
Meter

stream channel are inset into loam or silt loam. Both the stream gravels and loam are tentatively assigned to Horizon IV. Artifacts were not observed in sediments of Horizon IV, except in krotovinas where they could have been introduced through bioturbation. The age of Horizon IV is, therefore, unknown.

In trenches 1 and 3, Horizon III is comprised of a single stratigraphic unit, dark reddish brown (5YR 3/2-3/3) loam to sandy loam. At the north end of Trench I, this sediment is 40 cm thick over the cobbly clay of Horizon IV. In Trench 2, up to 80 cm of these sediments are inset into the cobbly clay of Horizon IV and partially overlie it toward the north. In Trench 3, a lens of dark brown cobbly loam overlies dark reddish brown stream gravels. Since the gravels appear to be Horizon IV, we tentatively assign the cobbly loam to Horizon III.

Both the loam in Trench 2 and the cobbly loam in Trench 3 have subangular structure; abundant mottles and krotovina in Trench 2 show these deposits to be highly bioturbated. Excavation Unit 1 at Trench 2 recovered cultural bone and abundant artifacts from Horizon III. A later mid-Holocene age for the Horizon is suggested by an obsidian projectile point recovered from near the bottom of the loam in Trench 2 (80 to 90 cm BS), either a Gatecliff Split-stem (3000 - 1300 B.C.) or a reworked Elko Series (1300 B.C. - A.D. 500).

Sediments of Horizon II are dark reddish brown (5YR 3-2.5/2) loam to sandy loam. These deposits overlie Horizon III loam in the north end of Trench 1, and throughout Trench 2 where they are up to 50 cm thick. At Trench 3, they overlie and are partially inset into the cobbly loam of Horizon III. Horizon II deposits contain abundant artifacts, including cultural bone and Fremont pottery. The latter suggests an age range for Horizon II between A.D. 500 and 1450. Surfaces defined by flake lines are commonly observed; some of these, particularly at Trench 3, may define cultural features.

Sediments of Horizon I are very dark brown (10YR 2/2) sandy loam. Observed only in Trench I, deposits of Horizon I form the lowest and most recent stream terrace, inset into and truncating all of the older sediments described above. Artifacts are abundant in Horizon I, including Desert Side-Notched projectile points, in use between about A.D. 1000 to 1850. As in Horizon II deposits, flake and pebble lines defining surfaces are common.

The present A horizon on all the terraces is very dark brown (10YR 2/2) sandy loam. Within the A horizon, and at the contact between it and Horizon I, are basin-shaped lenses of charcoal. These appear to be rootballs of Great Basin rye grass burned during a recent wildfire.

Subsurface Artifact Distributions

Tests recovered 29,135 debitage items and 117 formed artifacts, most of which were found in the three subsurface test units (Table 56). This constitutes a rather large collection considering the small volume of sediment excavated ($2.3\ m^3$). The assemblage reflects primarily toolstone reduction, but also includes small numbers of expedient flake tools, perforators, and several projectile points.

Classifiable projectile points (after Thomas 1981) include three Desert Side-notched and one reworked Gatecliff Split Stem suggesting a possible range of occupation from 3000 B.C. to historic times.

Unique among sites tested in the USX-West project area was the recovery of four Fremont Great Salt Lake Gray pottery sherds (Madsen 1977:19) from the upper 20 cm in Trench 3. The sherds are very thin (mean thickness of 3.8 mm) and have corrugated exterior surfaces created by unobliterated horizontal coils. One sherd (specimen 2041-14) is a neck portion from a wide-mouthed jar with an outcurved, flared mouth; such jars generally are considered to be cooking pots (Madsen 1977). Great Salt Lake Gray is the principal pottery type for the Fremont Great Salt Lake variant, centered around the Great Salt Lake, western Utah; the type dates between A.D. 400 and 1350 (Madsen 1977:19). The four sherds are interesting finds as corrugation as a decorative technique is not mentioned as a variety of Great Salt Lake (Madsen 1977). Corrugated wares apparently are common only in the Parowan Fremont variant of southwestern Utah; here, they date to between A.D. 1100 and 1200 (Madsen 1977:9).

Faunal materials recovered during excavation include a wide range of small rodents that likely are intrusive, some rabbit-sized specimens that may be prehistoric food residue, and fragments of large artiodactyls that likely were consumed by prehistoric residents at the site (Table 57). Bighorn sheep are represented by both adult and milk teeth and indicate at least two different individuals. A large, thick bone specimen that may be bison was found in the level containing Fremont pottery in EU3. Given bioturbation, this could be cow rather than bison; however, the numbers of rabbit-sized specimens and the occurrence of large mammals such as bighorn sheep in the same unit, suggest that the faunal collection is, in part, the residue of prehistoric cooking.

The large flat boulder adjacent to Trench 3 likely provided a convenient locus for reducing toolstone, preparing and cooking food, and sleeping. Faunal remains and Fremont pottery from a cultural surface located at about 30 cm BS in Trench 3 suggest that such an activity area is located here. Though none were exposed in tests, residential features such as structures, hearths, and refuse disposal areas are thought to be present in this portion of the site.

Table 56. Vertical Artifact Distributions, Site 26Ek3092.

		ARTIFACT CLASSES													DEBITAGE			
Trench/	Depth		Reduction				Points		Processing						Opalite		Other	
Unit No.	(cm BS)	HM	CR	QB	SB	IB	PT	FG	SC	PG	MP	OT	CE	Total	Flakes	Shatter	Debitage	Total
1/EU2	0-10	-	-	2	-	-	-	-	-	-	-	-	-	2	677	19	5	701
	10-20	-	-	1	1	-	-	-	1	-	1	-	-	4	502	15	1	518
	20-30	-	-	-	-	-	-	-	-	-	-	-	-	0	359	14	3	376
	30-40	-	-	-	-	-	1	1	1	-	-	-	-	3	341	6	2	349
	40-50	-	-	1	1	-	-	-	-	-	-	-	-	2	183	7	-	190
	50-60	-	-	-	1	1	-	-	-	-	-	-	-	2	147	3	1	151
	60-70	-	-	-	-	-	-	-	-	-	-	-	-	0	50	1	-	51
	Subtotal	0	0	4	3	1	1	1	2	-	1	0	0	13	2,259	65	12	2,336
2/EU1	0-10	-	-	3	-	2	-	-	3	-	1	-	-	9	2,672	2	17	2,691
	10-20	-	-	1	-	-	-	1	-	-	-	1	-	3	3,473	25	11	3,509
	20-30	-	1	1	1	-	-	-	-	-	-	-	-	3	1,160	8	3	1,171
	30-40	-	-	1	1	-	-	-	-	-	-	-	-	2	779	6	1	786
	40-50	-	1	-	1	-	-	-	1	-	-	-	-	3	410	-	2	412
	50-60	-	-	1	-	-	-	-	-	1	-	-	-	2	351	7	6	364
	60-70	-	-	1	-	1	-	-	-	-	-	-	-	2	346	5	6	357
	70-80	-	1	1	-	2	-	-	1	-	-	-	-	5	462	3	6	471
	80-90	-	-	-	1	-	1	-	-	-	-	-	-	2	225	4	-	229
	Subtotal	0	3	9	4	5	1	1	5	1	1	1	0	31	9,878	60	52	9,990
3/EU3	0-10	1	4	2	-	-	-	-	8	-	-	-	-	15	3,660	94	703	4,457
	10-20	-	-	4	-	-	1	1	1	-	-	-	2	9	7,111	216	1,316	8,643
	20-30	-	-	-	-	-	-	-	-	-	-	-	2	2	1,814	75	91	1,980
	30-40	-	-	-	-	1	-	-	-	-	-	-	-	1	347	28	20	395
	40-50	-	-	-	-	2	-	-	1	-	1	-	-	4	509	44	33	586
	50-60	-	-	1	-	-	-	-	1	-	-	1	-	3	444	27	40	511
	60-70	-	-	-	-	-	-	-	-	-	-	-	-	0	209	4	24	237
	Subtotal	1	4	7	0	3	1	1	11	0	1	1	4	34	14,094	488	2,227	16,809

Key:

Reduction Tools and Artifacts
HM = Hammerstones
CR = Cores
QB = Quarry Bifaces
SB = Small Bifaces
IB = Indeter Biface Fragments

Maintenance/Processing
SC = Scrapers and Spokeshaves
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
OT = Other Simple Flake Tools
CE = Ceramic Fragments

Projectile Points
PT = Classifiable Points
FG = Unclassifiable/Fragments

Table 57. Faunal Materials from 26Ek3092 Excavation Units.

Level	*Sylvilagus* sp.	*Sylvilagus idahoensis*	*Lepus* sp.	*Marmota flaviventris*	*Spermophilus* sp.	*Thomomys talpoides*	*Perognathus* sp.	*Peromyscus* sp.	*Neotoma* sp.	*Microtus* sp.	*Taxidea taxus*	cf. *Ovis Canadensis*	*Ovis Canadensis*	*Bos* or *Bison*	Artiodactyl	I - II	III	IV	V	V - VI	Unidentified	Total
EU2 (Trench 1)																						
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-	4
3	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	7	-	-	1	-	-	10
4	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	7	-	-	1	-	-	9
5	-	-	-	-	6	1	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-	23
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2
Subtotal	-	-	-	-	6	1	-	-	-	1	-	-	2	-	-	36	1	-	2	-	-	49
EU1 (Trench 2)																						
1	-	-	1	-	1	1	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	6
2	-	-	-	2	16	-	1	-	-	-	-	-	-	-	1	52	2	-	1	-	-	75
3	-	-	-	-	16	-	3	-	1	-	1	-	-	-	4	88	22	9	4	-	-	148
4	3	-	-	-	2	-	1	-	-	-	-	-	1	-	2	23	3	-	1	-	-	36
5	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	2	3	2	2	-	-	11
6	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	10	2	-	-	1	-	16
7	1	-	-	-	2	1	-	-	1	-	-	-	-	-	-	8	1	-	3	-	-	17
8	1	1	-	-	3	-	-	-	-	-	-	-	-	-	-	27	-	-	1	-	1	34
9	-	-	-	-	4	-	-	1	1	-	-	-	-	-	-	16	2	-	-	-	1	25
Subtotal	6	1	1	2	46	2	5	1	3	-	1	-	2	-	8	221	36	11	12	1	9	368
EU3 (Trench 3)																						
2	-	-	1	-	1	-	1	-	-	-	-	-	-	-	-	6	2	-	-	-	1	12
3	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	4	-	-	7
5	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	4
Subtotal	-	-	1	-	1	-	1	-	-	-	-	1	-	1	-	13	2	-	4	-	1	25
GRAND TOTAL	6	1	2	2	53	3	6	1	3	1	1	1	4	1	8	270	39	11	18	1	9	442

Summary

Site 26Ek3092 is unique in the USX-West project area in that it contains stratified alluvial deposits with potential for buried residential features. The site appears to have served as a campsite locus during toolstone forays dating from sometime about 3000 B.C. to A.D. 1850; its deposits preserve direct evidence of subsistence pursuits and food products. Information from the site can address research questions associated with the economics of toolstone procurement as well as contribute to understanding the chronology of quarry use.

The remaining eight are characterized by small artifact assemblages and either eroded or disturbed site contexts. Test *assessments indicate that none of these sites contain* significant data relevant to identified research issues (Elston 1988).

Chapter 12. BITTERROOT RIDGE SITES

by Elizabeth E. Budy

Bitterroot Ridge comprises a series of narrow, southeast-sloping finger ridges cut by steep intermittent drainages (Figure 45). Basalt Canyon forms the northern margin of the complex and defines the south margin of the toolstone source area. The archaeological character of this area is conditioned by the absence of locally outcropping opalite, and sites here tend to be quite discrete without intervening background scatters.

Archaeological sites are located on narrow ridge tops or slopes and cultural materials are limited to surface (or near surface) colluvial deposits overlying shallow bedrock. Tabular andesitic basalt is exposed at the surface in places along the knoll and forms prominent talus stripes along steep, exposed slopes. Thin soils are reddish-brown sandy silts and silty loams overlying andesitic basalt. The absence of permanent water near the sites likely constrained use of these sites to short term occupation. Ephemeral pools are found in Basalt Canyon, but no permanent water is located along the ridgeline complex southwest of the canyon.

Sparse covers of low sage and grasses are characteristic on ridge tops; clumps of big sage edge drainage channels or grow in saddles where deeper soils have accumulated. Several plants with edible tubers are moderately abundant on thin soils edging ridgetops, including onion, sego lily, and bitterroot. It is thought that these, notably bitterroot, may have provided root crops for local use during prehistoric times and, together with grasses, provide explanation for the recovery of diverse types of grinding stones found at several sites.

Descriptive Site Summary

Ten sites are located on the finger ridges composing the Bitterroot Ridge Complex (Table 58): eight were tested and include three reduction stations, one reduction complex, and four reduction/residential complexes.

The four reduction sites are located on small benches at the edge of an elevated knoll on the upper, western perimeter of the project area. The three small reduction stations cover no more than 200 m^2 each and each contained a discrete debitage concentration defined as a feature. Reduction complex site 26Ek3093 encompasses a sparse debitage scatter (1.875 m^2 in area) surrounding six discrete reduction features. Given their elevated position relative to the drainages of Basalt Canyon and Little Antelope Creek, these sites provide convenient perches for viewing the surrounding countryside and may be so located relative to observing game movement.

Figure 45. Topographic setting, Bitterroot Ridge sites.

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IN NEVADA

Note:

One or more pages have been removed from this part of the report due to sensitivity of specific archaeological site location information. Qualified persons may contact the Nevada Bureau of Land Management, Elko Field Office, to inquire about obtaining additional information.

Table 58. Descriptive Summary, Bitterroot Ridge Sites.

Site Number	Type	Features (n)	Maximum Site Area (sq m)
26Ek3093	Reduction Complex	6	1,875
26Ek3094	Isolated Artifact [NOT TESTED]	-	N/A
26Ek3095	Reduction/Residential Complex	25	15,000
26Ek3109	Undifferentiated Scatter [NOT TESTED]	-	2,700
26Ek3114	Reduction Station	1	100
26Ek3115	Reduction Station	1	100
26Ek3116	Reduction Station	1	200
26Ek3160	Reduction/Residential Complex	23	46,000
26Ek3165	Reduction/Residential Complex	2	4,500
26Ek3271	Reduction/Residential Complex	22	19,500

Four sites (26Ek3160, 26Ek3165, 26Ek3095, and 26Ek3271) in the Bitterroot Ridge Complex contained diverse subsistence-related tools intermixed in large reduction scatters. Located beyond the opalite source area, as demarcated on the southwest by Basalt Canyon, these sites are thought to represent repeatedly occupied reduction staging centers which sometimes served as short term campsites.

Except for site 26Ek3165, which is restricted to a small saddle (4,500 m^2 in area), the sites encompass large scatters (ranging from 15,000 to 46,000 m^2 in area) suggesting repeated uses of preferred locations. Within each large site are numbers of discrete artifact concentrations, each apparently a focus for a variety of reduction and subsistence-related activities, as well as dense, undifferentiated debitage and tool accumulations resulting from many different, but overlapping, uses. Recorded features primarily reflect thinning of large Quarry Bifaces, but various others contain, in addition, seed processing stones, stylized tools, pottery, and/or charcoal.

Testing Strategies

Since the Bitterroot Ridge sites are bedrock controlled and provide little opportunity for preserving buried cultural materials, assessment focused on defining surface artifact configurations; subsurface tests were limited to certain depositional contexts (Table 59).

Initially, close interval survey identified feature loci and located extra-feature artifacts for mapping and collection. At the three small reduction stations (26Ek3114, 26Ek3115, and 26Ek3116), feature concentrations were sampled by systematic surface skimming and all surrounding artifacts were point plotted and collected. Tests at reduction complex site 26Ek3093 sampled one (or 20%) of the total features identified.

Table 59. Summary of Testing Procedures, Bitterroot Ridge Sites.

Site Number	FEATURES RECORDED Total (n)	Sampled (n)	FEATURE CONTEXT Surface Skim Area (sq m)	Subsurface Excavation Volume (cu m)	NONFEATURE CONTEXT Surface Skim Area (sq m)	Subsurface Excavation Volume (cu m)	RECOVERED COLLECTIONS Debitage (n)	Formed Artifacts (n)
26Ek3093	6	1	49.00	0.10	-	-	2,598	56
26Ek3095	25	5	28.31	0.60	-	-	30,445	371
26Ek3114	1	1	10.00	-	-	-	4,281	20
26Ek3115	1	1	10.00	-	-	-	1,898	12
26Ek3116	1	1	12.00	-	-	-	2,492	31
26Ek3160	23	6	50.00	0.10	-	1.20	23,933	545
26Ek3165	2	2	16.00	-	-	0.25	4,125	41
26Ek3271	22	5	67.00	0.75	-	0.20	53,510	495

Surface artifact collection at the reduction/residential sites recovered large, diverse tool assemblages; some preserved in discrete features, many in undifferentiated scatters of debitage. Since these tools include stylized artifacts and subsistence-related tools, in addition to large numbers of Quarry Bifaces, attention focused subsequently on features possibly preserving evidence of discrete episodes of site use. Representative and/or unique features from each site were selected for systematic surface skimming. Potential hearths, visible as charcoal stains after surface skimming, were sampled by subsurface excavations. Subsurface tests at sites 26Ek3160, 26Ek3165, and 26Ek3271 also probed areas where deeper soils occurred to check for buried cultural remains.

Chronology

Several Bitterroot Ridge sites preserve charcoal from prehistoric fires which, in future investigations, may be appropriate for radiocarbon assay. At present, charcoal deposits are rendered suspect by their near-surface contexts, as in the instance of hearths identified at sites 26Ek3093 and 26Ek3095, and by the likely inclusion of material from wildfires which recently burned over these sites.

Obsidian is present in the Bitterroot Ridge sites, notably at the reduction/residential complexes, and future investigations may yield useful obsidian hydration dates. At this time, the chronology of site occupations depends on time-sensitive projectile points and pottery.

Time sensitive projectile points suggest occupation of the area from about 3000 B.C. to protohistoric times (Table 60), with most intensive use during the Late Archaic (after about A.D. 500). Rosegate Series points are most common and compose a large class at site 26Ek3271. Desert Side-notched and Cottonwood types also are common; these late points date discrete reduction features at sites 26Ek3114 and 26Ek3116 and campsite loci at sites 26Ek3095 and 26Ek3160. Elko Series points are relatively common only at site 26Ek3160, and this large site appears, from other evidence, to have been used more intensively over a longer period than other locations on Bitterroot Ridge.

Thirty-nine Shoshoni Brownware pottery fragments, all apparently from one vessel, were recovered from Feature 1 at site 26Ek3160. The pottery dates this feature between A.D. 1300 and 1850, and is the only instance of pottery found in the Bitterroot Ridge sites.

Table 60. Projectile Point Types from Bitterroot Ridge Sites.

Site Number	GSS	HBS	LSN	EAR	ECN	RSG	CTN	DSN	Other PPT	Other FRG	TOTAL
	Classifiable Types										
Reduction Sites											
26EK3093	-	-	1	-	-	-	-	-	1	-	2
26Ek3114	-	-	-	-	-	-	-	1	-	-	1
26Ek3115	-	-	-	-	-	-	-	-	-	-	0
26Ek3116	-	1	-	-	-	-	-	2	1	3	7
Reduction/ Residential Sites											
26Ek3095	2	-	-	-	1	2	2	2	3	2	14
26Ek3160	1	1	-	2	3	5	2	3	5	3	25
26Ek3165	-	-	-	-	-	-	-	-	-	2	2
26Ek3271	-	-	1	1	-	8	-	2	2	2	16
Total	3	2	2	3	4	15	4	10	12	12	67

Type Designations (after Thomas 1981)
GSS = Gatecliff Split Stem
HBS = Humboldt Series
LSN = Large Side-notched
EAR = Elko Earred
ECN = Elko Corner-notched
RSG = Rosegate Series
CTN = Cottonwood Series
DSN = Desert Side-notched

Other
PPT = Points Rejected by Thomas (1981) Key
FRG = Fragments

Assemblage Composition

Formed artifact collections from the Bitterroot Ridge sites include a diversity of stylized tools interspersed among reduction artifacts (Table 61). Quarry Bifaces are the largest

Table 61. Intersite Artifact Class Frequency Comparisons, Bitterroot Ridge Sites.

ARTIFACT CLASS	ARTIFACT FREQUENCY PER SITE: Reduction Sites				Reduction/Residential Complexes			
Lithic Processing/ Reduction Tools	26Ek3093	26Ek3114	26Ek3115	26Ek3116	26Ek3095	26Ek3160	26Ek3165	26Ek3271
Hammerstones	-	-	-	-	6	2	-	7
Scratched Stones	-	1	-	-	1	2	-	2
Other Percussion	1	-	-	-	1	2	-	8
Subtotal (%)	1(1.8)	1(5.0)	0(0)	0(0)	8(2.2)	6(1.1)	0(0)	17(3.4)
Reduction Artifacts								
Assayed Pieces	-	-	-	-	-	-	-	1
Cores	2	-	-	-	17	8	2	11
Quarry Bifaces	27	13	6	7	215	176	17	236
Preform Bifaces	5	-	-	-	6	16	2	12
Small Bifaces	6	1	1	1	56	169	6	85
Indeter. Bifaces	5	1	1	2	8	53	2	41
Subtotal (%)	45(80.4)	15(75.0)	8(66.7)	10(32.3)	302(81.4)	422(77.4)	29(70.7)	386(78.0)
Projectile Points								
Classifiable Types	1	1	-	3	9	17	-	12
Unclassifiable	1	-	-	4	5	8	2	4
Subtotal (%)	2(3.6)	1(5.0)	0(0)	7(22.6)	14(3.8)	25(4.6)	2(4.9)	16(3.2)
Maintenance and/or Processing Tools								
Scrapers	2	3	4	9	21	22	6	44
Knives	-	-	-	1	-	3	1	4
Gravers	1	-	-	2	1	3	-	5
Perforators	2	-	-	-	4	8	-	10
Spokeshaves	-	-	-	-	-	-	-	5
Multipurpose Flakes	1	-	-	1	4	1	-	2
Simple Flake Tools	-	-	-	1	2	2	-	-
Abraders	-	-	-	-	2	1	-	-
Planers	-	-	-	-	-	3	-	-
Subtotal (%)	6(10.7)	3(15.0)	4(33.4)	14(45.2)	34(9.2)	43(7.9)	7(17.1)	70(14.1)
Plant Processing								
Metates	1	-	-	-	9	3	3	2
Manos	-	-	-	-	1	3	-	2
Mortars	-	-	-	-	-	2	-	1
Pestles	-	-	-	-	1	1	-	1
Other	1	-	-	-	1	-	-	-
Subtotal (%)	2(3.6)	0(0)	0(0)	0(0)	12(3.2)	9(1.7)	3(7.3)	6(1.2)
Miscellaneous Artifacts								
Exotic/Decorated	-	-	-	-	1	1	-	-
Pottery	-	-	-	-	-	39	-	-
Subtotal (%)	0(0)	0(0)	0(0)	0(0)	1(0.3)	40(7.3)	0(0)	0(0)
Site Total	56	20	12	31	371	545	41	495

single class of artifacts recovered at any site and comprise more than 50% of several site assemblages; their frequency highlights the significance of this area as a biface staging center peripheral to the Tosawihi Quarries on the north. Small Bifaces, many of which appear to be directed toward tools such as drills, knives, scrapers, and, possibly, large dart point preforms, also are common at the large reduction/residential sites. At site 26Ek3160, these reduction forms are nearly as numerous as large Quarry Bifaces. Cores are constituent of most site assemblages, but compose a small percentage of the total reduction forms; it would appear that opalite toolstone material ordinarily arrived on these sites as bifacial roughouts. Coincident with the reduction debitage, is a small collection of specialized knapping tools such as hammerstones and "scratched stones" thought to have been used for preparing platforms.

Projectile points and Preform Bifaces are substantial constituents of site assemblages, present in the small reduction sites and moderately abundant in the large reduction/residential complexes. Scraping and perforating tools frequently are included in hunters' tool kits and may be used to maintain wooden or bone tools, prepare hides, and process meat, among other functions (Thomas 1983a, 1983b). A few of these tools, often in conjunction with points or preforms, commonly are found in discrete debitage concentrations suggesting toolstone reduction frequently was conducted in conjunction with hunting in the vicinity of Bitterroot Ridge.

Flaked stone maintenance and/or processing tools, some modified for hafting or otherwise stylized in outline shape, are most numerous and diverse at the large residential/ reduction complexes. Perforators include irregular flakes with bifacially modified points as well as drills with elongate tips and shaped bases thinned as if for hafting. Among scrapers, each manifesting use wear perpendicular to the edge, are both simple flake scrapers as well as carefully shaped end scrapers with thinned haft elements. A similar diversity of modified form is characteristic of the knives. Attention to controlled form reflects concern for having the right tool for the task at hand and signals a potentially wide range of activities conducted at these sites.

Groundstone artifacts, especially from the large site complexes, contribute to inferences of residential use. Compared to other functional tool types, groundstone composes only a small percentage and suggests no strong reliance on local plant foods. With one exception (an ignimbrite metate from site 26Ek3095), the seed grinding tools are made from locally available tuff/basalt or sandstone. Manos and pestle fragments tend to be carefully shaped, while mortars evidence only battered surfaces with slight or no development of concavities. The metates, on the other hand, reflect a range of use, from lightly ground and unshaped tablets to carefully modified metates with well developed grinding troughs. At sites 26Ek3095, 26Ek3160, and 26Ek3165, metates are found in discrete clusters of other tools and debitage and are thought to represent the loci of small family camps. This suggests that toolstone was procured during early summer foraging and these features may be evidence of an "embedded strategy" (Elston 1988).

Reduction Sites: Context and Structure

Reduction complex site 26Ek3093 includes six feature concentrations all of which are situated similarly along the extreme east edge of a knoll top (Figure 46). The features reflect biface production, with some limited core reduction, and vary in size from 3 to 180 m^2 (Table 62). These features tend to be perched at the edge of the knoll and their size may in part be conditioned by slope and time elapsed since their creation. For example, all but Feature 5 are confined mostly to relatively flat ground while Feature 5, covering the largest area, composes two lobes of debitage lying on a (> 20%) slope. A Large Side-notched projectile point, a type which generally dates to before A.D. 1300 (Thomas 1981), also suggests this feature has been exposed to bioturbation and slope wash for more than 600 years.

Table 62. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Reduction Complex Site 26Ek3093.

FEATURE		Total	ARTIFACT CLASSES												
		Area	Reduction						Points		Processing				
No.	Type	(sq m)	OP	CR	QB	PB	SB	IB	PT	FG	SC	PG	MP	GS	Total
1	Biface Reduction	28	-	-	3	-	-	-	-	-	-	-	-	-	3
2	Core & Biface	8	-	-	-	-	-	-	-	-	-	-	-	-	0
3	Biface Reduction	60	-	-	2	1	-	-	-	-	-	-	-	-	3
4	Complex Locus: Sample Feature	49	-	-	12	4	4	5	-	-	1	2	1	1	30
5	Core and Biface	180	1	2	7	-	1	-	2	-	1	1	-	-	15
6	Biface Reduction	3	-	-	-	-	-	-	-	-	-	-	-	-	0
-	Extra-Feature	N/A	-	-	3	-	1	-	-	-	-	-	-	1	5
															56

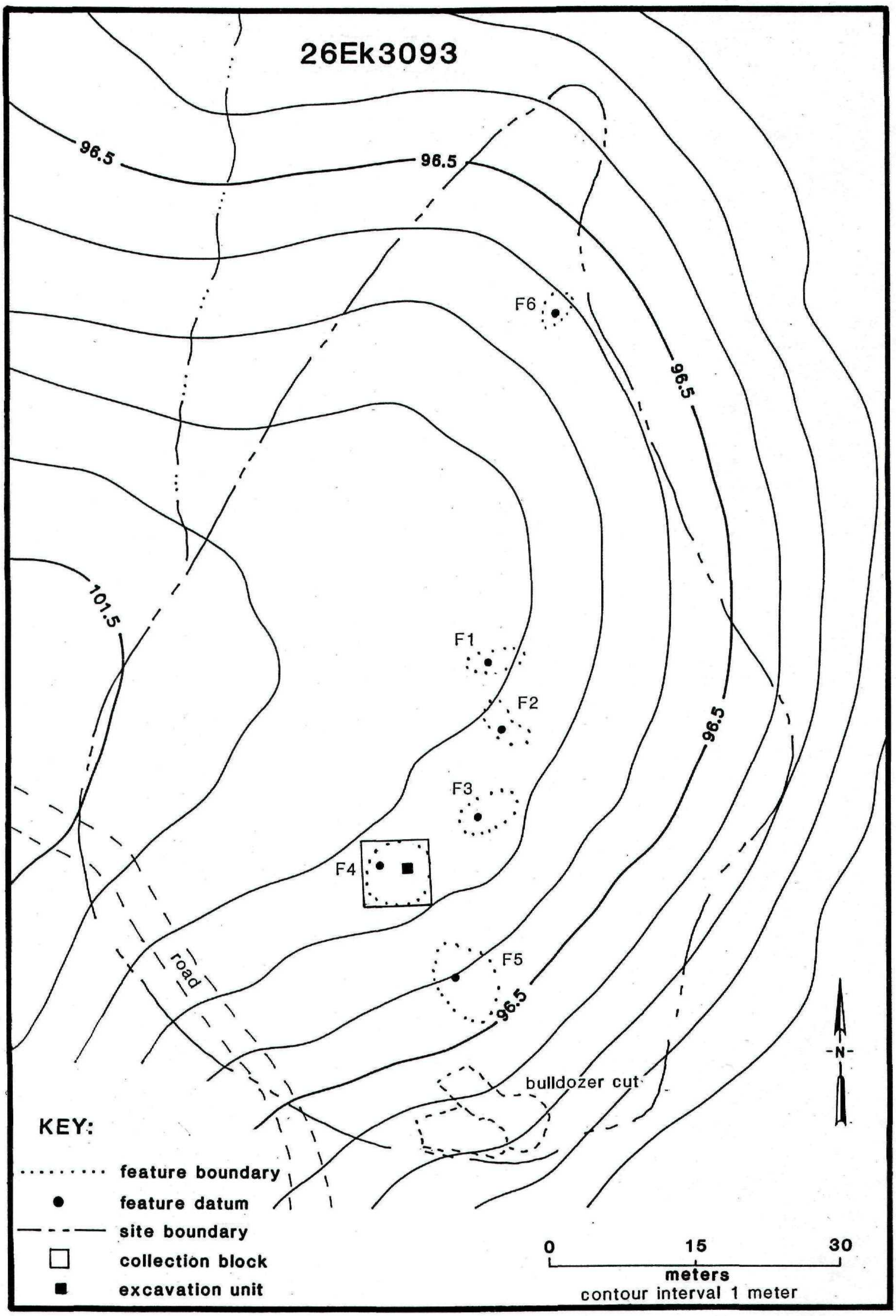
Key to Artifact Classes

Reduction Tools and Artifacts
SS = Scratched Stone
CR = Core
OP = Other Percussion
QB = Quarry Bifaces
PB = Preform Bifaces
SB = Small Bifaces
IB = Indeter Biface Fragments

Maintenance/Processing
SC = Scrapers and Spokeshaves
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
GS = Groundstone Fragment

Projectile Points
PT = Classifiable Points
FG = Unclassifiable/ Fragments

Figure 46. 26Ek3093, site map.


26Ek3093
96.5
96.5
96.5
96.5
96.5
101.5
F1
F2
F3
F4
F5
F6
road
bulldozer cut
N
KEY:
feature boundary
feature datum
site boundary
collection block
excavation unit
0
15
30
meters
contour interval 1 meter

Similar in the kinds of associated artifacts, but situated on relatively flat ground (4% to 9% slope), Feature 4 was selected for complete surface collection. A 7 by 7 m grid was laid over the feature so as to totally enclose the scatter. Recovered surface debitage totalled 2528 items and was composed largely of opalite flakes (98.3%) with small quantities of opalite shatter (0.9%) and obsidian flakes (0.7%) (Table 63). Subsurface tests (screened through 1/8 in. mesh) yielded only 70 debitage items from 0.10 m^3 of sediment.

Table 63. Debitage from Sample Feature 4, Site 26Ek3093.

Collection Type	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
Surface	2,486	98.3	1.1	24	0.9	2.3	18	0.7	2,528
Subsurface	67	95.7	3.2	2	2.9	4.6	1	1.4	70

Prior to collection, Feature 4 was visible as a light density scatter surrounding two small concentrations of debitage. Materials appeared to be moving along the gently sloping ground to the southeast of the lobes and rejected bifaces were clustered along the lower edge of the scatter (Figure 47a). After surface skimming, an irregular ashy stain was exposed; a 50 cm by 1 m excavation unit was placed in the southeast portion of the stain so as to intersect the darkest charcoal concentration. Subtle differences in degree of soil compaction were observed during excavation with looser sediments filling a small pit observable in profile above a pebble line (Figure 47b). The ashy feature appears to be a small unlined hearth deflated by exposure at the surface; lack of soil oxidation and limited amounts of charcoal contained within it suggests a single, brief episode of use.

The distribution of artifacts in this features suggests a knapper was positioned central to, and slightly above, concentrations A and B (in the flattest portion of the feature) and produced a pile of small flakes at lobe A (n = 344; mean weight = 0.5 g) and another pile of larger flakes at Lobe B (n = 306; mean weight = 1.6 g). Debitage progressively diminishes in frequency with distance along the slope while discarded Quarry Bifaces tend to be concentrated the lower edge of the scatter in an apparent toss zone. Having generated the reduction scatter which defines our feature while situated about two meters from the hearth, the knapper seems to have moved in closer to the fire (where a scraper, a multipurpose tool, two perforators, and a point preform were found) to conduct some small maintenance or processing tasks.

Figure 47a. Plan of Feature 4, site 26Ek3093.

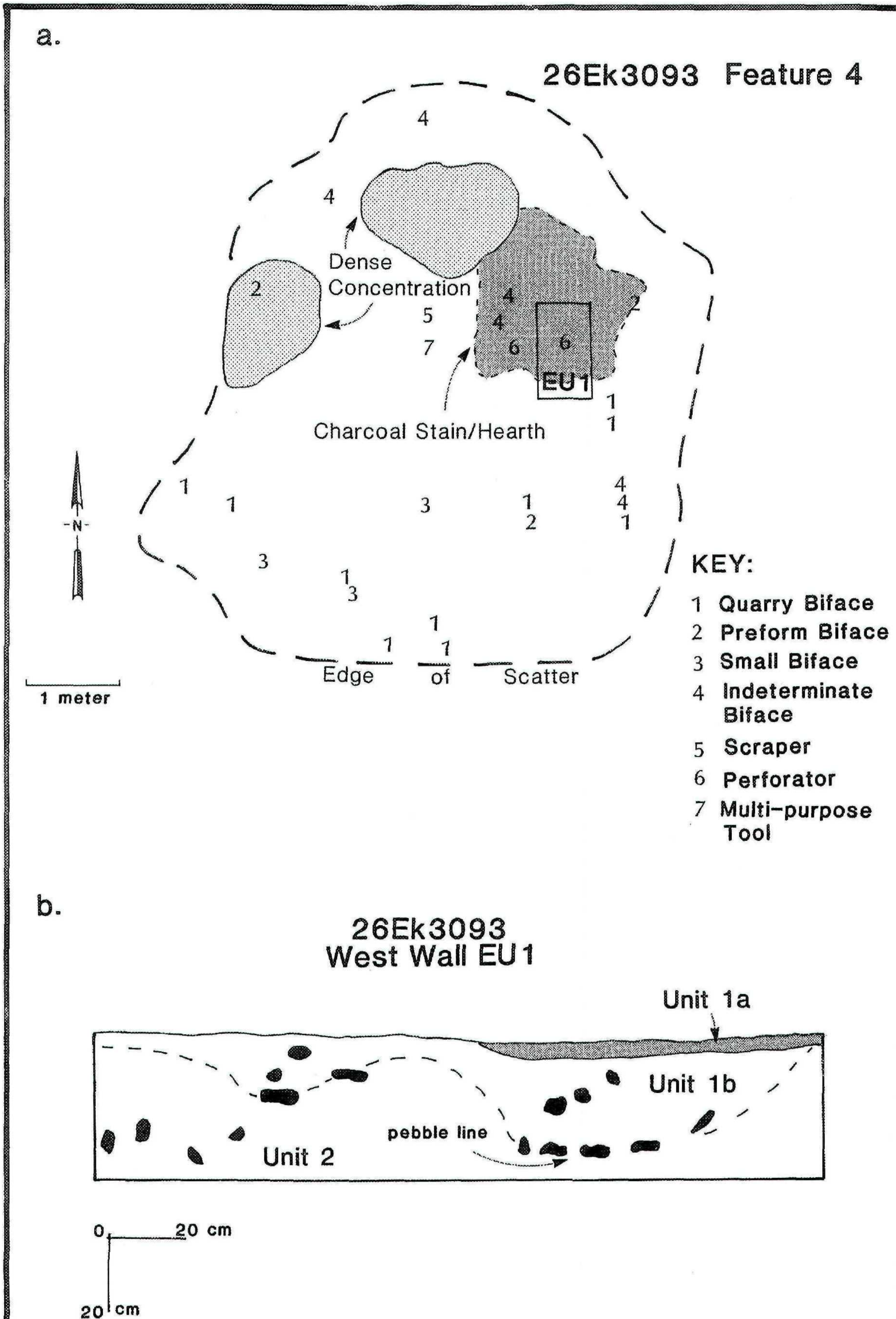
Figure 47b. Profile of hearth in west wall EU1, site 26Ek3093.

Key:

Unit 1a: ashy charcoal stain; dark grey (5YR 4/4) silt loam.

Unit 1b: loose upper layer; reddish brown (2.5YR 4/4) silt loam.

Unit 2: compact lower layer; reddish brown (2.5YR 2/5) silty clay loam.


a.
26Ek3093 Feature 4
Dense Concentration
Charcoal Stain/Hearth
EU1
Edge of Scatter
N
1 meter
KEY:
1 Quarry Biface
2 Preform Biface
3 Small Biface
4 Indeterminate Biface
5 Scraper
6 Perforator
7 Multi-purpose Tool
b.
26Ek3093
West Wall EU1
Unit 1a
Unit 1b
Unit 2
pebble line
0 20 cm
20 cm

Each of the isolated reduction sites (26Ek3114, 26Ek3115, and 26Ek3116) includes one small (<16 m^2) biface reduction feature, two of which are dated after A.D.1300 by Desert Side-notched projectile points. Though all appear to reflect brief biface production episodes, there are differences in relative debitage densities and in the quantities and kinds of other artifacts associated (Table 64).

Table 64. Artifact Classes Recovered from Sample Features and Extra-Feature Contexts at Small Reduction Sites, Bitterroot Ridge Complex.

Site Number	Fea No.	Type	SS	QB	PB	SB	IB	PT	FG	SC	KN	PG	MP	OT	Total
			ARTIFACT CLASSES												
			Reduction					Points		Processing					
26Ek3114	1	Biface Reduction	1	12	-	1	1	1	-	3	-	-	-	1	19
	-	Extra-Feature	-	1	-	-	-	-	-	-	-	-	-	-	1
26Ek3115	1	Biface Reduction	-	6	-	1	1	-	-	4	-	-	-	-	12
26Ek3116	1	Biface Reduction	-	2	-	1	2	3	3	8	1	2	1	1	24
	-	Extra-Feature	-	5	-	-	-	-	1	1	-	-	-	-	7

Key To Artifact Classes

Reduction Tools and Artifacts
SS = Scratched Stone
QB = Quarry Bifaces
PB = Preform Bifaces
SB = Small Bifaces
IB = Indeter Biface Fragments

Maintenance/Processing
SC = Scrapers
KN = Knives
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
OT = Other Simple Flake Tools

Projectile Points
PT = Classifiable Points
FG = Unclassifiable/ Fragments

Grids for systematic surface collection were placed over each feature so as to sample most (63% to 100%) of each. Recoveries summarized in Table 65 indicate each feature is dominated (>90%) by opalite flakes (mean weight ranges from 1.1 to 1.5 g) with very little other toolstone material.

Table 65. Sample Feature Debitage from Small Reduction Sites, Bitterroot Ridge Complex.

Site Number	Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	Opalite Debitage Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	Other Debitage (n)	Other Debitage (%)	Total
26Ek3114	1	11	10	428	3,772	90.1	1.3	508	9.9	0.6	1	1.6	4,281
26Ek3115	1	16	10	190	1,785	94.1	1.1	111	5.8	1.4	2	0.1	1,898
26Ek3116	1	12	12	208	2,377	94.1	1.5	110	1.6	1.3	5	0.4	2,492

Feature 1 at site 26Ek3115, with the smallest assemblage and the lowest average debitage density (190 items per m^2), included six Quarry Bifaces, two other bifaces, and four scrapers. Debitage density at the biface reduction feature in site 26Ek3114, on the other hand, was much higher (average density of 436 items per m^2) and this feature contained a large collection of bifaces (n=14), 80% of which are stage II and stage III Quarry Bifaces; three scrapers and a Desert Side-notched projectile point also were recovered. The feature at site 26Ek3116 is similarly late in time, as indicated by two Desert Side-notched points, but debitage density is moderate (208 items per m^2). The feature yielded only two Quarry Bifaces, but also produced a large collection of other tools including eight scrapers, two perforators, a knife, a multipurpose tool, a simple flake tool, and three point preforms. Because many of these tools (especially scrapers and perforators), are thought to be associated with hide processing, it may be that a large mammal procured nearby was dressed out at this locus.

Reduction/Residential Sites: Context and Structure

Description of the complex structure at reduction/ residential sites considers each site individually. The discussion is ordered by relative proximity to the quarry source area to the north, beginning with site 26Ek3095 on the edge of Basalt Canyon and concluding with site 26Ek3165 located on a ridgeline forming the southern perimeter of the project area.

Site 26Ek3095

Site 26Ek3095 is a large lithic scatter located on the north and east-facing slopes of a ridge marginal to Basalt Canyon (Figure 48). A narrow bench along the upper portion of the site was the focus of prehistoric activity; here, small concentrations of debitage and tools occur as more or less spatially discrete clusters, 25 of which were recorded as features. Bedrock is located near surface forestalling any significant subsurface accumulations of cultural materials. However, the distribution of artifacts in several surface features suggests the preservation of internal structure that may provide means to distinguish various types of site use and the organization of occupants and activities.

The 25 features recorded at the site include 4 complex loci containing dense reduction debris and seed processing tools, 1 eroded artifact scatter, 1 biface "cache," 13 biface reduction areas, and 6 loci containing both core and biface reduction residue (Table 66). Except for Feature 10, features are restricted in space, organized in content, and appear to be discrete activity areas.

Figure 48. 26Ek3095, site map.

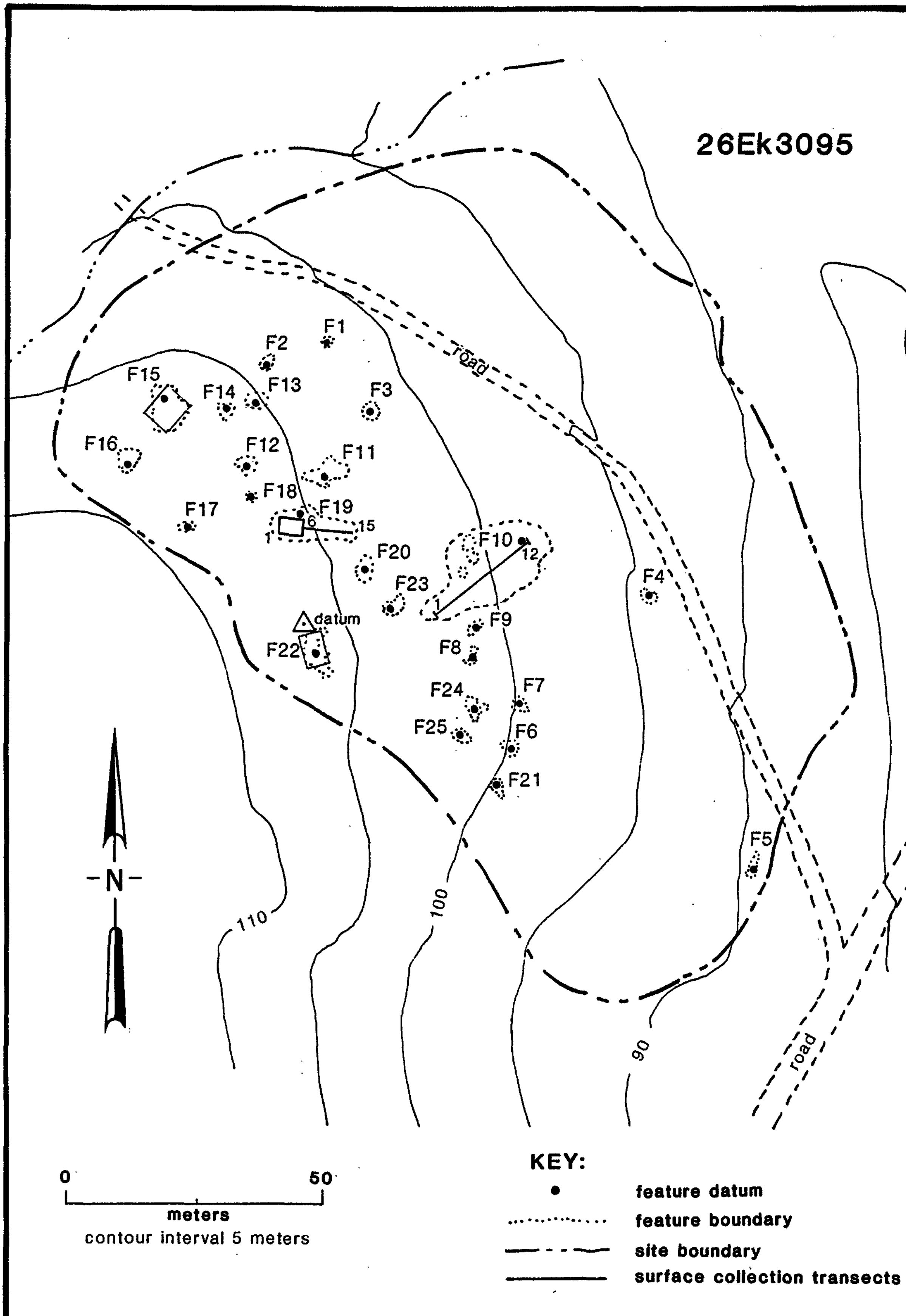

26Ek3095
road
road
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F15
F16
F17
F18
F19
F20
F21
F22
F23
F24
F25
datum
110
100
90
N
0
50
meters
contour interval 5 meters
KEY:
feature datum
feature boundary
site boundary
surface collection transects

Table 66. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Site 26Ek3095.

Fea No.	Type	Total Area (sq m)	ARTIFACT CLASSES: Reduction HM	SS	CR	QB	PB	SB	IB	Points PT	FG	Processing SC	PG	MP	OT	AB	GS	SP	Total
1	Biface Reduction	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2	Biface Reduction	7	-	-	-	3	-	1	-	-	-	-	-	-	-	-	-	-	4
3	Biface Reduction	7	-	-	-	5	-	1	-	-	-	1	-	-	-	-	-	-	7
4	Biface Reduction	7	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
5	Core & Biface	48	-	-	1	6	-	5	-	-	-	-	-	-	-	-	-	-	12
6	Core & Biface	78	-	-	1	7	-	1	1	-	-	-	-	-	-	-	-	-	10
7	Core & Biface	28	-	-	1	4	-	1	-	-	-	-	-	-	-	-	-	-	6
8	Biface Reduction	10	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	3
9	Biface Reduction	11	-	-	-	5	-	-	-	1	-	1	-	-	-	-	-	-	7
10	Eroded Scatter: Sample Feature	250	-	-	-	23	1	9	1	5	-	2	2	1	-	-	1	-	45
11	Core & Biface	24	1	-	-	6	1	-	-	-	-	3	-	-	-	-	-	-	11
12	Biface Reduction	11	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	4
13	Biface Reduction	54	1	-	-	9	-	1	-	-	-	-	-	-	-	-	-	-	11
14	Core & Biface	20	2	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	4
15	Complex Locus: Sample Feature	48	-	-	2	17	-	4	4	-	-	3	-	-	2	1	4	-	37
16	Biface Reduction	42	-	-	-	3	1	-	-	1	1	1	-	-	-	-	-	-	7
17	Biface Reduction	24	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
18	Biface Reduction	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
19	Complex Locus: Sample Feature	75	2	-	4	19	1	3	-	2	-	2	1	1	-	1	2	1	39
20	Biface Reduction	50	-	-	-	7	-	-	-	-	-	-	-	1	-	-	-	-	8
21	Core & Biface	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
22	Complex Locus: Sample Feature	20	-	-	1	35	-	2	1	-	-	1	1	-	-	-	1	-	42
23	Biface Reduction	5	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
24	Biface Cache: Sample Feature	4	-	-	1	12	-	-	-	-	-	1	-	-	-	-	-	-	14
25	Complex Locus	9	-	-	-	2	-	-	-	-	-	1	-	-	-	-	1	-	4
-	Extra-Feature	N/A	-	-	5	41	2	28	1	2	1	5	1	1	-	-	3	-	92

Key to Artifact Classes

Reduction Tools and Artifacts
HM = Hammerstones
SS = Scratched Stone
CR = Cores
QB = Quarry Bifaces
PB = Preform Bifaces
SB = Small Bifaces
IB = Indeter. Biface Fragments

Maintenance/Processing
SC = Scrapers and Spokeshaves
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
OT = Other Simple Flake Tools
AB = Shaft Abraders
GS = Groundstone
SP = Sandstone Pipe

Projectile Points
PT = Classifiable Points
FG = Unclassifiable/Fragments

The 19 features recorded as biface or core and biface reduction stations have the simplest pattern of surface organization. Debitage, usually reflecting a restricted range of similar materials (by color, inclusions, graininess), is concentrated in small areas. Ten of these loci are restricted to less than 11 m^2 and appear to be places where a knapper spent a short time reducing stone. In most cases, a few broken Quarry Bifaces (from 1 to 5) of the same material as the debitage also are present and other tools are rare. The larger reduction features likely reflect both longer exposure at the surface, resulting in wider dispersal, and, as may be indicated by the more numerous rejected bifaces, more intensive energy invested in toolstone reduction. As with the small, discrete features, however, maintenance and/or processing tools are scarce and duration of use appears to have been quite brief.

Four complex loci (features 15, 19, 22, and 25) are characterized by small clusters of metate fragments and other specialized tools surrounded by dense scatters of reduction debris; these are thought to represent campsites. Two types of groundstone features were segregated based on size of the debitage concentration and numbers of reconstructed metates. Features 22 and 25 are small, averaging 15 m^2 in area, and contain only one metate each. Features 15 and 19 are large, averaging 62 m^2 in area, and contain portions of two or more metates.

Feature 22 defines a small area (20 m^2) of dense opalite reduction debris surrounding four large pieces from one basalt metate and debitage from the reduction of a small obsidian core. A 2 by 4 m surface collection grid was aligned along the narrow bench were materials were concentrated around the metate fragments (Figure 49). Surface collections recovered the highest average debitage density (1114 items per m^2) and the largest collection of Quarry Bifaces (n=35) of any feature sampled (Table 67). A 50 cm by 1 m excavation unit, placed in the obsidian reduction area, then sampled subsurface materials. Bedrock was encountered at 30 cm below surface, but cultural materials were all near the surface (from 0 to 10 cm BS) and likely were deposited at about the same time; only a small number of very small opalite flakes (but no obsidian) were found deeper than 10 cm below surface.

Although no evidence of a hearth was found, the collection of tools and debitage from Feature 22 suggests this was the locus of a short term camp at some time in the recent prehistoric past. The presence of the metate (a "woman's tool") suggests use by a small family group during early summer foraging; however, the density of the reduction debris is more consistent with the kinds of high energy reduction activities expected to result from a logistic foray for toolstone (ordinarily conducted by individual males or specialized task groups). It will be important to try to verify the relatedness of artifacts in this feature in future data recovery so that indices of energy investments, group composition, and duration of occupation can be calibrated systematically.

Table 67. Debitage from Sample Feature Collections, Site 26Ek3095.

SURFACE COLLECTIONS

Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	Opalite Debitage Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	Other Debitage (n)	Other Debitage (%)	Total
10	250	0.75	108	80	98.8	1.0	1	1.2	0.4	-	-	81
15	48	12.00	399	4,612	96.4	0.9	158	3.3	1.2	13	0.3	4,783
19	75	6.56	818	5,041	93.9	1.2	289	5.4	2.3	38	0.7	5,368
22	20	8.00	1,114	8,482	95.2	1.1	346	3.9	1.3	86	1.0	8,914
24	4	1.00	603	582	96.5	1.4	15	2.5	10.6	6	1.0	603

SUBSURFACE COLLECTIONS

Fea No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	Opalite Debitage Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	Other Debitage (n)	Other Debitage (%)	Total
15	1 / D	20	0.10	577	94.7	0.2	17	2.8	0.5	15	2.5	609
19	2 / D	40	0.20	2,884	96.5	0.6	93	3.1	1.2	11	0.4	2,988
22	3 / D	30	0.15	2,429	94.5	0.3	131	5.1	1.0	10	0.4	2,570
24	4 / A	15	0.15	4,414	97.4	0.6	115	2.5	1.5	-	-	4,529

Key to Excavation Unit Type
A = 1 by 1 m, 1/8 in. screen
D = 50 cm by 1 m, 1/8 in. screen

Both large groundstone loci, features 15 and 19, were sampled. A surface sample from Feature 15 was taken from a 3 by 4 m block centered on a cluster of groundstone fragments (Figure 50a). Two loci of concentration in Feature 19 were sampled separately. A 2 by 4 m block centered on a groundstone cluster in Locus 1, while nine 25 by 25 cm were located at one meter intervals along the slope through Locus 2 (Figure 50b). Debitage from these features is similarly dominated by small to medium sized flakes from several distinct opalite materials, but they differ somewhat in other constituents (see Table 67). Feature 19 has a higher debitage density, more flake tools, and two types of projectile points (Rosegate and Desert Side-notched); Feature 15 has twice as many metates, no projectile points, and few flake tools.

Figure 49. Plan of Feature 22, site 26Ek3095.

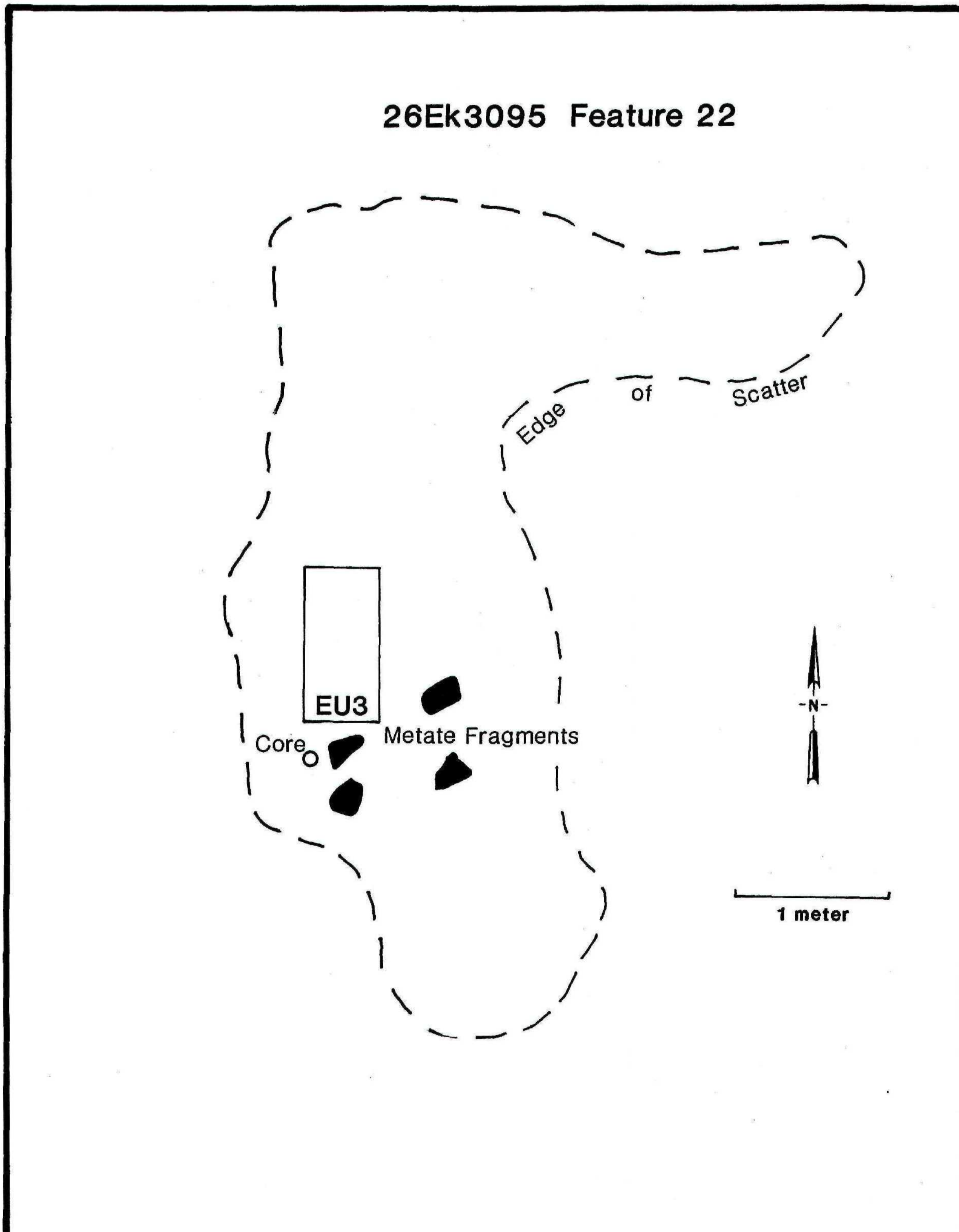
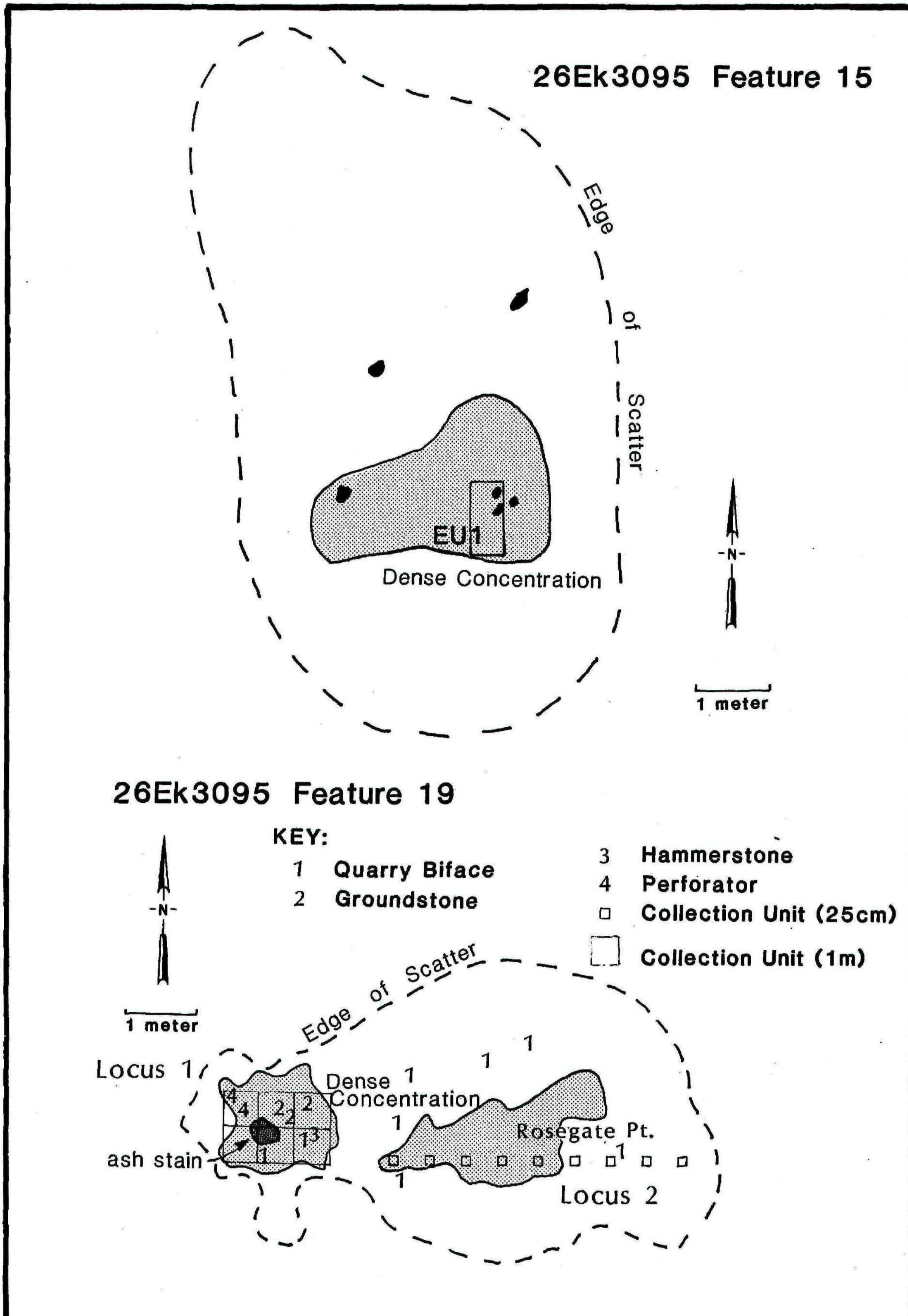

26Ek3095 Feature 22
Edge of Scatter
EU3
Core
Metate Fragments
N
1 meter

Figure 50a. Plan of Feature 15, site 26Ek3095.

Figure 50b. Plan of Feature 19, site 26Ek3095.


26Ek3095 Feature 15
Edge of Scatter
EU1
Dense Concentration
-N-
1 meter
26Ek3095 Feature 19
KEY:
1 Quarry Biface
2 Groundstone
3 Hammerstone
4 Perforator
Collection Unit (25cm)
Collection Unit (1m)
-N-
1 meter
Edge of Scatter
Locus 1
Dense Concentration
ash stain
Rosegate Pt.
Locus 2

Feature 15 contained four metates while Feature 19 contained one; in addition, fragments from a single distinctive ignimbrite metate appear in both. It seems likely that either a large piece was scavenged for reuse, or that small fragments were used as boiling stones or heating rocks. The fragments from Feature 19 have sharp, angular breaks (fire-fractured or more recent?) while those from Feature 15 are more eroded (boiling or longer exposure to the surface?). The pieces from Feature 19 were incorporated in a small, ashy hearth-like area which included a Desert Side-notched projectile point in two fragments. The base was found in level 3 of the excavation unit (20 to 30 cm BS); the tip was found on the surface (0 to 2 cm BS).

The variety of stylized tools, the heavy wear on metate fragments, and the presence of an arrow shaft abrader in both features suggest that these features are the loci of small family camps. Quite likely, these camps were used more than once, either by distinct groups or by the same family at different times.

The association of Desert Side-notched and Rosegate Series points with the two loci in Feature 19 suggest two distinct episodes of use. During the latest, apparently in summer when seeds were available, maintenance and processing activities centered around a small hearth in Locus 1 (see Figure 50a). On the other hand, the lower concentration in Locus 2, centered on the Rosegate Series point, contains evidence of reduction but not campsite use. Bifaces and debitage are more widely dispersed in Locus 2, consistent with an inferred longer exposure at the surface but few tools and no groundstone were present here.

Feature 15, with its numerous metates, lack of discernible hearth, and less clearly organized surface arrangements may be the relic of a somewhat older use area; one that was repeatedly reoccupied. If so, sufficient time has passed to obscure individual activity areas and former hearth locations.

Feature 24 was selected as a representative small biface reduction feature and possible biface cache area. The feature consists of a small (4 m^2) debitage scatter centered on the narrow bench at the south end of the site. Materials observed on the surface included a concentration of greyish-white opalite flakes and three Quarry Bifaces, including two crude Stage II biface fragments, and one complete Stage III biface, the only unbroken, unflawed one of its size and kind observed on the surface.

A 1 by 1 m sample unit was excavated to 15 cm below surface where bedrock was encountered. When combined with surface collections, total artifact recovery includes 5,132 debitage items, 12 Quarry Bifaces, 1 core, and 1 scraper (see tables 53 and 54). The debitage is dominated by small opalite flakes and reflects the progressive reduction of large Quarry Bifaces. The biface recovery also is consistent with the hypothesized cache.

Of the 12 Quarry Bifaces recovered from the 1 by 1 m collection unit, 9 are Stage III bifaces made from the same distinctive grey-speckled opalite. These bifaces were made on progressively smaller flakes, ranging from a very large, fairly thick, leaf-shaped form (specimen 2082-2) to a thin, lanceolate form with incipient haft (specimen 2081-3). All appear similar in manufacture, perhaps made by the same individual.

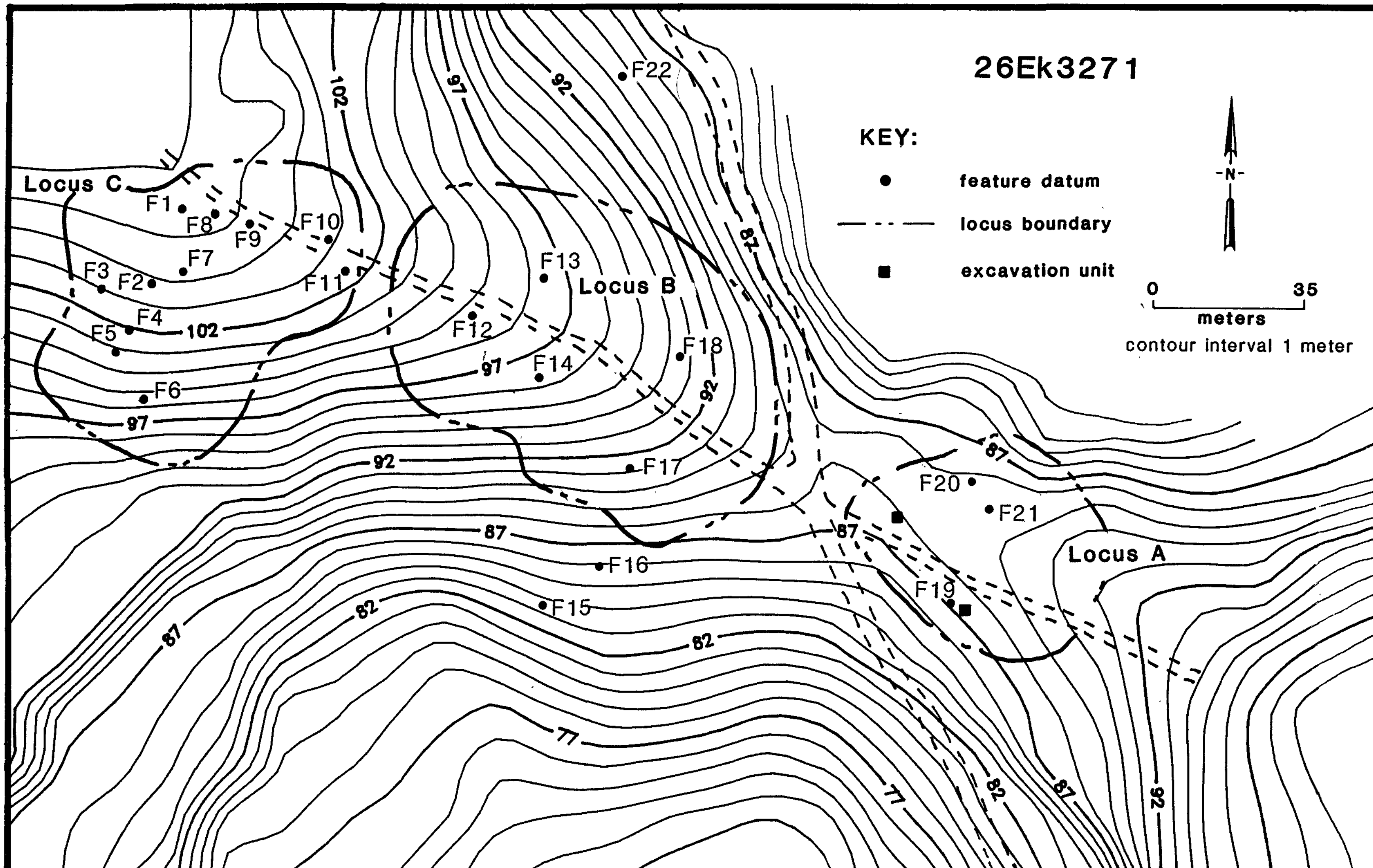
Feature 10 is unlike any other recorded on the site due to its large size (250 m^2), poor spacial definition, abundant and variable formed artifacts (see Table 66), and sparse debitage component (see Table 67). Twelve 25 by 25 cm surface units, located parallel to the slope through the area where most specialized tools were found, resulted in the recovery of only 81 items, mostly opalite flakes (95.4%) that are small in size (mean weight = 1.0 g). This indicates a low overall debitage density (108 m^2) background to the tool scatter.

Artifacts include a large (n=34) and varied collection of reduction bifaces, five projectile points, one mano, and several stylized cutting, scraping, and perforating tools (n=5). Projectile points include one Elko Corner-notched and one Desert Side-notched, as well as three small unclassifiable types; together, these reflect a time range between 1300 B.C. and the historic period. The possibility that some of the tools originate from buried features located on the bench above the scatter needs further investigation in data recovery.

Site 26Ek3271

Site 26Ek3271 occupies the crest of a narrow, southeast-sloping ridgeline and small saddle adjacent the steep southern slopes of Basalt Canyon (Figure 51). Relatively flat ground is limited to the saddle on the east, designated Area A, and a bench on the upper, northwestern edge of the site, designated Area C. Both areas contain discrete flaking stations which were recorded as features. The central site area, designated Area B, consists of a dense flake scatter with few segregatable artifact concentrations. In spite of the narrow, exposed, and strongly sloping (13%) terrain, which appears poorly suited for camping or other sustained use, Area B contained a large number and wide variety of flake tools; intensive reuse of the ridgeline crest is apparent in the thick accumulation of debitage and the large downslope scatter. However, the central site areas (ridgecrest and saddle) are intersected by roads and a water well site that have apparently obliterated significant portions of the site.

Figure 51. 26Ek3271, site map.


26Ek3271
KEY:
feature datum
locus boundary
excavation unit
N
0
35
meters
contour interval 1 meter
Locus A
Locus B
Locus C
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F15
F16
F17
F18
F19
F20
F21
F22
102
97
92
87
82
77

When compared to assemblages from the two adjacent large reduction/residential complexes (sites 26Ek3095 and 26Ek3160), it is apparent that site 26Ek3271 contained large numbers of maintenance and/or processing tools (see Table 61), yet few of these artifacts are associated with spatially discrete features. In fact, the site retains little obvious structural organization in spite of the diversity of the assemblage as a whole. While this may be attributed in part to post-depositional disturbance in the central site area, much of the prehistoric pattern probably has been obscured by recurrent prehistoric uses of the same narrow ridgeline, especially for intensive biface reduction. Unlike site 26Ek3160 located on the ridge to the south, with its even larger undifferentiated scatter, there is little evidence that site 26Ek3271 was used intensively before about A.D. 500; more than 50% of the classifiable projectile points are Rosegate Series which date to between A.D. 500 and 1300 (see Table 60).

The most clearly organized site activities reflect manipulation of large Quarry Bifaces. The significance of this ridgecrest as a locus of biface reduction appears to be related both to its proximity to the quarry sources to the north and to the elevated position of the landform relative to surrounding terrain.

Twenty-two concentrations were recorded as features, 16 of which (or 72.72%) are discrete biface reduction areas (Table 68). Except where dispersed by movement along slopes, features tend to be restricted spatially and appear to result from single reduction episodes; usually, these features contain as residue several rejected and/or broken Quarry Bifaces. Four flaking loci (features 5, 6, 7, and 16) likewise contain cores, shatter, and larger flakes as well as biface thinning residue from the same opalite material. The two remaining loci (features 12 and 18) likely reflect former short term campsite areas whose patterns have been obscured by reuse and/or other disturbance.

The predominance of biface thinning at site 26Ek3271 is apparent in all systematic collections of debitage, both in the high proportions of flakes to shatter as well as in the relatively consistent average weights of debitage items (Table 69). The intensity of this activity likewise is reflected in the high average density of debitage from sample feature collections, notably in features in the central site area (features 12 and 18) and on the saddle (feature 21). Subsurface tests indicate bedrock is located generally within 20 cm below surface; no hearths or other cultural charcoal features were exposed.

Table 68. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Site 26Ek3271.

Fea No.	Type	Total Area (sq m)	HM	OP	SS	AS	CR	QB	PB	SB	IB	PT	FG	SC	KN	PG	MP	GS	Total
			ARTIFACT CLASSES																
						Reduction						Points			Processing				
1	Biface Reduction	32	-	-	-	-	-	-	-	2	1	-	-	-	-	1	-	-	4
2	Burned Scatter:																		
	Sample Feature	18	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	2
3	Biface Reduction	30	-	-	-	-	-	-	1	-	-	-	-	2	1	1	1	-	6
4	Biface Reduction	20	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
5	Core Reduction	10	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	2
6	Core & Biface	77	1	-	-	-	-	5	-	-	1	-	-	-	-	-	-	-	7
7	Core & Biface	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
8	Biface Reduction	20	-	-	-	-	-	1	-	2	-	-	-	2	-	-	-	-	5
9	Biface Reduction	250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
10	Biface Reduction	15	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2
11	Biface Reduction	80	-	-	-	-	-	1	2	5	1	-	-	1	-	-	1	-	11
12	Complex Locus:																		
	Sample Feature	60	1	3	1	1	3	38	3	16	8	2	1	25	1	3	-	-	106
13	Biface Reduction	40	-	-	-	-	-	5	-	2	1	1	-	-	-	-	-	-	9
14	Biface Reduction	30	-	-	-	-	-	13	1	2	2	-	-	-	-	-	-	-	18
15	Biface Reduction	25	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	2
16	Core & Biface	40	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
17	Biface Reduction	15	-	-	-	-	-	3	-	-	1	-	-	-	-	-	-	-	4
18	Mortar Locus:																		
	Sample Feature	5	-	-	-	-	1	4	-	1	2	-	-	2	1	-	-	1	12
19	Biface Reduction:																		
	Sample Feature	18	-	-	-	-	2	6	-	2	-	-	-	1	-	-	-	-	11
20	Biface Reduction	17	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	7
21	Biface Reduction:																		
	Sample Feature	5	-	-	-	-	-	14	-	-	-	-	-	4	-	-	-	-	18
22	Biface Reduction	20	-	-	-	-	-	2	-	-	-	1	-	-	-	-	-	-	3
-	Extra-Feature	N/A	4	3	1	-	5	132	5	53	23	8	3	11	1	10	-	4	263

Key to Artifact Classes

Reduction Tools and Artifacts
HM = Hammerstones
SS = Scratched Stone
OP = Other Percussion
AS = Assayed Piece
CR = Cores
QB = Quarry Trajectory Bifaces
PB = Preform Trajectory Bifaces
SB = Small Trajectory Bifaces
IB = Indeter. Biface Fragments

Maintenance/Processing
SC = Scrapers and Spokeshaves
KN = Knives
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
GS = Groundstone

Projectile Points
PT = Classifiable Points
FG = Unclassifiable/Fragments

Table 69. Summary of Sample Feature and Other Debitage Collections, Site 26Ek3271.

SURFACE COLLECTIONS

Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	OTHER DEBITAGE (n)	OTHER DEBITAGE (%)	Total
2	18	18	69	1,214	97.5	1.3	26	2.1	4.5	5	0.4	1,245
12	60	44	829	35,721	97.9	1.3	471	1.3	2.7	275	0.7	36,467
18	5	2	783	1,551	99.0	0.9	8	0.5	2.8	7	0.4	1,566
19	18	0	-	-	-	-	-	-	-	-	-	0
21	5	3	1,417	4,216	99.2	1.4	24	0.6	4.1	11	0.3	4,251

SUBSURFACE COLLECTIONS

Fea No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	OTHER DEBITAGE (n)	OTHER DEBITAGE (%)	Total
12	3 / D	20	0.10	367	93.6	0.7	23	5.9	9.8	2	0.5	392
12	4 / D	20	0.10	338	96.0	0.5	12	3.4	0.7	2	0.6	352
18	6 / D	30	0.30	2,341	96.9	0.4	67	2.8	1.9	9	0.4	2,417
19	1 / A	20	0.20	1,076	96.2	0.9	17	1.5	0.8	26	2.3	1,119
21	5 / D	10	0.05	1,480	97.8	0.2	25	1.7	0.7	8	0.5	1,513
-	2 / A	20	0.20	3,906	93.3	0.6	186	4.4	1.7	96	2.3	4,188

Key to Excavation Unit Type
A = 1 by 1 m, 1/8 in. screen
D = 50 cm by 1 m, 1/8 in. screen

Feature 2, encompassing a small (18 m^2) area on the gently sloping ridgetop in Area C, was collected completely by systematic surface skimming. In addition to taking entirely the residue of what appeared to be a small, biface reduction episode, collections from Feature 2 were designed to address the effects of wildfire on surface debitage. Soil stained with charcoal and burned sagebrush stumps observed over the entire site area provided clear evidence of a recent wildfire, and the differential effects of heat on stone artifacts at Feature 2 suggested a useful opportunity to segregate transformations resulting from wildfire from those produced by intentional heat treatment. At Feature 2, the exposed upper surfaces of flakes were seen to be crazed and/or vitrified while the under surfaces, contacting the soil, were either dull, sugary, or otherwise unaffected by heat. This difference was especially noticeable on those flakes composing a small concentration adjacent a charcoal stain and two burned sagebrush stumps (Figure 52a). Field personnel noted that the concentration may have underlain a desiccated, collapsed sagebrush plant which, when it burned, produced the effects observed.

Two (features 12 and 18) of the five features defined within the dense scatter comprising Area B were systematically surface collected; subsurface probes were conducted by placing a 50 cm by 1 m excavation unit in each.

Feature 12 is a discrete concentration of debitage surrounded by a large area (60 m^2) of more dispersed debitage (Figure 52b). Surface skimming recovered 36,467 items of debitage and 38 Quarry Bifaces. Combined with the numbers of other artifacts and tools (n=68), including two Rosegate Series points and 25 scrapers (see Table 68), the scatter suggests campsite use coincident with intensive biface reduction.

Feature 18 composed a small, partially disturbed scatter of debitage associated with a large basalt mortar and several small fire-altered rocks. Explorations hoped to discover an associated hearth, but erosion and road construction appear to have obscured such a feature if indeed one ever was present.

The saddle on the eastern portion of the site offered flat ground suitable for campsite use and explorations in Area A were designed to discover hearths and/or food preparation areas. The centers of features 19 and 21 were probed and sidewalls examined for charcoal and/or rocklines, but none were observed. Similarly, an excavation unit (EU2) was located where a metate and several broken (fire-cracked?) cobbles were found on the surface, but excavation exposed no subsurface features. Although site 26Ek3271 is inferred to be a short term residential location, based on the kinds and variety of tools recovered, no residential features were preserved. Lack of preservation of hearths may be attributed to the lack of sediment accumulation on the narrow sloping landform and the rapid deflation of charcoal and ash deposits on this exposed ridgeline.

Site 26Ek3160

Site 26Ek3160, one of the largest sites (46,000 m^2) recorded in the Tosawihi vicinity, is located on a broad, southeast trending ridge; the drainages to either side are ephemeral, likely to contain water only during runoff (Figure 53). The site contains a diverse artifact assemblage (see Table 61) indicative of an array of subsistence activities conducted here in conjunction with opalite toolstone reduction. Particularly interesting is the abundance of Small Bifaces (n=169) at this site. In many respects, the site poses difficulties for interpretation because of an apparent history of reuse over a long period of time.

The crest of the ridge central to the site is covered by a nearly continuous flake scatter, of variable but generally high density, where few distinct features are discernible. Although

Figure 52a. Plan of Feature 2, site 26Ek3271.

Figure 52b. Plan of Feature 12, site 26Ek3271.

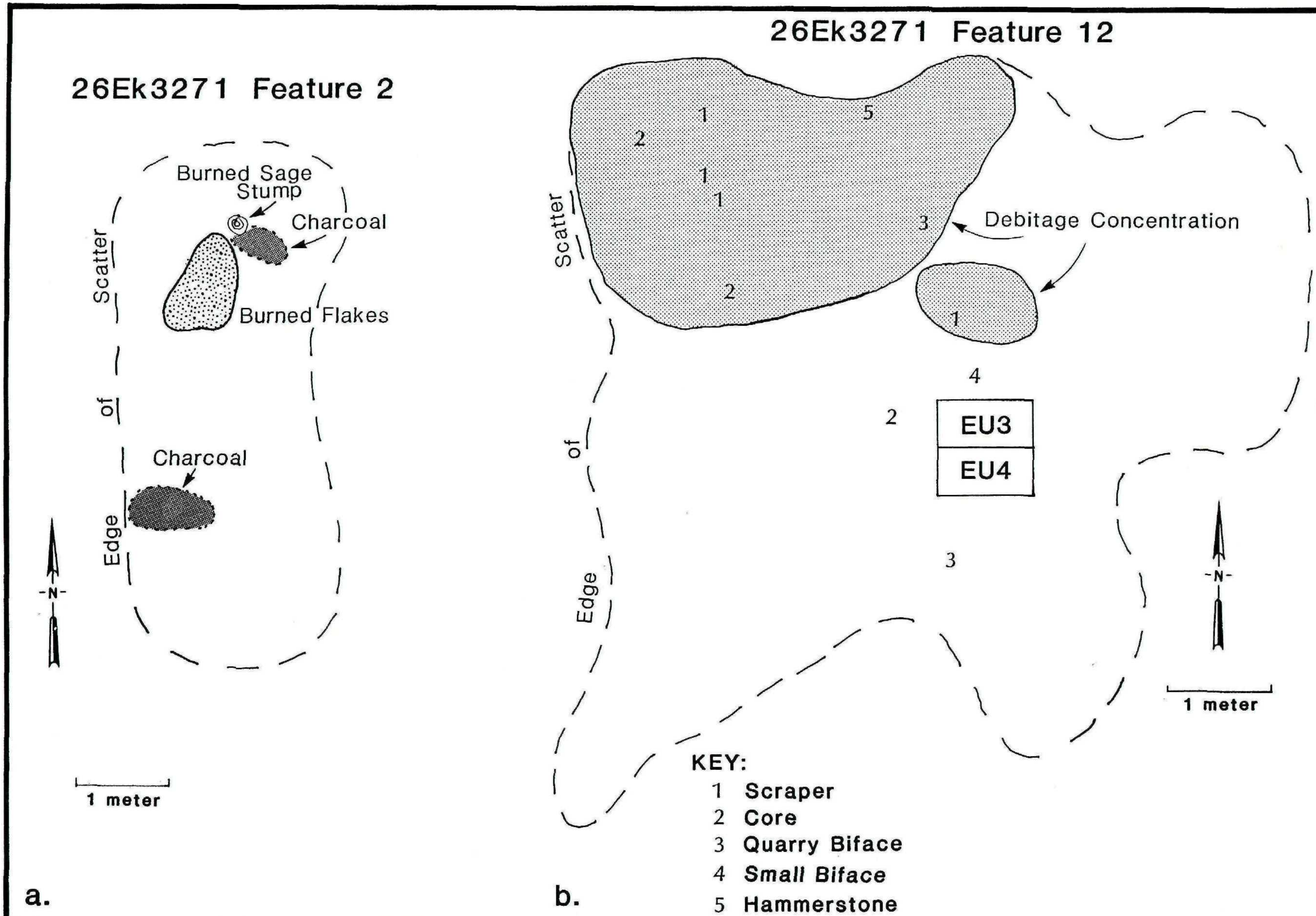
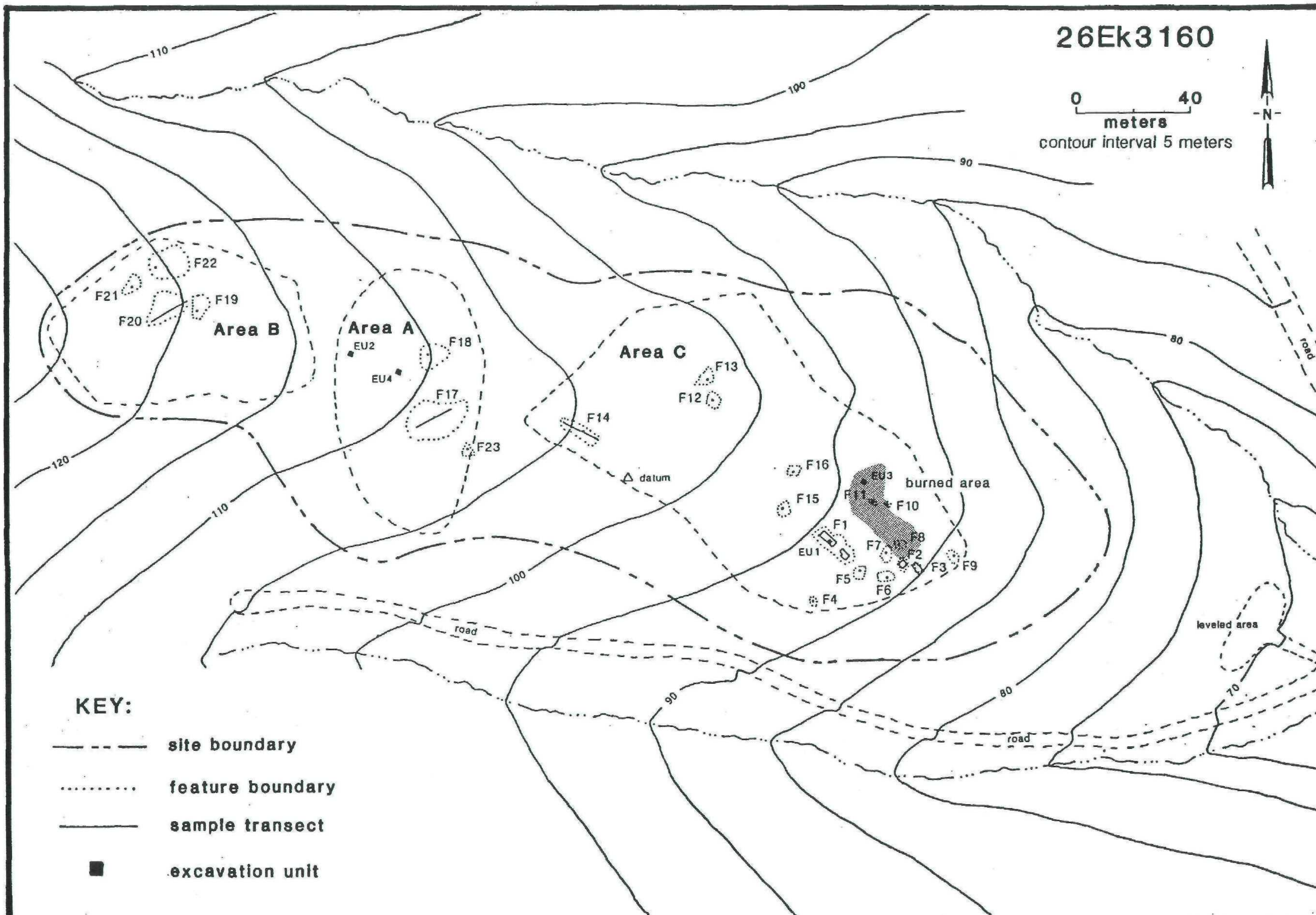

26Ek3271 Feature 2
Burned Sage Stump
Charcoal
Burned Flakes
Charcoal
Edge of Scatter
-N-
1 meter
a.
26Ek3271 Feature 12
1
5
2
1
1
3
Debitage Concentration
2
1
4
2
EU3
EU4
3
Edge of Scatter
-N-
1 meter
KEY:
1 Scraper
2 Core
3 Quarry Biface
4 Small Biface
5 Hammerstone
b.

Figure 53. 26Ek3160, site map.



26Ek3160
0 40
meters
contour interval 5 meters
N
110
100
90
80
70
120
Area B
Area A
Area C
F22
F21
F19
F20
F18
EU2
EU4
F17
F23
F14
F13
F12
datum
F16
F15
EU3
burned area
F11
F10
F1
F8
F7
F2
EU1
F3
F9
F5
F6
F4
road
leveled area
KEY:
site boundary
feature boundary
sample transect
excavation unit

23 artifact concentrations were segregated as features, these compose only a small proportion of the many different, and apparently separate, past site uses. A large (40%) proportion of the formed artifacts were collected from nonfeature contexts, that is, from the accumulation of materials composing the background scatter. Regular reuse of this ridgeline for several thousand years of prehistory is suggested by the projectile point data (see Table 60). Located beyond the extent of modern roadways and other recent disturbances, site 26Ek3160 provides a rich arena for future archaeological investigation.

Three site areas, designated A, B, and C, were defined on the basis of debitage densities and physical setting. On the upper, western edge of the site, Area B is characterized by a light to moderate density scatter of off-white opalite debitage situated on the crest of the ridge. Four reduction scatters (features 19 through 22) were recorded here; biface reduction flakes prevail, as they do elsewhere across the site, and Quarry Bifaces dominate the artifact collections (Table 70). Most features in Area B cover large areas (76 to 185 m^2), probably dispersed by slope movement and/or bioturbation. Groundstone artifacts found in features 19 and 20 (a mortar and a metate, respectively), in conjunction with several other processing tools, suggest these features are campsite loci. Feature 20 was selected for controlled surface collection, but due to the shallow bedrock here, no subsurface tests were conducted.

Feature 20 was sampled by taking five 1 by 1 m surface scrapes at two meter intervals along a transect established parallel to the slope. The debitage is composed largely (92.8%) of small to medium sized flakes (mean weight = 1.2 g) and small amounts of shatter (6.1%) (Table 71) and includes fragments of both Quarry and Small Bifaces (see Table 70).

Central to the site, Area A is a light scatter of opalite debitage situated on a flat, gentle slope extending over the side of the ridge crest. Only three reduction loci (features 17, 18, and 23) are visible on the surface as discrete artifact concentrations; however, pockets of sediment contain buried cultural materials.

Feature 23 delimits a discrete, light density scatter (30 items per m^2) containing a mortar, two point preforms, a simple flake tool, and nine reduction bifaces; the artifacts suggest food preparation incidental to biface thinning and possible campsite use. Features 17 and 18 are large flake scatters. Feature 18 (110 m^2) seems to have been primarily affected by slopewash, contains no definable concentration, and yielded one Quarry Biface. Covering 240 m^2 in area, Feature 17 is a debitage scatter containing three interior flake concentrations whose distinctiveness have been somewhat blurred by slopewash and/or overlapping uses. A large collection of formed artifacts was recovered including both reduction artifacts (n=18) and processing tools (n=2) as well as two projectile points; one projectile point is classified as a Rosegate type.

Table 70. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Site 26Ek3160.

Fea No.	Type	Total Area (sq m)	ARTIFACT CLASSES: Reduction								Points		Processing									Total
			HM	OP	SS	CR	QB	PB	SB	IB	PT	FG	SC	KN	PG	MP	OT	AB	PL	GS	CE	
1	Complex Locus: Sample Feature	135	1	1	2	1	26	1	8	8	5	-	8	-	-	-	-	-	2	2	39	104
2	Burned Scatter: Sample Feature	6	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	3
3	Biface Reduction: Sample Feature	9	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
4	Biface Reduction	8	-	-	-	-	2	-	1	3	-	-	-	-	1	1	-	-	-	-	-	8
5	Core & Biface	24	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
6	Biface Reduction	4	-	-	-	-	-	-	1	-	-	-	1	-	1	-	-	-	-	-	-	3
7	Core & Biface	20	1	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
8	Burned Scatter	7	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
9	Biface Reduction	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
10	Burned Scatter	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
11	Burned Scatter	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
12	Biface Reduction	7	-	-	-	-	4	1	3	1	-	1	-	-	1	-	1	-	-	-	-	12
13	Biface Reduction	48	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	3
14	Biface Reduction Sample Feature	140	-	-	-	-	1	1	4	1	1	-	-	-	-	-	-	-	-	-	-	8
15	Biface Reduction	49	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2
16	Biface Reduction	48	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
17	Core & Biface: Sample Feature	240	-	-	-	2	9	1	4	2	1	1	-	1	1	-	-	-	-	-	-	22
18	Biface Reduction	110	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
19	Complex Locus	76	-	-	-	-	3	-	2	1	-	-	-	-	1	-	-	-	-	1	-	8
20	Complex Locus: Sample Feature	185	-	-	-	-	3	1	5	-	1	-	-	-	1	-	-	-	-	-	1	12
21	Core & Biface	17	-	-	-	1	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	4
22	Biface Reduction	180	-	-	-	-	3	-	-	1	-	-	1	-	-	-	-	-	-	-	-	5
23	Complex Locus	30	-	-	-	-	6	2	2	1	-	-	-	-	1	-	1	-	-	1	-	14
-	Extra-Feature	N/A	-	1	-	4	107	7	134	34	9	6	12	2	4	-	-	-	-	4	-	325

Key to Artifact Classes

Reduction Tools and Artifacts
HM = Hammerstones & other Percussion
SS = Scratched Stone
OP = Other Percussion
CR = Cores
QB = Quarry Bifaces
PB = Preform Bifaces
SB = Small Bifaces
IB = Indeter. Biface Fragments

Maintenance/Processing
SC = Scrapers and Spokeshaves
KN = Knives
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
OT = Other Simple Flake Tools
AB = Abraders
GS = Groundstone
CE = Ceramic Fragments
PL = Planers

Projectile Points
PT = Classifiable Points
FG = Unclassifiable/Fragments

Table 71. Summary of Sample Feature and Other Debitage Collections, Site 26Ek3160.

SURFACE COLLECTIONS

Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
1	135	17	621	9,842	93.2	1.2	646	6.1	3.5	71	0.7	10,559
2	6	4	573	1,150	50.2	0.7	1,140	49.8	0.7	-	-	2,290
3	9	8	304	2,247	92.3	2.1	184	7.6	0.8	3	0.1	2,434
14	140	8	358	2,841	99.2	0.9	-	-	-	23	0.8	2,864
17	240	8	315	2,411	95.6	0.8	81	3.2	0.7	29	1.2	2,521
20	185	5	191	886	92.8	1.2	58	6.1	0.6	11	1.2	955

SUBSURFACE COLLECTIONS

Fea No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
1	1 / F	20	0.10	480	97.4	1.6	13	2.6	20.0	1	0.2	494
-	2 / B	60	0.60	445	93.4	1.0	16	3.4	8.6	9	1.9	470
-	3 / C	20	0.20	>669	52.0	0.8	616	47.9	1.2	1	0.1	1,286
-	4 / C	40	0.40	> 44	73.3	0.7	15	25.0	0.7	1	1.6	60

Key to Excavation Unit Type
B = 1 by 1 m, 1/4 in. screen
C = 1 by 1 m, 1/4 in. with 1/8 in. quad
F = 50 cm by 1 m, 1/4 in. with 1.8 in. quad

Variable density of debitage at Feature 17 was sampled by taking eight 1 by 1 m surface scrapes at two meter intervals along the long axis of the feature (perpendicular to the slope). Flake density ranges from a moderate 189 items per m^2 in the least concentrated areas to a maximum of 477 items per m^2, but mean flake weight is consistent for all units (0.8 ± 0.1) and similarly reflects biface thinning. The surface distribution suggests that several (at least three) discrete biface reduction activity areas have been blended somewhat by erosion. The concentrations may reflect refuse generated by one individual or by several knappers working in concert, but the similarity in debitage visibility and composition suggests a similar length of exposure on the surface, likely dating to some time between A.D. 500 and 1300 (based on the Rosegate projectile point).

Two 1 by 1 m excavation units (EU2 and EU4), placed in nonfeature contexts in Area A, sampled the extent of buried cultural remains. Unit 2 was excavated to a depth of 60 cm below surface and produced 470 pieces of debitage and 7 formed artifacts. The debitage appears to be distributed rather evenly under a near surface peak where a mano, biface and scraper were found. Rodent turbation is extensive, but the depth of cultural materials may derive from buried cultural surfaces and provide clear research potential for future studies. In contrast, Unit 4 was excavated to a depth of 40 cm below surface but yielded only a small debitage assemblage (see Table 71).

Area C, occupying the toe of the ridgeline, is characterized by dense, overlapping scatters composed of diverse toolstone materials (opalites, cherts, and obsidian) and containing numbers of functionally different tools. Within this, 16 features were identified as more or less discrete concentrations. Recorded features include eight biface reduction, two core/biface reduction, one core reduction, four burned reduction scatters and one complex (metate/pottery) locus. Features 3 and 14 (probably reduction scatters), are located at alternate ends of Locus C and varying in size and artifact associations were systematically sampled.

Feature 14 covers a large area (140 m^2) on the ridge crest at the western (upslope) end of Area C. Surface debitage was sampled by taking eight 1 by 1 m surface scrapes at two meter intervals parallel to the slope. The feature contains moderate (average 358 items per m^2) to dense (772 items per m^2) debitage which appeared to be predominantly composed of biface thinning flakes. The biface assemblage is mostly (63%) Small Bifaces, but also include one large Quarry Biface and a biface fragment. An unclassifiable projectile point and a point preform also were recovered.

Feature 3 is contained within a small area (9 m^2) on the lower, east edge of Area C where a single Quarry Biface was recovered within a moderate density (average 304 items per m^2) debitage concentration. A 2 by 4 m grid was centered over the feature and recovered most (88%) of it. Debitage is comprised of off-white opalite (probably limited to a single toolstone variety) and includes numbers of large flakes. This suggests preliminary trimming of bifacial roughouts transported from a single source area.

Reduction features 2, 8, 10, and 11 are located in an area where lithics have been exposed to fire (see Figure 53). Feature 2, which evidenced quantities of burned debitage, was sampled with four surface units taken from a a 2 by 2 m block in the center of the concentration. Small pieces (mean weight = 0.7 g) of thermally produced shatter compose (49.8%) of the debitage collection; flakes likewise are blackened, crazed, and/or fractured by heat. It is apparent that the flakes were exposed to fire after they were produced, and there is no indication of intentional heat treatment. Debitage from an excavation unit (EU3) located at the north edge of the burned area similarly is affected by heat; 48% consists of thermal shatter and burned materials were found to a depth of 20 cm below surface. The source of the fire(s) which produced these effects on surface and subsurface debitage within a spatially restricted area, begs further definition. Do these burned materials reflect their inadvertent inclusion in prehistoric fires (hearths, ovens, heat treatment pits) or simply their redeposition after an ancient localized wildfire?

Feature 1 is unique among loci recorded at the site, both in the diversity of its artifact assemblages, and in the complexity of its surface arrangements. Feature 1 is a large area (135 m^2) containing a continuous light density flake scatter surrounding two discrete debitage concentrations and a scatter of Shoshoni Brownware pottery (Figure 54).

Twelve surface units, arranged in a 2 by 6 m block, were centered in the westernmost (upslope) reduction concentration. Debitage averages 818 items per m^2, and includes small thinning flakes as well as large secondary flakes in a variety of opalite materials; some obsidian and exotic (nonlocal) cherts also were reduced here. Included in the surface units, and somewhat scattered around its perimeter, were 18 Quarry Bifaces, 6 Small Bifaces, 8 indeterminate fragments, and a projectile point preform. The assemblage indicates that this area was used intensively to reduce large bifaces procured in the nearby quarries. Although a Rosegate Series projectile point also was found, the recovery of a Cottonwood and three Desert Side-notched points within the spatially organized context suggests that the debitage was produced during single period of use. Likewise, the association of seed processing tools (two manos and one metate fragment) and several scrapers (n=8) likely indicate campsite use during this interval.

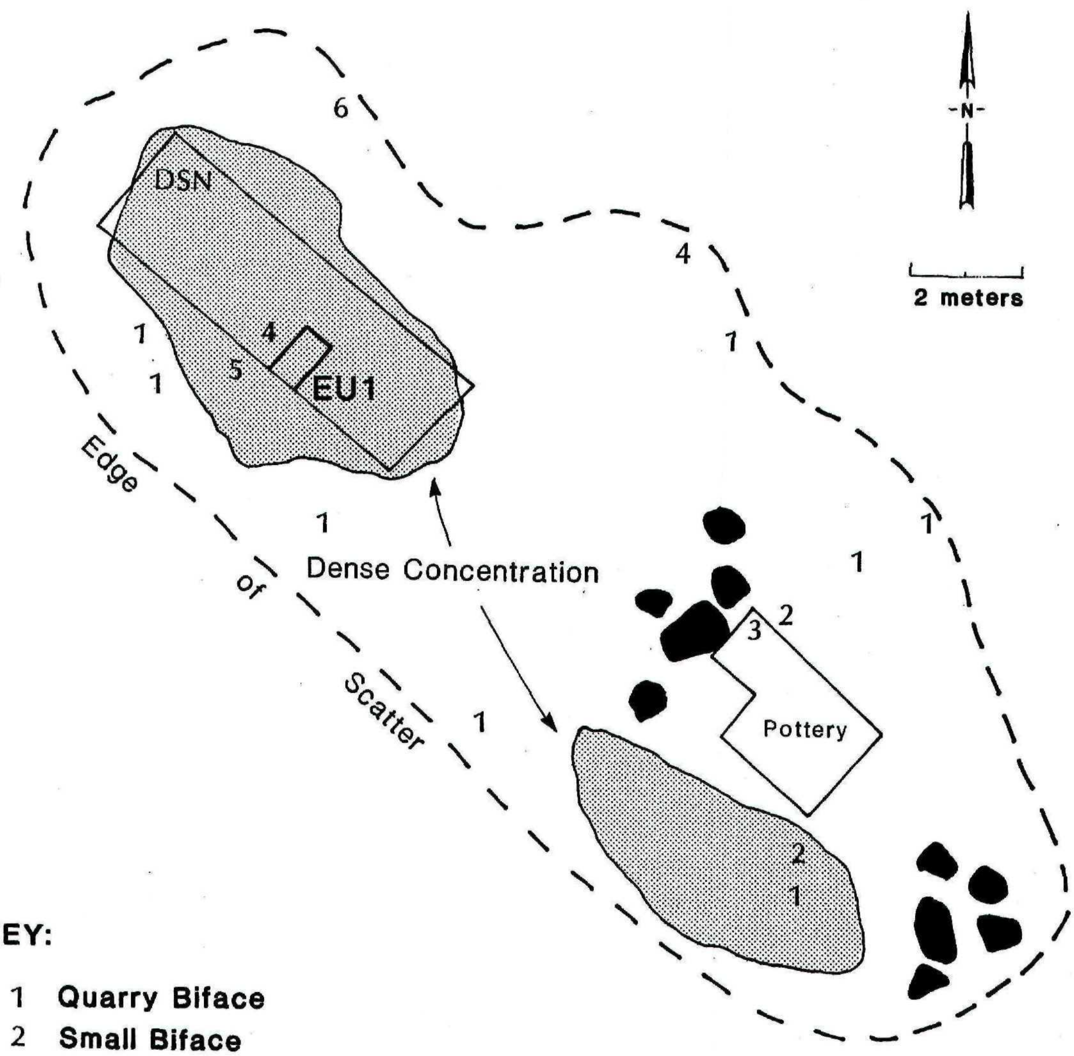
A scatter of 39 Shoshoni Brownware pottery sherds (apparently representing one pot drop) was located among several basalt boulders, and adjacent to another dense concentration of debitage at the east end (downslope) of Feature 1. Five 1 by 1 m surface units, enclosing the pottery scatter, were collected. Debitage of light to moderate density and two Quarry Bifaces were recovered in the pottery locus, but several (n=5) other reduction artifacts were scattered among the boulders. The Shoshoni pottery in the lower area and the Desert Side-notched points in the upper suggest a contemporaneity of Late Archaic use at this complex feature.

Site 26Ek3165

Site 26Ek3165 is located in a small, broad saddle that forms part of an unnamed ridgeline on the south margin of the project area (Figure 55). Debitage is scattered on the slopes of the knoll slopes surrounding the saddle and is concentrated in

Figure 54. Plan of Feature 1, site 26Ek3160.

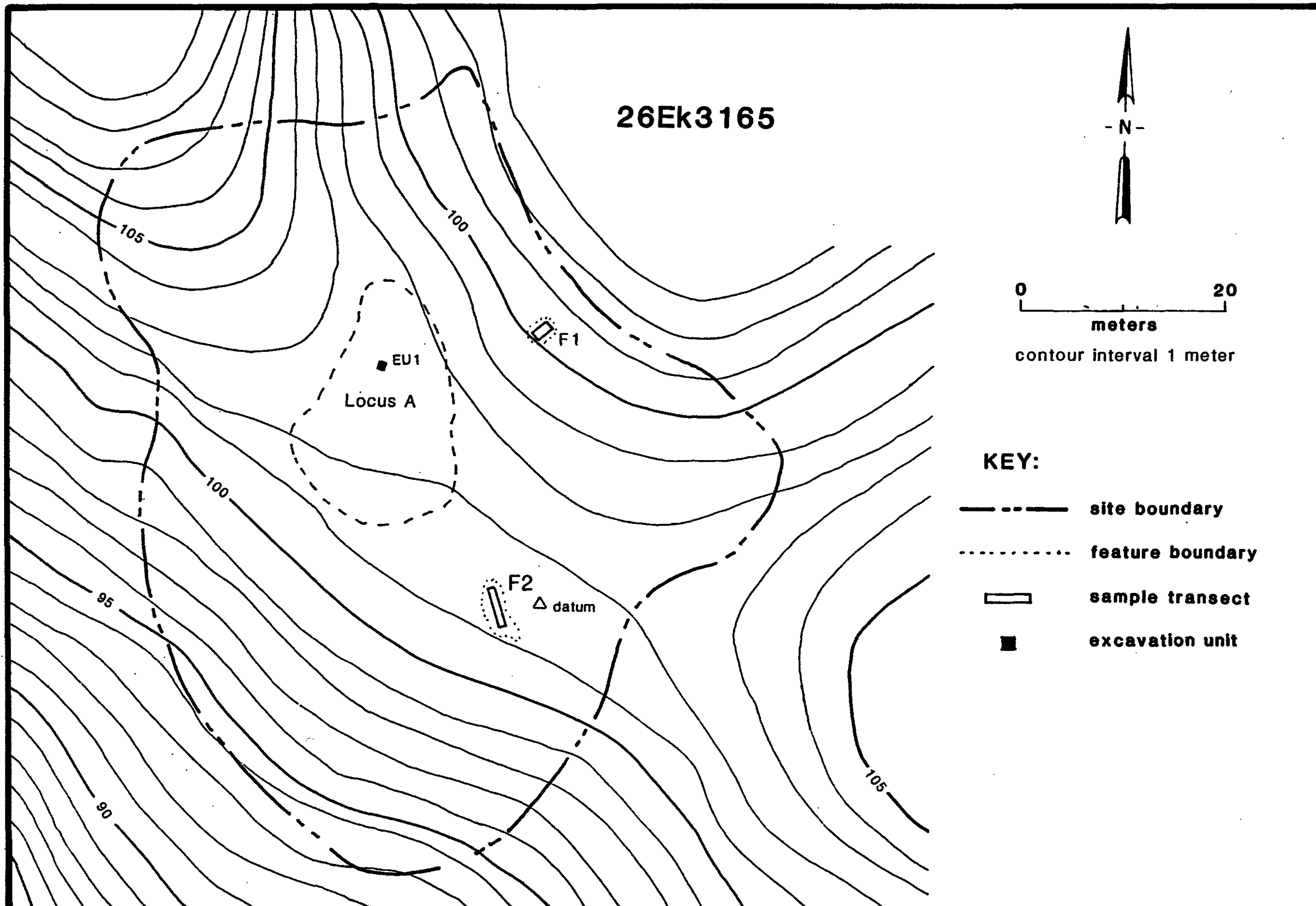
26Ek3160 Feature 1



KEY:

1 **Quarry Biface**
2 **Small Biface**
3 **Projectile Point**
4 **Groundstone**
5 **Chopper**
6 **Flake Tool**
DSN **Desert Side-notched Pt.**
☐ **Surface Collection Units**

Figure 55. 26Ek3165, site map.


26Ek3165
N
0
20
meters
contour interval 1 meter
KEY:
site boundary
feature boundary
sample transect
excavation unit
105
100
100
95
90
105
EU1
Locus A
F1
F2
datum

two small reduction features, each centered around a single metate. Both features are located on the eastern portion of the site. Formed artifacts scattered across the site include two cores, five Quarry Bifaces, six Small Bifaces, and one projectile point preform. Locus A was defined as an area central to the saddle where accumulated sediments provide potential for buried cultural materials.

Features 1 and 2, both containing a single metate within a discrete debitage scatter, offer an interesting comparison. Both features were sampled by surface skimming. A 2 by 4 m grid block grid was imposed to collect most (80%) of Feature 1; a 1 by 8 m collection transect, oriented parallel to the slope, sampled materials (21% of surface area) scattered along the long central axis of Feature 2. While both indicate seed processing, differences in overall size, debitage density, and associated artifacts (Table 72) reflect subtle distinctions in organization of activities and duration of use of these features.

Table 72. Summary of Debitage Collections, Site 26Ek3165

SURFACE COLLECTIONS

Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	Total
1	10	8	215	1,710	99.7	0.9	6	0.3	4.0	1,716
2	38	8	284	2,244	98.8	1.2	27	1.2	2.6	2,271

SUBSURFACE COLLECTIONS

Fea No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	Total
-	1 / *B	30	0.25	135	97.8	0.9	3	2.2	0.4	138

Key to Excavation Unit Type
B = 1 by 1 m, 1/4 in. screen
* last level excavated as a 50 cm by 1m unit, 1/4 in. screen

Feature 1, with its small average flake size (mean weight = 0.9 g), near absence of shatter (0.3%), paucity of Quarry Bifaces (n=2), and absence of other tools, save the metate, suggests food preparation but not campsite use. On the other hand, Feature 2, with two distinct surface debitage concentrations, includes more variable flake sizes (mean flake weight ranges from 0.9 to 2.0g), more variable opalite materials, numerous Quarry Bifaces (n=7), and six other tools (two spokeshaves, three scrapers, and one multipurpose flake tool) in addition to its metate. An unclassifiable obsidian projectile point, an opalite preform, and one Small Biface also were found. The recovered assemblage is consistent with use of Feature 2 as a short term camp.

A 1 by 1 m excavation unit was located in the center of the saddle adjacent to a large basalt metate in the depositional zone designated Locus A. Though only a light scatter of debitage was noted on the surface, subsurface excavation recovered 138 debitage items and three Quarry Bifaces. The bifaces and debitage were concentrated in the upper 20 cm below surface, loosely compacted in a silty loam; materials diminished below a contact with a more compact silty clay layer. Two of the Quarry Bifaces, a Stage II and a Stage IV, were found stacked one upon the other somewhat embedded in the clayey soil at 19 cm below surface. The apparently purposeful placement of these bifaces may signal a cache pile nearby while the other debitage recovery suggests a shallow buried use area, perhaps associated with the large metate. Further investigation will be necessary to define relationships, if any, between surface metate, the shallow subsurface debitage layer, and a possible biface cache.

Summary

Reduction complex 26Ek3093 and small reduction sites 26Ek3114, 26Ek3115, and 26Ek3116, contribute to an understanding of toolstone reduction strategies on the periphery of the Tosawihi Quarries. Tests at Site 26Ek3271 recovered a wealth of data indicating intensive reuse of its ridgeline setting for biface thinning, likely coincident with short term camping, but disturbance to the site is extensive. The three remaining large reduction/residential complexes (26Ek3095, 26Ek3160, and 26Ek3165) contain significant data.

Site 26Ek3095 is considered significant because of its high research potential and clear patterns of spacial organization. The features associated with seed processing tools at 26Ek3095 are inferred campsites whose artifacts provide clues to the organization of groups using nearby quarries. Data from these features can be used to assess group size and sex composition, subsistence activities, seasonality of site use, and duration of stay. Data from the biface cache (Feature 24) may be used to model an episode of biface reduction, quite possibly conducted by a single individual, and so develop indices of the amount of energy invested in such an event.

The large artifact collection and the diversity of functional tools and reduction bifaces highlight the significance of site 26Ek3160 as a staging center and short term campsite peripheral to the quarry zone. It is notable that 40% of the formed artifacts were recovered from nonfeature contexts where time, bioturbation, erosion, and overlapping use, have blurred formerly discrete activity areas into nearly continuous scatters of debitage. Some of the earlier discrete features may be distinguished, if preserved, in soil pockets in Area A, and any containing charcoal can be used for radiocarbon dating. Features with internal spatial organization, such as Feature 1, also provide valuable data about reduction strategies and domestic activities that can address several previously identified research issues.

Site 26Ek3165, the southernmost site in the project area, offers significant potential relevant to developing gravity models (see Elston 1988) and for observing possible change in reduction strategies with increased distance from the primary quarry source area. The two clearly delimited metate loci can be usefully compared to other inferred campsite features at nearby sites. Though lacking clear chronological markers for the present, temporal differences in site use likely are present which will segregate the apparently more recent surface features from likely earlier discrete features now possibly buried in Locus A.

Part V. USX-East Study Area

The USX-East Study Area is introduced in Chapter 13, followed by site descriptions organized geographically; Ramadan Ridge in Chapter 14, Corral Fan in Chapter 15, Undine Gorge in Chapter 16, and Holeplug Ridge in Chapter 17.

Chapter 13. INTRODUCTION TO USX-EAST

by Steven G. Botkin

The USX-East project area, some 0.4 miles due east of USX-West, occupies about 160 acres of the Little Antelope Creek watershed. It is contiguous along its western extreme with the southern boundary of the Tosawihi Quarries (site 26Ek3032). Raven's (1988) survey recorded 37 prehistoric sites in USX-East, of which 31 were explored in the course of testing. The results of these investigations are presented in the following four chapters.

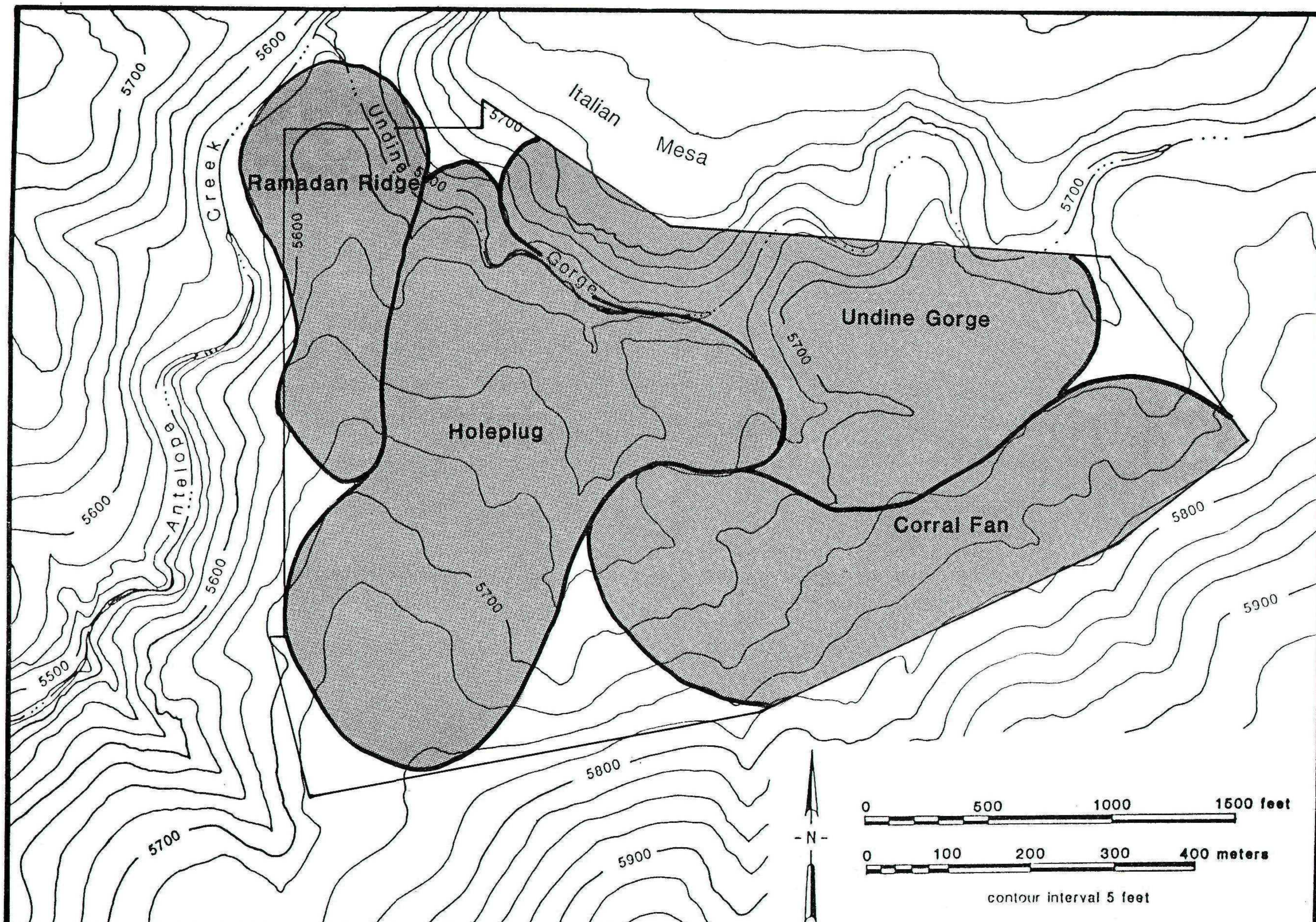
Archaeological sites in USX-East, like those in USX-West, contain artifact assemblages and cultural features with considerable variety in their composition and size, and they occur over a wide range of geographic contexts. However, all the sites appear to be derived from aboriginal extraction and processing of opalite toolstone. Pertaining to this theme, USX-East contains an array of site types that include pit, outcrop, and cobble quarries of assorted sizes, and numerous rockshelters. As well, several locations display attributes suggestive of residential occupation. Beyond these superficial similarities, however, tests suggest that the archaeological records of USX-East and West differ in some considerable, albeit subtle, ways.

In marked contrast to USX-West, toolstone sources in USX-East are more numerous, and are widespread. Moreover, we observe that surficial site boundaries in USX-East seem less clear because they are less topographically constrained and they are blurred further by a ubiquitous background lithic scatter of variable density. Boundaries of most large sites in the East are arbitrary, enclosing constellations of spatially discrete cultural features aggregated on the basis of inferred function, relative proximity to one another, and/or on shared topographic position. Given these attributes, it appears that unlike USX-West, the prehistoric record of the USX-East area is quite similar to that of the Tosawihi Quarries (26Ek3032) proper (cf. Elston et al. 1987).

Recall from Chapter 2 that, for heuristic purposes, the USX-East test arena has been divided into four subareas named for prominent landforms they contain: Ramadan Ridge, Holeplug Ridge, Undine Gorge, and Corral Fan (Figure 56). These units are employed to segregate the area-specific chapter discussions which follow.

Ramadan Ridge encompasses the broad, gently inclined lower (northern) half of the north trending ridgeline from which it takes its name. Two sites occur within it; both were tested. They are large quarry pit/reduction complexes which, in contrast

Figure 56. USX-East project area and archaeological subareas.



Ramadan Ridge
Undine Gorge
Holeplug
Corral Fan
Italian Mesa
Antelope Creek
Undine Gorge
5500
5600
5700
5800
5900
N
0 500 1000 1500 feet
0 100 200 300 400 meters
contour interval 5 feet

to other sites of this type in the project area, contain artifact assemblages of sufficient functional diversity to imply some residential use as well. Given its extreme western position in the project area, the boundaries of Ramadan Ridge sites abut and, in places, subsume localities within the Bedrock Bend, Middle Little Antelope Canyon, and Big Meadows site neighborhoods of the Tosawihi Quarries (cf. Elston et al. 1987:36, 40-41).

Named for the long low rise that arcs northward from the highest elevations of Ramadan Ridge, the Holeplug subarea occupies the central portion of USX-East. It encompasses a broad swath of undulating landscape that includes the southern crest and northeastern slopes of Ramadan Ridge and, after falling gradually downward to the north, is bounded by the southern margin of Undine Gorge. Nineteen sites occur within it; all, save one, were tested. The area lacks opalite outcrops and the archaeological record is composed of reduction complexes and isolated reduction stations. The only quarry activity observed occurs at an extensive but apparently little used cobble field.

The northernmost tier of sites examined are distributed along Undine Gorge, a seasonal drainage transiting the project area from east to west. The western half of the unit is dominated by the cliff of silicified tuff that forms the terminus of Italian Mesa, while its eastern extent attains a more gently rolling aspect encompassing knolls along the southern bank of the meandering gorge. Ten of the twelve sites here were tested. Surface and near surface opalite outcrops along the eastern knolls were quarried intensively; the walls of rockshelters in the steep rocky buttresses to the west show evidence of minor toolstone extraction.

Corral Fan spans the southern quarter of the project area where it comprises a portion of the mildly dissected northwestern foot slopes of the high ridge dominating the horizon to the south. Containing only four prehistoric sites, Corral Fan represents the area of lowest site density in USX-East. An isolated quarry pit at its eastern extreme exploits the sole opalite exposure within the area and was the only site tested there. The three remaining sites are extensive but diffuse lithic scatters which lack discernible cultural features or internal organization.

Discussions in the next four chapters follow the organization scheme employed in Parts III (North Access Corridor) and IV (USX-East) of this volume.

Chapter 14. RAMADAN RIDGE

by Steven G. Botkin

From its base in Big Meadows at the confluence of Little Antelope Creek and Undine Gorge, Ramadan Ridge rises gradually southward in a succession of broad, nearly flat benches to span the entire western quarter of USX-East (Figure 57). Ramadan Ridge is contiguous on the north to the large residential localities in Big Meadows of the Tosawihi Quarries. It is not surprising to find indications of residential use at the two Ramadan Ridge sites tested, in addition to toolstone procurement and processing.

Along the ridgecrest a relatively shallow colluvium of sandy silt with abundant gravels overlays beds of toolstone-quality silicified tuffs, or opalite. At numerous but widely scattered locations, especially on slopes between benches, opalite bedrock appears in low ledges or is weathered into extensive cobble fields; the majority of these exposures show evidence of aboriginal manipulation.

A chain of small pools in Little Antelope Canyon bottom, monitored during 1988 field work, held water until late June; a more persistent water source occurs in Big Meadow some 300 meters north of the study area where an apparently perennial spring now feeds a stock pond. Little Antelope Creek is a link in the most direct foot route between Tosawihi Quarries and the Humboldt River. For people transiting this corridor, Ramadan Ridge and the comparatively well watered flats immediately north are the nearest suitable campsites to the opalite toolstone sources (Elston et al. 1987:40).

Vegetation within the subarea is essentially identical to that of the surroundings and appears to have offered no particular inducement to site occupation. Shallow soils along the crest of Ramadan Ridge host a sparse cover of low sagebrush, rabbitbrush, and phlox, while locally dense stands of tall sagebrush and understory grasses are supported by patches of deeper soils on the lower ridge slopes. However, more productive plant foods occur immediately outside the study area, within Big Meadow and along the courses of its influent drainages.

Descriptive Site Summary

Two sites within the Ramadan Ridge subarea (26Ek3170 and 26Ek3171) were recorded (Raven 1988) and subjected to testing (Table 73).

Figure 57. Topographic setting, Ramadan Ridge sites.

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Note:

One or more pages have been removed from this part of the report due to sensitivity of specific archaeological site location information. Qualified persons may contact the Nevada Bureau of Land Management, Elko Field Office, to inquire about obtaining additional information.

Table 73. Descriptive Site Summary, Ramadan Ridge.

Site No.	Type	Maximum Number of Features	Site Area (sq. m)
26Ek3170	Quarry Pit/Reduction/Residential Complex	13	31,000
26Ek3171	Quarry Pit/Reduction/Residential Complex	8	6,770

Sites 26Ek3170 and 3171 occupy major benches of Ramadan Ridge and their locations offer broad views of the western portion of the USX-East area including Ondine Gorge and its confluence with Little Antelope Creek.

Site 26Ek3170 is a fan-shaped scatter of debitage and artifacts encompassing an area of 31,000 m^2. The site contains 12 discrete lithic concentrations recorded as features, a quarry pit feature and a large central area where debitage density is high. Site 26Ek3171 covers only 6,770 m^2 and contains 6 lithic features and 2 quarry pits.

Although dominated by the residue of opalite quarrying and the early stages of biface reduction, the diversity of both assemblages suggests that the Ramadan sites hosted a wider array of activities than implied by their original classification as "Quarry Pit/Reduction Complexes" (Raven 1988:6). The presence of groundstone, scrapers, and other flake tools, as well as drills, perforators, and numerous projectile points and point preforms points toward residential use of the sites in addition to quarrying.

Testing Strategies

Following close interval reconnaissance of each site following procedures outlined in Chapter 2, cultural features from each site were selected for special scrutiny. In addition, surface testing and excavation were conducted outside features in the large zone of dense but internally undifferentiated lithic scatter (Table 74).

Table 74. Summary of Testing Procedures, Ramadan Ridge Sites.

	FEATURES RECORDED		FEATURE CONTEXT				NONFEATURE CONTEXT		RECOVERED COLLECTIONS	
Site Number	Total (n)	Sampled (n)	Surface Skim Area (sq m)	Trench Cross Section (n)	Stratigraphic Profile (n)	Column Samples (n)	Surface Skim Area (sq m)	Subsurface Excavation Volume (cu m)	Debitage (n)	Formed Artifacts (n)
26Ek3170	13	2	9.75	1	1	-	5	0.8	9,458	136
26Ek3171	8	2	5.4375	2	3	20	-	1.4	5,265	51

At 26Ek3170, two of thirteen cultural features were sampled. Feature 1, a quarry pit and reduction station centered on a 3 m long opalite outcrop, was tested with a discontinuous transect of 12 25 by 25 cm collection units, shovel-skimmed and screened at 1 m intervals along the long axis of the feature and bisected with a backhoe trench. Feature 9, a small (3 by 2.5 m) biface reduction station was collected totally through shovel-skimming and screening. Composition of the high density zone in the site's northwestern quadrant was sampled by placing a line of 1 x 1 m discretionary surface collection units across it from east to west, proceeding from near the crest of the ridge well down its western slope; a total of 5 collection units was shovel-skimmed and screened. To explore the depth and nature of deposition in the same area, 2 1 by 1 m excavation units were dug, one along the line defined by the surface collection units, the other near the zone's northern extreme.

Similar procedures were applied to 26Ek3171, where three cultural features were sampled. A small, high density core reduction station was collected in its entirety by shovel-skimming and screening. The smaller (6 m diameter) of the two quarry pits occurring at the site was sampled by shovel-skimming and screening units along two transects arrayed on cross axes. In addition, a hand excavated trench along one of the axes exposed the internal structure of the feature. The larger (9 m diameter) quarry pit was bisected by a backhoe trench. Detailed stratigraphic profiles were prepared and samples of all principal stratigraphic components were collected from both trenches.

Additionally, three 1 by 1 m excavation units were placed in non-feature settings in the western portion of the site where soil color and the abundance and diversity of cultural materials suggested that subsurface components were likely to occur.

Chronology

Neither of the Ramadan Ridge sites yielded sufficient charcoal or other remains suitable for direct radiometric assay. Our present chronological perspective is provided solely by the relative dates offered by stylistically time-sensitive artifact classes - projectile points and pottery. These indicators suggest a predominantly late occupation of the site (Table 75).

The projectile point assemblage from 26Ek3170 implies site use largely after ca. A.D. 1300; 3 Desert Series points (2 Desert Side-notched and 1 Cottonwood Triangular) were retrieved from surface and buried contexts. However, a single truncated, edge-ground basal fragment of an obsidian stemmed projectile point at least hints of occupation as early as 8000 B.P. (Elston 1986). Three large point preforms; one in obsidian and two of heat-treated white opalite, could not be classified on the basis of Thomas's (1981) key. Of these, the obsidian piece is equivocal but provocative; it consists of a robust, colaterally flaked, truncated fragment which may also represent the proximal portion of a stemmed point.

Table 75. Projectile Point Types from Ramadan Ridge Sites.

Site Number	Classifiable Types STM	CTN	DSN	Unclassifiable OOK	TOTAL
Quarry Pit/ Reduction Complex					
26EK3170	1	1	2		4
26Ek3171			1	1	2
Total	1	1	3	1	6

Classifiable Types
STM = Great Basin Stemmed
CTN = Cottonwood Series
DSN = Desert Side-notched

Unclassifiable
OOK = Points out of Thomas (1981) Key

Temporally diagnostic artifacts from 26Ek3171 are exclusively late. Projectile points include a Desert Side-notched and an obsidian lanceolate piece with a concave base. The latter is not classifiable but probably referable to the Cottonwood type of the Desert Series (Hester and Heizer 1979). Both points suggest a post-A.D. 1300 occupation of the site, a chronology supported by the presence of eight sherds of Promontory Grey Ware (Madsen 1977, 1986) recovered from a non-feature context.

Assemblage Composition

As depicted in Table 76, assemblages recovered from 26Ek3170 and -3171 are quite similar, with reduction artifacts and their associated lithic processing tools comprising roughly 80% of the assemblages from both sites. Quarry Bifaces dominate formed artifact counts, representing approximately half of the collection from 26Ek3170 and some 40% of that at 26Ek3171. However, cores are rarely encountered. Small Bifaces are the largest class of tools at 26Ek3170.

Table 76. Intersite Artifact Class Frequency Comparisons, Ramadan Ridge Sites.

ARTIFACT CLASS	Quarry/Reduction/Residential	
	26Ek3170	26Ek3171
Lithic Processing/ Reduction Tools		
Hammerstones	1	7
Scratched Stones	-	1
Other Percussion	5	-
Subtotal (%)	6 (4.2%)	8 (10.8%)
Reduction Artifacts		
Assayed Pieces	-	4
Cores	4	1
Quarry Bifaces	71	30
Preform Bifaces	3	-
Small Bifaces	33	10
Indeterminate Bifaces	1	-
Subtotal (%)	112 (78.3%)	45 (60.8%)
Projectile Points		
Classifiable	4	1
Unclassifiable	-	1
Subtotal (%)	4 (2.8%)	2 (2.7%)
Maintenance and/or Processing Tools		
Scrapers/Spokeshaves	10	6
Perforators/Gravers	1	1
Multipurpose Flakes	3	-
Indeterminate Flakes	5	-
Knives	-	3
Subtotal (%)	19 (13.3%)	10 (13.5%)
Plant Processing		
Manos	1	1
Metates	1	-
Subtotal (%)	2 (1.4%)	1 (1.4%)
Miscellaneous Artifacts		
Stone Pipes	-	-
Ceramic Sherds	-	8
Subtotal (%)	0 (0.0%)	8 (10.8%)
Site Total	143	74

The remaining formed artifacts, between 15% and 26% of each assemblage, represent a diverse array of implements whose functions were presumably ancillary to and supportive of the more narrowly defined toolstone-oriented endeavors. In addition to hunting implied by the occurrence of projectile points, groundstone artifacts recovered from both of the sites suggest at least minimal processing of plant foods as well. Other flaked stone tools include implements bearing a wide variety of working edges and range from simple, minimally modified flakes employed as expedient scrapers and cutters, to highly stylized, carefully executed perforators, end scrapers, and knives. These artifacts are distributed unevenly, primarily in extra-feature contexts, rather than in direct association with toolstone production features.

The Ramadan Sites

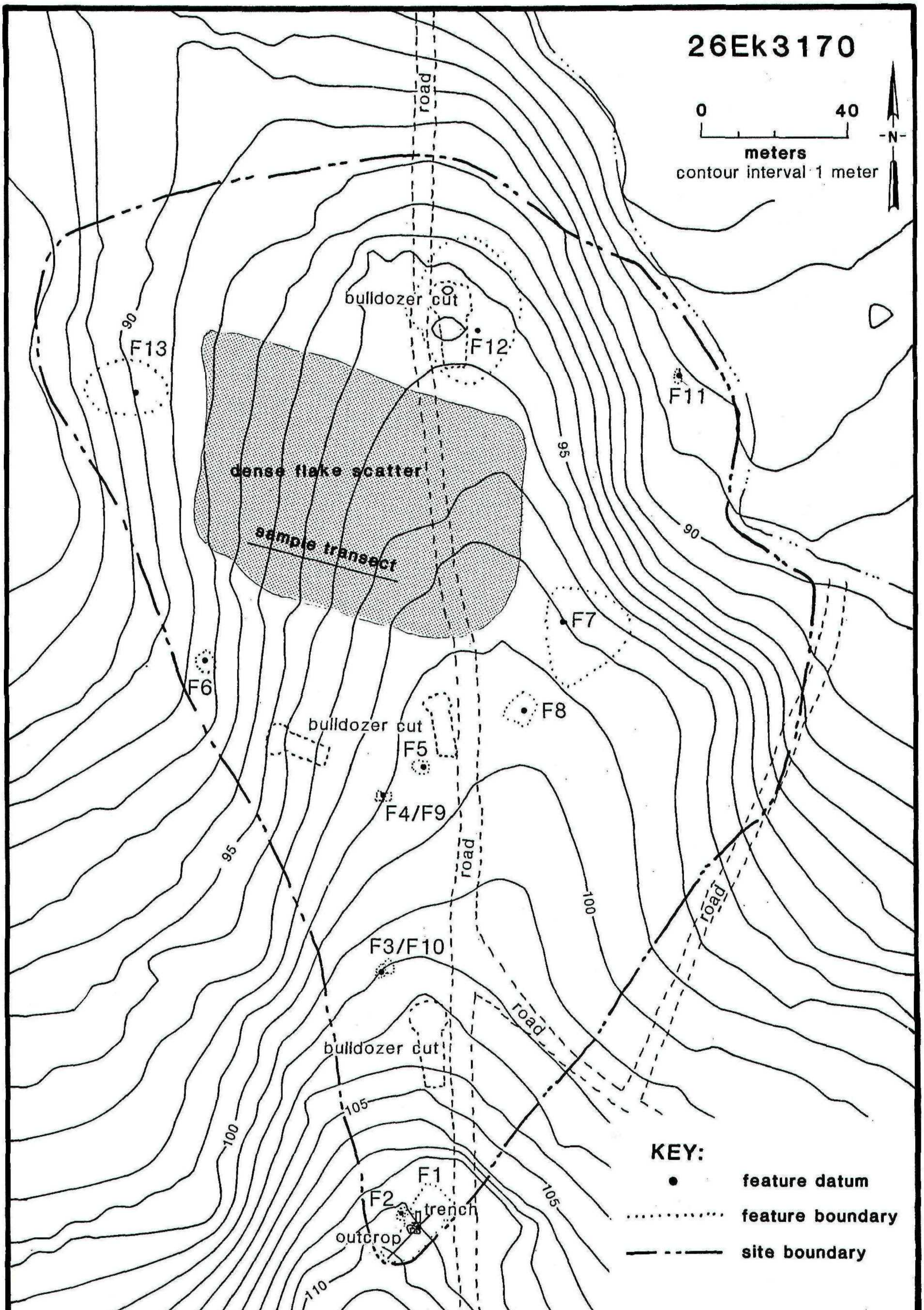
Consideration of the context and structure of the resources occupying the Ramadan Ridge subarea are offered by presentation of testing results on a site-by-site basis. In doing so we rely mostly on descriptions of data obtained from cultural features that were selected as Sample Features and qualitative information gathered in extra-feature site contexts. For the remaining features, where data are largely qualitative and descriptive, our presentations are correspondingly general and more summary in nature.

Site 26Ek3170

Site 26Ek3170 occupies the entire first bench on Ramadan Ridge (Figure 58). If its northern boundary is coterminous with that of the Tosawihi Quarries site (26Ek3032) and is more administrative (for purposes of the National Register) than archaeological. Only a slight undulation in the ridgeline serves to differentiate 26Ek3170 from habitation Locality 27 in the Big Meadows archaeological neighborhood (Elston et al. 1987). As defined by topography and artifact distribution, 26Ek3170 also includes the quarry pit localities 23 and 26 of 26Ek3032 although these fall outside the USX-East study and were not examined during the testing program.

Even after these deletions, the site remains the most extensive in the USX-East project area, covering the ridge between elevations of 5585 to 5660 ft. amsl (Figure 58). Over this expanse are scattered 13 discrete cultural features (12 reduction stations and a quarry pit), as well as a large zone in the site's northwestern quadrant marked by a nearly continuous, moderate density scatter of debitage and artifacts (shaded on Figure 58).

Figure 58. 26Ek3170, site map.


26Ek3170
0
40
meters
contour interval 1 meter
N
road
bulldozer cut
F12
F13
90
F11
dense flake scatter
sample transect
95
90
F7
F6
F8
bulldozer cut
F5
F4/F9
95
road
100
road
F3/F10
road
bulldozer cut
105
100
F1
F2
trench
outcrop
105
110
KEY:
feature datum
feature boundary
site boundary

Although largely intact, the site has suffered historic disturbance in that two major dirt roads meet south of its center, one of which bisects the site. The intersection has served recently for heavy equipment deployment. During the winter of 1987-1988 large vehicles apparently became mired, and their consequent extrication virtually obliterated ca. 1000 m^2 of the site surface. Additionally, several older bladed scrapes occur throughout the site, one of them directly intruding a cluster of reduction stations (Feature 12).

The thirteen cultural features that occur on site 26Ek3170 include a single quarry pit and a dozen reduction stations; their sizes and the types of formed artifacts recovered from them are summarized in Table 77.

Table 77. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Site 26Ek3170.

		Total	ARTIFACT CLASSES													
Fea		Area	Reduction							Points	Processing					
No.	Type	(sq m)	HM	OP	CR	QB	SB	PB	IB	PT	SC	PG	MP	OT	GS	Total
1*	Quarry Pit/ Core Reduction	145	-	-	1	5	-	-	-	-	1	-	-	-	-	7
2	Biface Reduction	75	-	-	-	2	-	-	-	-	-	-	-	1	-	3
3	Biface Reduction	13	-	-	-	1	-	-	-	-	-	-	-	-	-	1
4	Core & Biface Reduction	63	-	-	-	-	-	-	-	-	-	-	1	-	-	1
5	Biface Reduction	50	-	-	-	4	2	-	-	-	-	-	1	-	-	7
6	Biface Reduction	44	-	-	-	4	-	-	-	-	-	-	-	-	-	4
7	Core & Biface Reduction	560	-	-	1	9	1	-	-	-	-	-	-	1	-	12
8	Biface Reduction	79	-	-	-	1	2	-	-	-	-	-	-	-	-	3
9*	Biface Reduction	6	-	-	-	2	-	-	-	-	-	-	-	-	-	2
10	Core & Biface Reduction	71	-	-	-	2	-	-	-	-	-	-	-	2	-	4
11	Biface Reduction	5	-	-	-	1	-	-	-	-	-	-	-	-	-	1
12	Biface Reduction	1420	-	-	-	9	2	-	-	-	-	-	-	-	-	11
13	Biface Reduction	189				7					1					8
-	Extra-Feature	N/A	1	5	2	24	26	3	1	4	8	1	1	1	2	79

* Sample Feature

Key to Artifact Class:

Reduction Tools and Artifacts
HM = Hammerstones
OP = Other Percussion
CR = Cores
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces
PB = Preform Trajectory Bifaces
IB = Indeter. Biface Fragments

Maintenance/Processing
SC = Scrapers and Spokeshaves
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
OT = Other
GS = Groundstone

Projectile Points
PT = Classifiable Points

Located at the southern extreme of the site, quarry pit Feature 1 was manifest on the surface as a small shallow depression ca. 3 m long, adjacent to the downhill side of a low, linear, dike-like outcrop of opalite; the outcrop, some 3 m long and 0.5 m wide, runs perpendicular to the axis of the slope (Figure 59). Our discontinuous collection across the feature returned 1247 cultural items, of which 980 are opalite flakes and 261 are pieces of opalite shatter. From this sample, as well as from other surface contexts, the feature yielded five Quarry Bifaces, a core, and one flake scraper, all of opalite. The sample shows that density and average weight of debitage are greatest upslope of the pit, which apparently constitutes the principal reduction workshop of the feature. In this zone flakes are significantly larger (6.26 to 14.35 gm) than in the downslope scatter (3.96 to 4.9 gm), suggesting that either colluvial processes account for the uneven distribution of flake sizes or, alternatively, that different stages of toolstone processing occurred in the two locations.

A backhoe trench perpendicular to the outcrop, extending 3 m upslope and 5 m downslope, reveals the feature in profile (Figure 60). Upslope of the outcrop, 20 cm of colluvial soil overlies weathered red tuff. Downslope, the berm of the quarry pit comprised of soil and opalite quarry waste, overlies 30 cm of weathered tuff, which in turn overlies toolstone quality opalite. The opalite outcrop protrudes through the tuff, but rises only some 10 to 20 cm above the ground surface; the face of the outcrop is steepest on the downslope side. These relationships suggest that the opalite dike is actually a layer of opalite between two layers of tuff, all three of which have been tilted toward the vertical and planed off by erosion. The shallow, trench-like quarry pit, about 1.5 m wide and 30 cm deep, was excavated along the downslope face of the outcrop. The berm of soil and quarry waste parallels the pit on its downslope side, but contains few flakes, chunks, and cores compared to other such features tested at other sites in the project area. The small size of the pit and the relatively small amounts of quarry waste in its berm suggest that the toolstone source was not intensively developed.

As is the case at all other sites in the project area, the twelve features labeled "reduction stations" at 26Ek3170 occur as localized concentrations of debitage, visually distinct from the background artifact scatter that blankets the sites. Cultural features are distributed throughout the site, positioned with a preference for flatter slopes. Most features are located off the main axis of the ridge line, but any features in this position would have been destroyed by the road. Feature inventories suggest that they are composed predominantly of opalite waste flakes and angular shatter created during the processing of toolstone, and that all save one (Feature 4) include fragments of Quarry Bifaces; these presumably were produced, broken, and subsequently discarded at the features

Figure 59. Plan of Feature 1, site 26Ek3170.

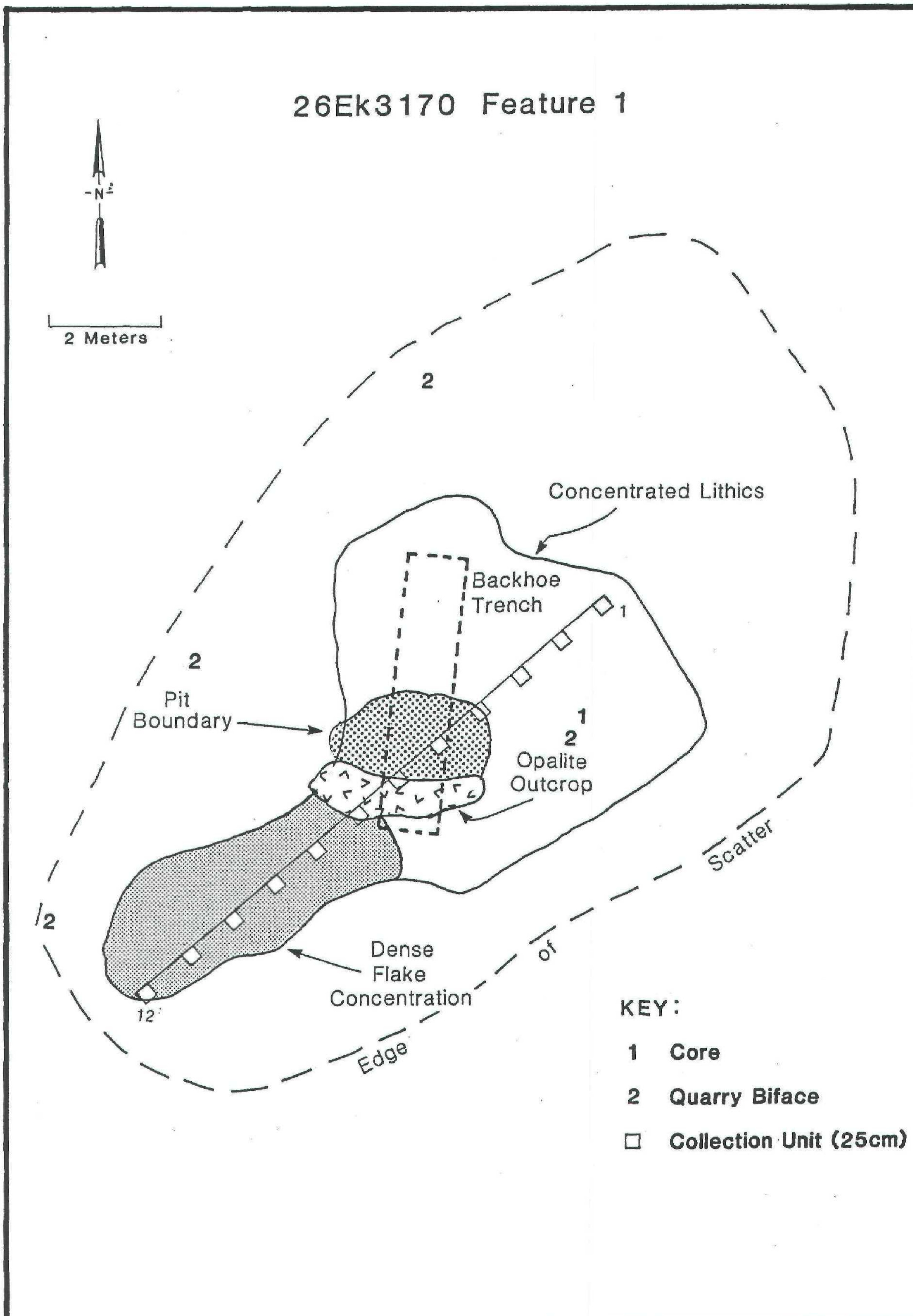
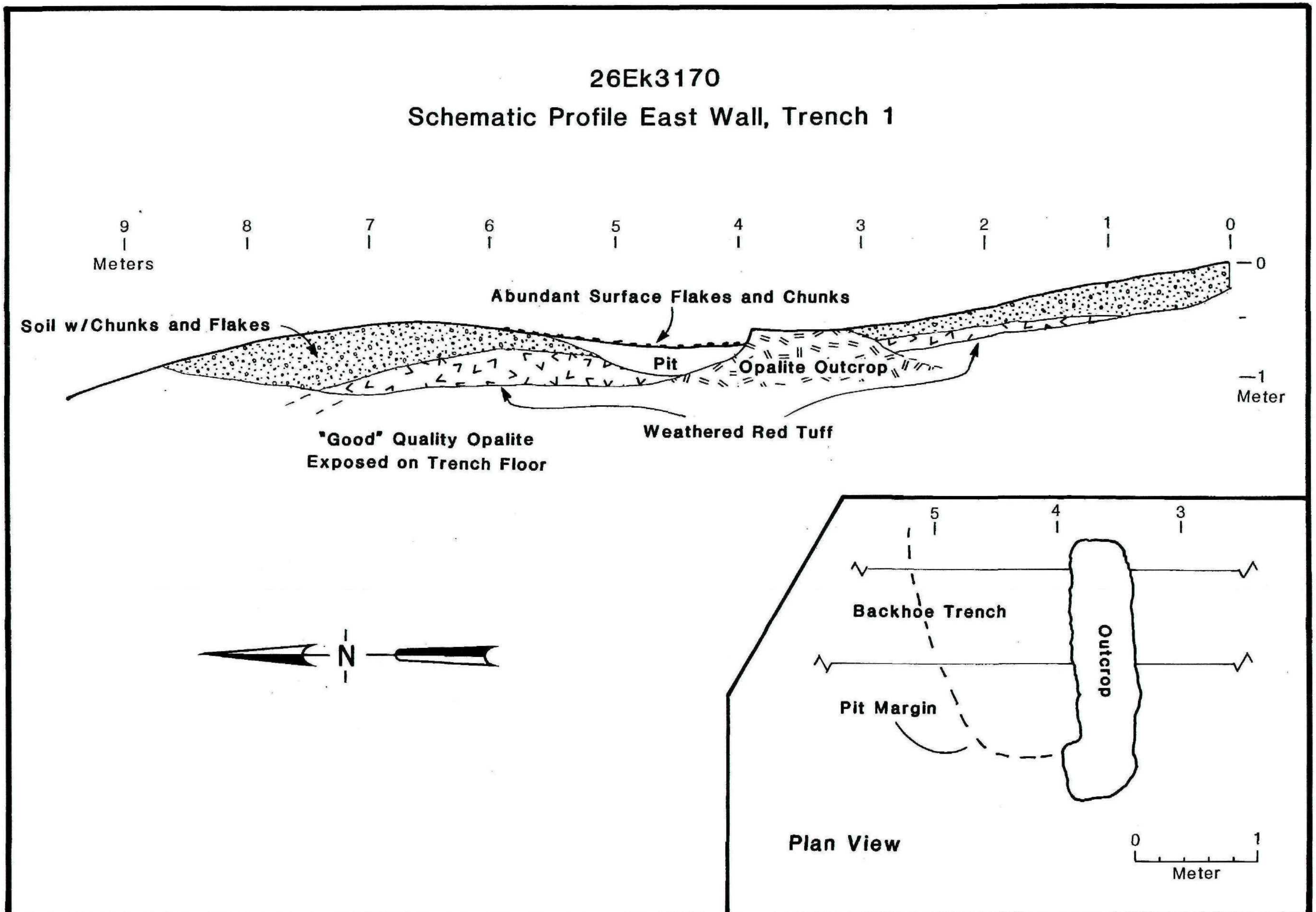

26Ek3170 Feature 1
N
2 Meters
2
Concentrated Lithics
Backhoe Trench
1
2
Pit Boundary
1
2
Opalite Outcrop
2
Dense Flake Concentration
12
Edge of Scatter
KEY:
1 Core
2 Quarry Biface
Collection Unit (25cm)

Figure 60. 26Ek3170, Feature 1, Trench 1, east wall profile.


26Ek3170
Schematic Profile East Wall, Trench 1
9
8
7
6
5
4
3
2
1
0
Meters
—0
—1
Meter
Abundant Surface Flakes and Chunks
Soil w/Chunks and Flakes
Pit
Opalite Outcrop
"Good" Quality Opalite
Exposed on Trench Floor
Weathered Red Tuff
N
5
4
3
Backhoe Trench
Outcrop
Pit Margin
Plan View
0
1
Meter

during the reduction process. Augmenting the preponderance of opalite debris, almost half of the features include obsidian debitage in their inventories (Features 3, 4, 7-10), and most (n=7) contain small flake tools such as scrapers, not directly attributable to toolstone processing tasks. Overall sizes and the number of lithic concentrations defining the features vary widely, from diminutive Feature 11 (5 m^2) with one concentration to mammoth Feature 12 whose four concentrations of reduction debris and intervening moderate density scatter encompasses some 4400 m^2. We observe that features located in the southern half (upslope) of the site tend to be smaller and more clearly defined than those in the north, where, perhaps owing to the higher density of the background lithic scatter, we were less able to differentiate feature boundaries confidently from the abundant background debris.

The origins of reduction features and the degree to which post-depositional factors color our perception of them remains obscure at 26Ek3170 and at all other sites in the project area. Obviously, they were affected by colluvial processes and bioturbation, although the magnitude and direction of these actions is unknown. In all cases, debitage concentrations are elongated ellipses in plan view, their long axes parallel to the direction of slope, with most abundant accumulations of affiliated debris occurring contiguous and immediately downslope of the concentrations. At several locations, particularly Feature 11, the two dense concentrations of cultural materials which define the feature occur coincident with a pair of rodent backdirt piles. Lithic concentrations (e.g. Feature 7 and 13) occurring within dense stands of tall sagebrush may suggest that the shelter afforded in such contexts enticed toolstone processors to locate there. Given, however, that copses of tall sage co-occur with the deepest soil accumulations, they may instead indicate contexts most conducive to intensive rodent burrowing likely to bring materials to the surface. In addition, stands of sagebrush may serve merely to impend the colluvial transport of surface artifacts which over time accrete to become discernible as concentrations.

Quarry Pit Feature 9

The total collection of cultural materials from the upper 2 cm of Feature 9 supported our initial field observation that this 3 by 2.5 m concentration of artifacts had functioned as a biface reduction station. Debitage density was high, ca. 378 items per m^2, composed of 2674 opalite flakes and 162 fragments of opalite shatter. Two Stage II Quarry Bifaces of opalite accompany the debris, and these, corroborated by the relatively high mean weight of individual waste flakes indicate that initial phases of biface manufacture created the scatter. Although no tools were recovered, non-opalite debitage occurs in the feature as well. Three obsidian flakes hint at more than exclusively quarry related activities, as does the occurrence of 13 flakes of rhyolite and a single flake of basalt. These last two material types, however, commonly are employed for percussion tools throughout the project area and may instead represent the attrition of hammerstones used in biface reduction. Opalite composing the debitage and bifaces appears to consist of material from a common source and, on the basis of visual inspection, is of the same color and texture as that occurring at the quarry pit of Feature 1 located some 100 m upslope.

The northwestern quadrant of the site (shaded area in Figure 58), with a dense debitage scatter and a high incidence of apparently isolated artifacts, proved difficult to assess *since its structure was reflected by subtle differences in* surface artifact density over a large area. A line of 5 1 by 1 meter shovel scrapes along the sample transect (Figure 58) was placed to help quantify variation in this area. Recovery rates obtained are summarized in Table 78.

Table 78. Debitage Recovered from Discretionary Surface Collections, Site 26Ek3170.

	OPALITE DEBITAGE				OTHER DEBITAGE			
Unit	Flakes		Shatter		Flakes		Shatter	
Number	(n)	(Av Wt [g])	(n)	(Av Wt [g])	(n)	(Av Wt [g])	(n)	(Av Wt)
1	46	3.10	4	0.45	2	6.50	-	-
2	119	2.13	28	1.27	2	0.20	-	-
3	1158	1.56	44	2.05	3	2.30	-	-
4	62	1.79	12	1.58	-	-	-	-
5	50	3.33	13	3.77	1	0.80	-	-

Table 78 merits note in two particulars. First, the absolute flake density peaks strongly toward the center of the area, in concert with flakes of the smallest mean size (1.56g). Second, the ratio of flakes to shatter also reaches its highest peak (26.3:1) at this point. This suggests that, generally, later stage reduction was occurring in the center of the area, with earlier stage reduction carried on along the peripheries. Noteworthy, too, is the great color diversity of opalite recovered from all of the collection units suggesting that the zone consists of a palimpsest of numerous reduction episodes, often involving material from different off-site sources.

Because of the abundance and diversity of surface materials occurring in this northwestern quadrant, as well as to the apparent possibility of depth in the silty deposits, two 1 by 1 m excavation units were placed to test the vertical distribution of artifacts. One (Excavation Unit 1) was coincident with Discretionary Surface Collection Unit 1; the other explored an expanse to the north.

The two units exposed basically similar profiles, of which the west wall of Unit 2 is given as example (Figure 61). An upper, humic layer of loose sandy silt, high in organics, occupies the upper 3 to 6 cm. It is underlain by 15 to 20 cm of somewhat bioturbated silt loam, and contains occasional angular to sub-rounded cobbles of rhyolite, tuff, and opalite. This stratum grades to a clayey silt at 20 to 30 cm below the surface; both units were terminated at 40 cm, where increasing proportions of rhyolite tuff clasts rendered further excavation fruitless. Recovered cultural materials are presented in Table 79.

Table 79. Artifact Collections from Excavation Units 1 and 2, Site 26Ek3170.

	ARTIFACT CLASSES											
	Reduction					Points	Processing		Opalite Debitage		Other Debitage	
	HM	AP	QB	SB	PB	PT	SC	GS	F	S	F	S
Excavation Unit 1	-	-	-	-	1	3	2	-	1949	202	424	-
Excavation Unit 2	1	1	3	1	-	-	-	1	890	271	21	-

Key to Artifact Classes

Reduction Tools and Artifacts
HM = Hammerstones
AP = Assayed Pieces
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces
PB = Preform Trajectory Bifaces

Projectile Points
PT = Classifiable Points

Maintenance/Processing
SC = Scrapers
GS = Groundstone (metate)

Debitage
F = Flakes
S = Shatter

While in Unit 1 about 90% of the cultural items were recovered in the upper 20 cm of the deposit, over 40% from Unit 2 came from levels 20 to 40 cm below surface. In both units opalite waste flakes dominate the assemblage, but like surface contexts in the same area, a diverse variety of stone tools occurs as well, including three of the four classifiable projectile points, and a metate.

The second bench of Ramadan Ridge is occupied by 26Ek3171 (Figure 62). Like 26Ek3170, lying some 100 m downslope to the north, the site juxtaposes functionally distinct activity areas; two quarry pits and a cobble quarry lie interspersed with reduction stations and a large indistinct zone scattered with abundant and diverse materials.

Eight cultural features occur on the relatively flat surface of the bench, with which the boundaries of the site are coterminous. Various of these features have been compromised by historic and modern mining activities; a bladed road runs along the ridge crest from north to south, and several bladed scrapes

Figure 61. 26Ek3170, excavation unit 2, west wall profile.

1. Fine sandy silt with organics (root zone). 10YR 6/2.
2. Silt loam with fine to coarse sand. 10YR 5/2.
3. Clayey silt. 10YR 4/3.

26Ek3170

WEST WALL, UNIT 2

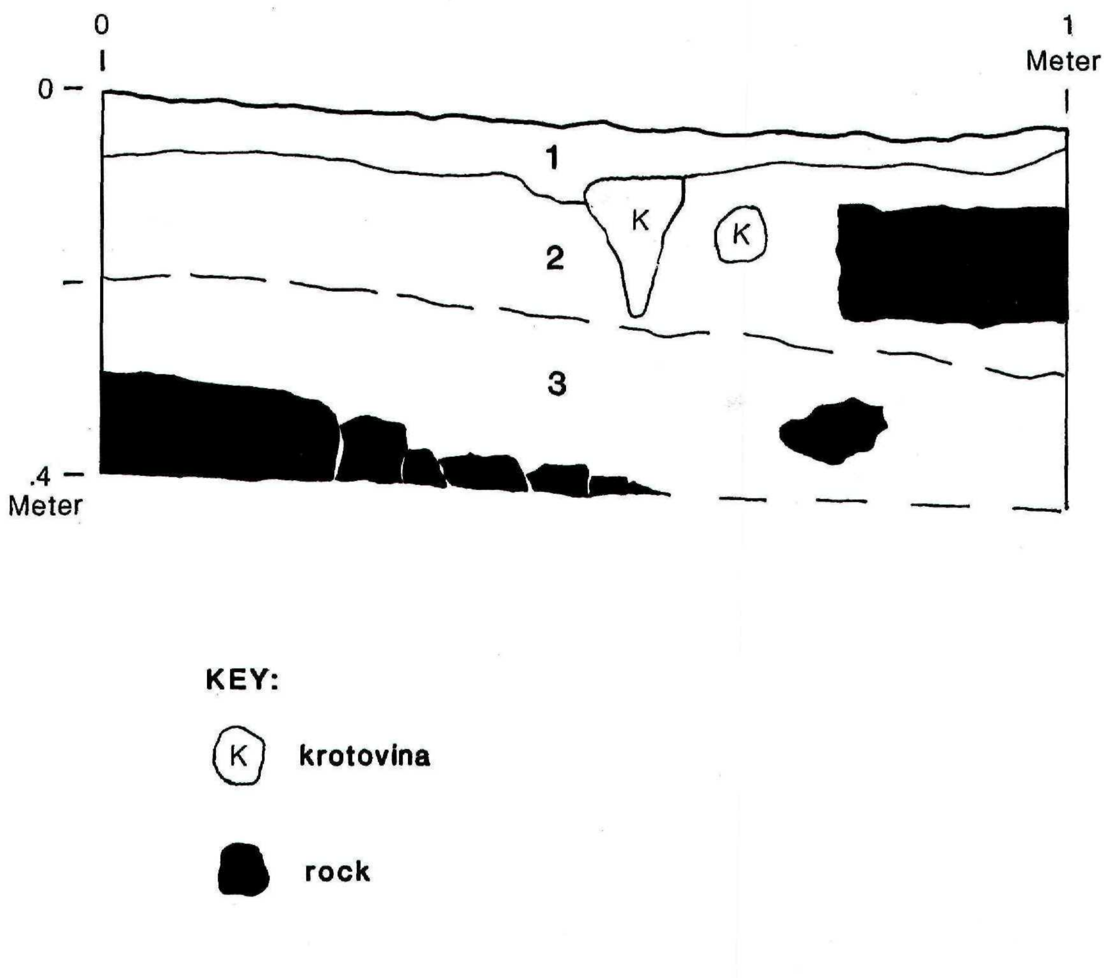
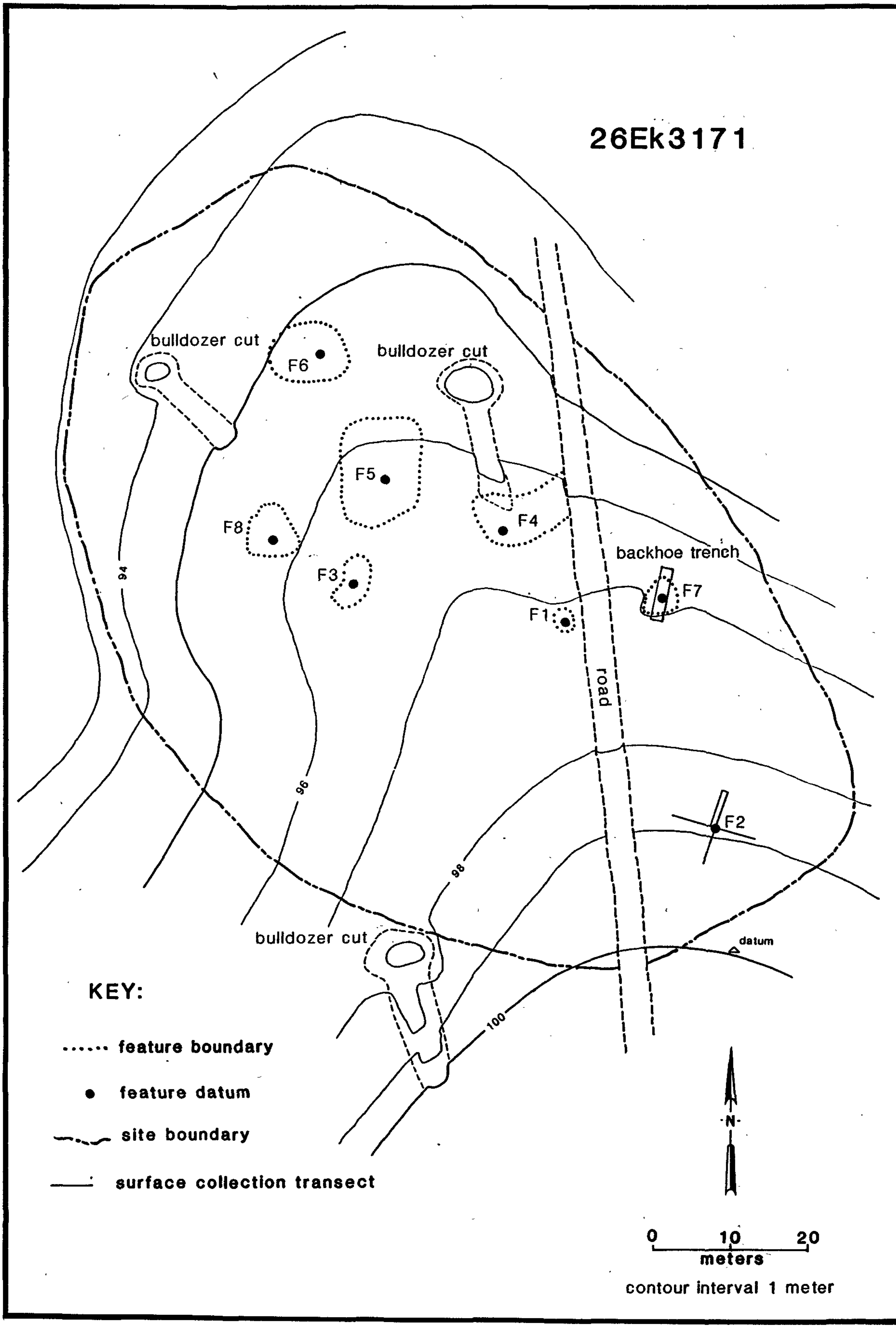


Figure 62. 26Ek3171, site map.


26Ek3171
bulldozer cut
bulldozer cut
bulldozer cut
F1
F2
F3
F4
F5
F6
F7
F8
backhoe trench
road
datum
94
96
98
100
KEY:
feature boundary
feature datum
site boundary
surface collection transect
N
0 10 20
meters
contour interval 1 meter

occur within the site precinct. The cobble quarry of Feature 4 has been intruded by one such scrape. And, Feature 7, a quarry pit, served as the station of a recent exploratory drilling operation, with the consequence that its surface sustained major impact. Its interior was penetrated by the drill hole, and its contents infused with drilling fluids. In addition to surface disturbance, a scatter of refuse testifies to several decades of intermittent 20th century use, some of it likely related to a small mineshaft that lies just upslope to the south of the site.

26Ek3171

From the vista provided by comparison of the relative frequencies of artifact types and the diversity of prehistoric *behaviors implied by them, 26Ek3171 appears to have hosted* activities roughly identical to those evidenced at 26Ek3170, but in microcosm (Table 80; cf. Table 76). However, owing perhaps to the comparatively greater abundance of opalite source material offered at 26Ek3171 by two quarry pits (Features 2 and 7; Figure 62) and an extensive cobble field (Feature 4), toolstone manipulation here appears to have included relatively greater emphasis on the most incipient steps in the processing of the stone.

Table 80. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Site 26Ek3171.

		Total	ARTIFACT CLASSES												
Fea		Area	Reduction					Points		Processing					
No.	Type	(sq m)	HM	SS	AS	QB	SB	PT	FG	SC	KN	PG	GS	CS	Total
1*	Core Reduction	189	3	3	1	-	8	-	-	-	-	-	-	-	13
2*	Quarry Pit/Core Reduction	140	2	-	2	3	-	-	-	1	-	-	-	-	8
3	Core Reduction	16	-	-	-	-	1	-	-	-	-	-	-	-	1
4	Cobble Quarry/ Core Reduction	227	-	-	-	3	1	-	1	2	-	1	-	-	8
5	Biface Reduction	177	-	-	-	3	3	1	-	-	-	-	-	-	7
6	Biface Reduction	63	-	-	-	1	-	-	-	2	-	-	-	-	3
7	Quarry Pit/Biface Reduction	55	2	-	-	6	-	-	-	-	-	-	-	-	8
8	Biface Reduction	28	-	-	-	2	-	-	-	-	-	-	-	-	2
-	Extra- Feature	N/A	-	1	2	4	4	-	-	1	3	-	1	8	21

* Sample Feature

Key to Artifact Class

<u>Reduction Tools and Artifacts</u>
HM = Hammerstones
SS = Scratched Stone
AS = Assayed Piece
QB = Quarry Trajectory Biface
SB = Small Trajectory Biface

<u>Maintenance/Processing</u>
SC = Scrapers and Spokeshaves
KN = Knives
PG = Perforators and Gravers
GS = Groundstone
CS = Ceramic Sherd

<u>Projectile Points</u>
PT = Classifiable Point
FG = Unclassifiable/Fragment

Inventory suggests that fully one half of the eight features recorded at the site (Features 1-4) contain debitage assemblages comprised chiefly of massive angular shatter and large primary flakes indicative of quarrying, and the preliminary transformation of these pieces into minimally reduced Quarry Bifaces. Although comparable in overall size to features at 26Ek3170, those at 26Ek3171 appear to be somewhat less densely littered with cultural debris and are composed of fewer discernible concentrations of artifacts. Only Features 4 and 7 evidence multiple debitage concentrations (n=3 and 2, respectively); the remaining features are defined by only a single lithic cluster each. Like its neighbor on the north, the majority of features at 26Ek3171 also include tools customarily associated with maintenance and processing rather than toolstone procurement. Among these features, Feature 4 is noteworthy for the number and variety of such tools, and Feature 5 for a Desert Side-notched projectile point. A high incidence of such non-quarrying and reduction tools also occurs outside feature boundaries.

Feature 1

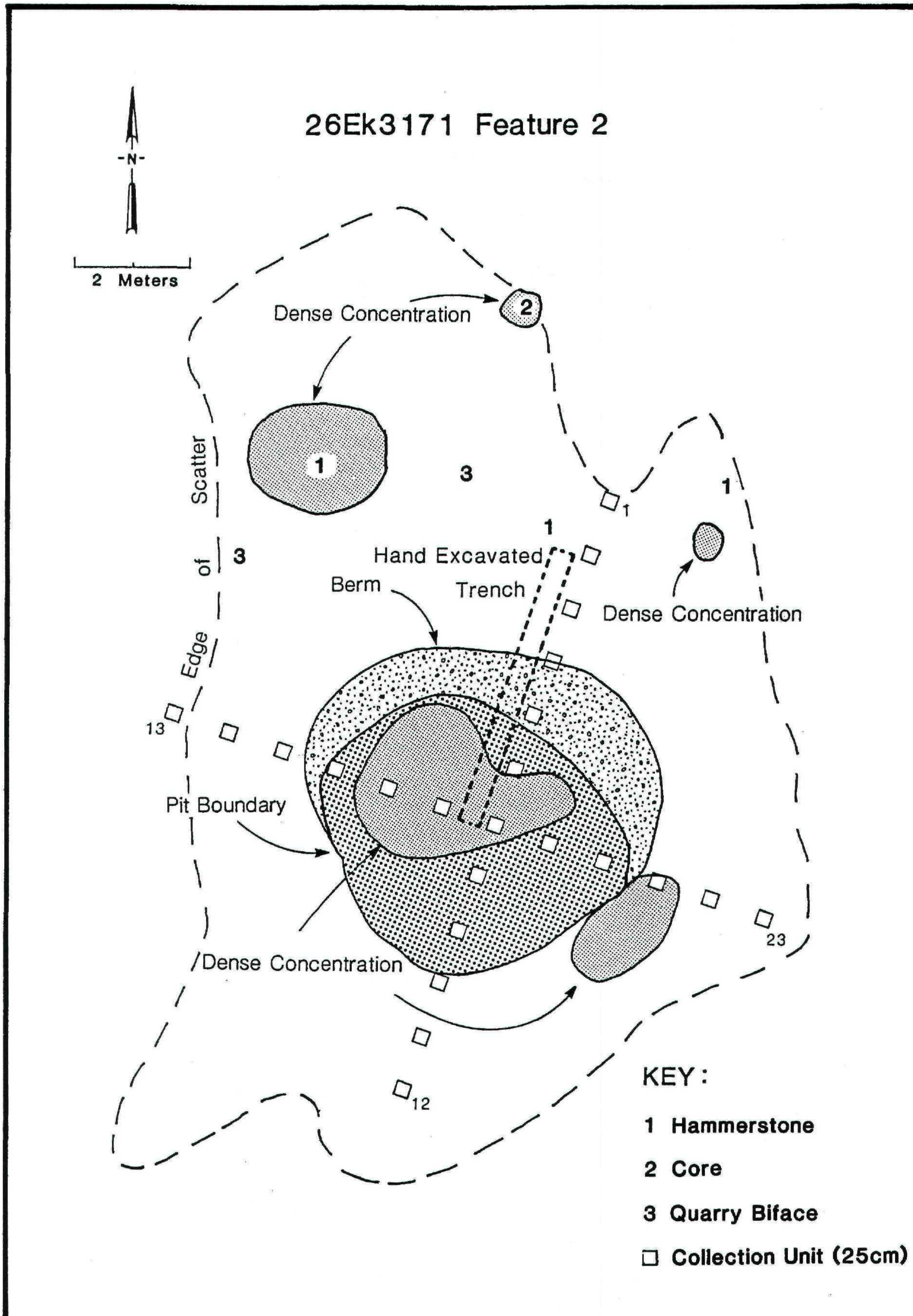
The single lithic scatter tested, a small (ca. 2 m diameter), circular concentration of reduction debris, yielded a sample of 2703 cultural items, of which 1874 are opalite flakes and 794 are pieces of opalite shatter. The mean weight of flakes in the assemblage (10.46 gm) is sufficiently robust to support the field assessment that the feature represents an early stage reduction station, a conclusion enhanced further by the incidence of 6 Stage 2 Quarry bifaces, a pair of Stage 3 Quarry Bifaces, and a single core. The small area of the feature and relative uniformity of material suggest that it resulted from a single reduction episode.

Feature 2

The surface of Feature 2, the smaller (6 m diameter) of the quarry pits at the site, yielded few artifacts (2 Stage 2 and 1 Stage 4 Quarry Biface, and a pair each of hammerstones and assayed pieces). Collection units arrayed along intersecting baselines recovered 1440 cultural items, composed of 582 opalite flakes and 838 pieces of opalite shatter. The abundance of flakes climbs gradually as each line crosses the pit berm from the exterior, and declines somewhat in the interior of the pit. This suggests either that the berm was the area in which primary reduction was concentrated, or that previously accumulated debitage was thrown out of the pit during the course of further excavation (Figure 63).

The pit contains a large (40 by 60 by 37 cm) subrounded, battered opalite boulder exposed near its center. This boulder

Figure 63. Plan of Feature 2, site 26Ek3171.



26Ek3171 Feature 2
N
2 Meters
Dense Concentration
2
1
3
1
1
Hand Excavated
Trench
Berm
Dense Concentration
3
Edge of Scatter
13
Pit Boundary
/Dense Concentration
23
12
KEY:
1 Hammerstone
2 Core
3 Quarry Biface
Collection Unit (25cm)

is similar to boulders in the bottom of Little Antelope Creek, but the feature lies ca. 25 meters above the creek. Such boulders are common in the study area, relicts of Pliocene/Pleistocene Little Antelope Creek (Mark Bartlett, Touchstone Resources Company, personal communication 1988).

The shallow (70 cm deep) trench, hand excavated from the center of the feature through its northern (downslope) berm is offered in profile by Figure 64. In the center of the pit, the upper layers are a 1 cm lag deposit of opalite flakes and angular chunks of tuff overlying 2-3 cm of black (10YR 2/1), duff-like organic material comprised of partially decomposed vegetation and charcoal, the latter presumably derived from recent range fires.

Below the duff is 40 to 50 cm of dark brown (10YR 3/3) cobbly, gravelly silt loam, with abundant large clasts of tuff and opalite. Opalite toolstone is more abundant than tuff in the upper 20 cm of this deposit, while equal amounts of these materials occur in the lower portion.

Below ca. 50 cm from the surface lies a dark reddish brown (5YR 3/4) gravelly, cobbly, sandy clay. Tuff is mostly absent, and the opalite clasts seem less dense - either they are more highly weathered or they are poorly silicified. This material is probably not a cultural deposit; perhaps it is the undisturbed B horizon above the bedrock.

Interpretation of the stratigraphic record at this feature is difficult because the deposits were not very well observed in the shallow trench. We assume that the upper 50 cm of the sediment in the pit was derived from toolstone extraction and processing, but these deposits seem to lack the internal stratification marking sequent quarrying episodes observed elsewhere.

Feature 7

Feature 7 is a large, open quarry pit over 6 m in diameter and at least 80 cm deep, surrounded by a berm of opalite cores and flakes on the down-slope side, particularly dense in the northwest quadrant of the feature. A backhoe trench was cut through Feature 7 along its north-south axis (Figure 65).

The ground slopes down to the north in the vicinity of the feature. A shallow (20 to 30 cm) mantle of colluvial soil overlies tuff bedrock. The upper 10 to 30 cm of bedrock is highly weathered and fractured into angular blocks, 10 to 20 cm in diameter; orange clay (probably a weathering product of the tuff) fills the cracks between blocks. Below the weathered zone, the bedrock is solid and, in places, more silicified. Feature 7 was apparently excavated through the weathered bedrock into an underlying pocket of silicified tuff or opalite.

Figure 64. 26Ek3171, Feature 2, north and south wall profiles.

1. Organic duff. 10YR 2/1.
2. Brown gravelly silt loam with opalite cobbles. 10YR 3/2.
3. Brown silt loam, increasingly plastic, with opalite and tuff cobbles. 7.5YR 3/2.
4. Gravelly, sandy clay. 5YR 3/4.

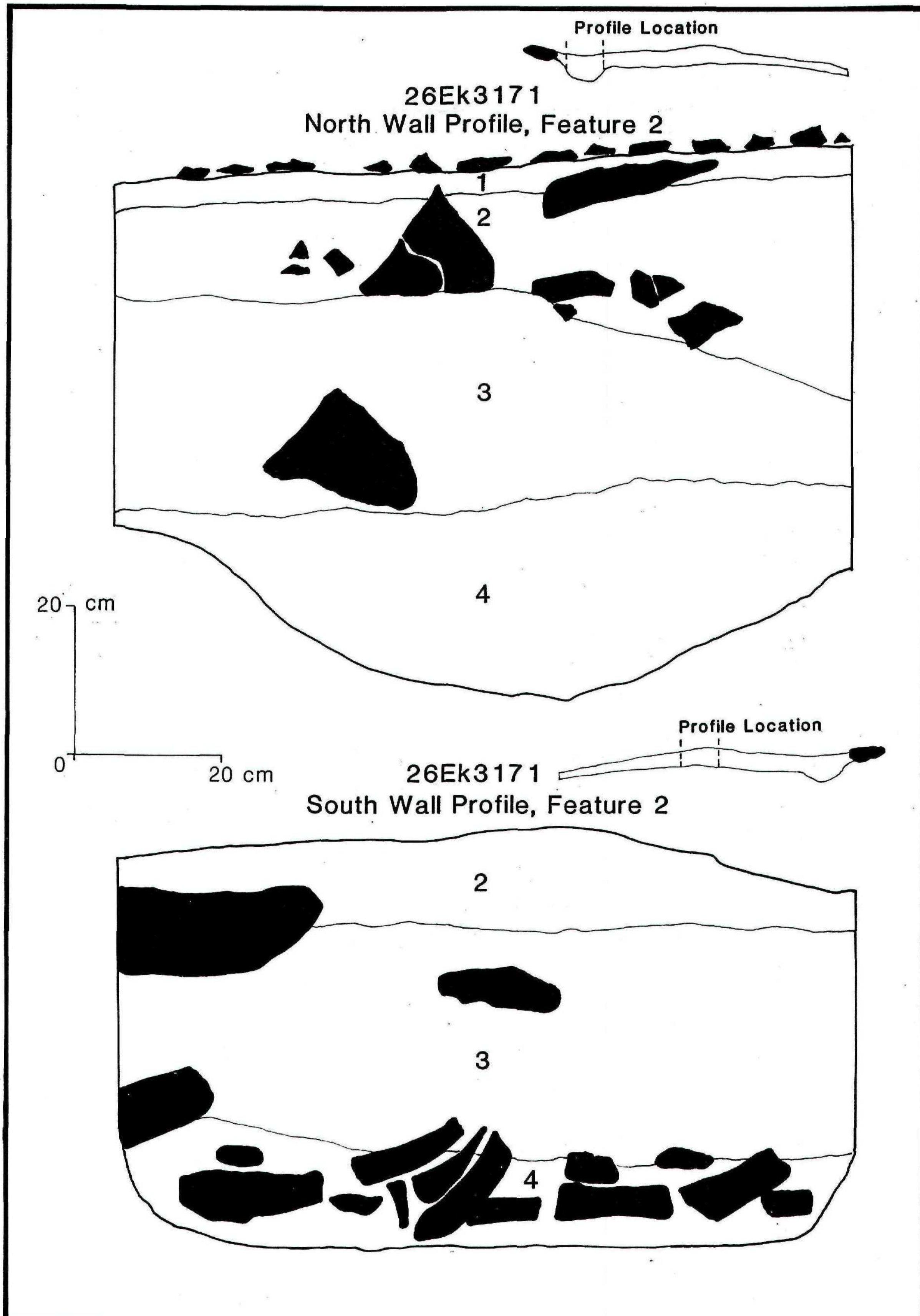
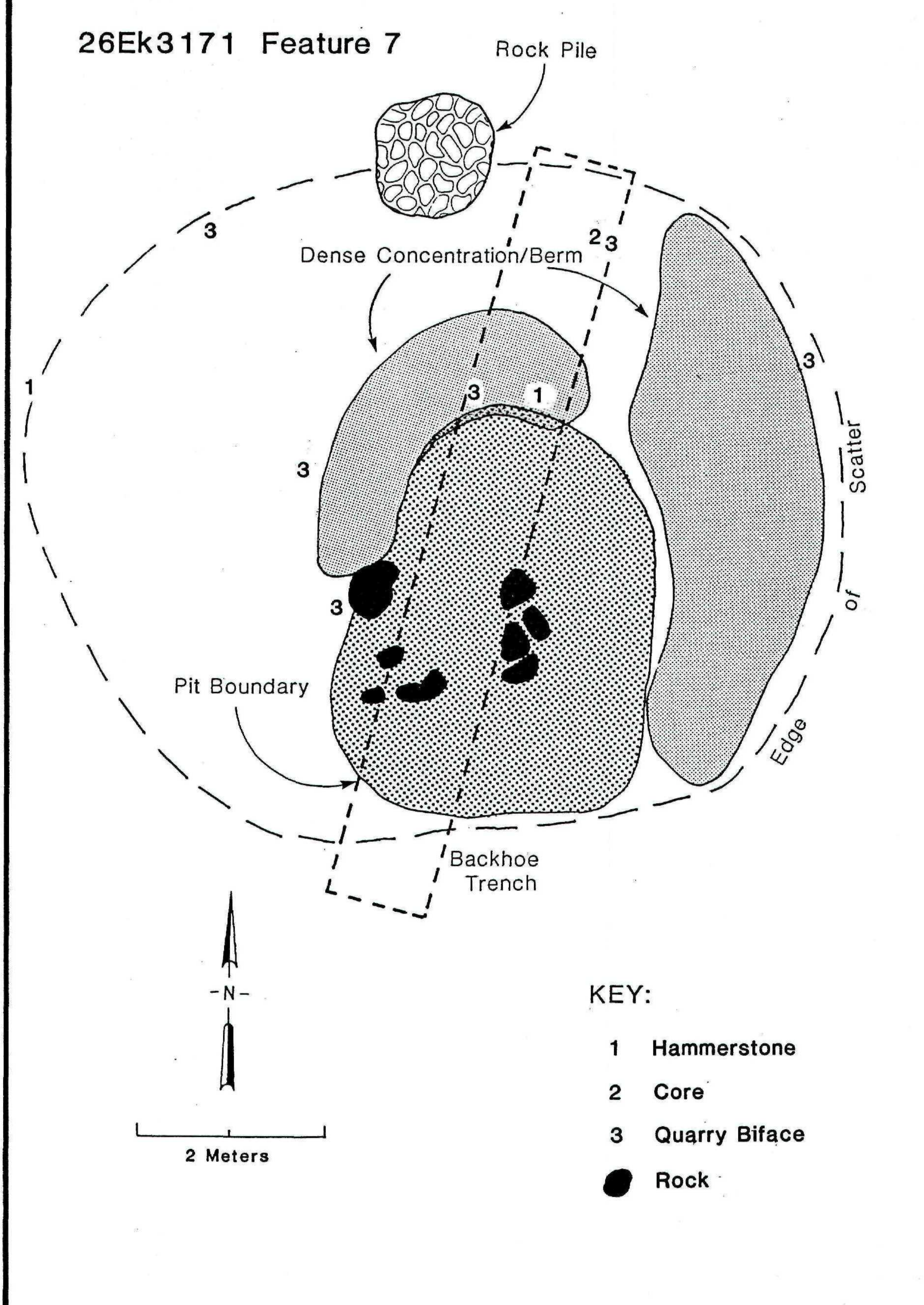

Profile Location
26Ek3171
North Wall Profile, Feature 2
1
2
3
4
20 cm
0
20 cm
Profile Location
26Ek3171
South Wall Profile, Feature 2
2
3
4

Figure 65. Plan of Feature 7, site 26Ek3171.


26Ek3171 Feature 7
Rock Pile
Dense Concentration/Berm
Pit Boundary
Backhoe Trench
Edge of Scatter
-N-
2 Meters
KEY:
1 Hammerstone
2 Core
3 Quarry Biface
Rock

The stratigraphic record at Feature 7 is complex and not easily deciphered (Figure 66). Rather than being continuous across the profile, or obviously truncated by later excavations, the strata are intercalated lenses, seldom more than 2 m in length. While there are trends in their relationships, it is not possible at this point to discern obvious stratigraphic horizons that relate to different periods of quarry use. There do, however, seem to be only a few basic types of sediment. While strata are numbered, it was not possible for the numerical order to reflect completely vertical position in the stratigraphic column.

The trench profile suggests that Feature 7 was not created during a single episode of quarrying, but gradually assumed its present size and configuration over time, beginning downslope and working mostly upslope to the south. In other words, the pit was backfilled more or less continually on the north side as excavation proceeded southward. This means that some of the pit fill is topsoil overburden, some is quarry waste, some is processing debris, and some is slopewash.

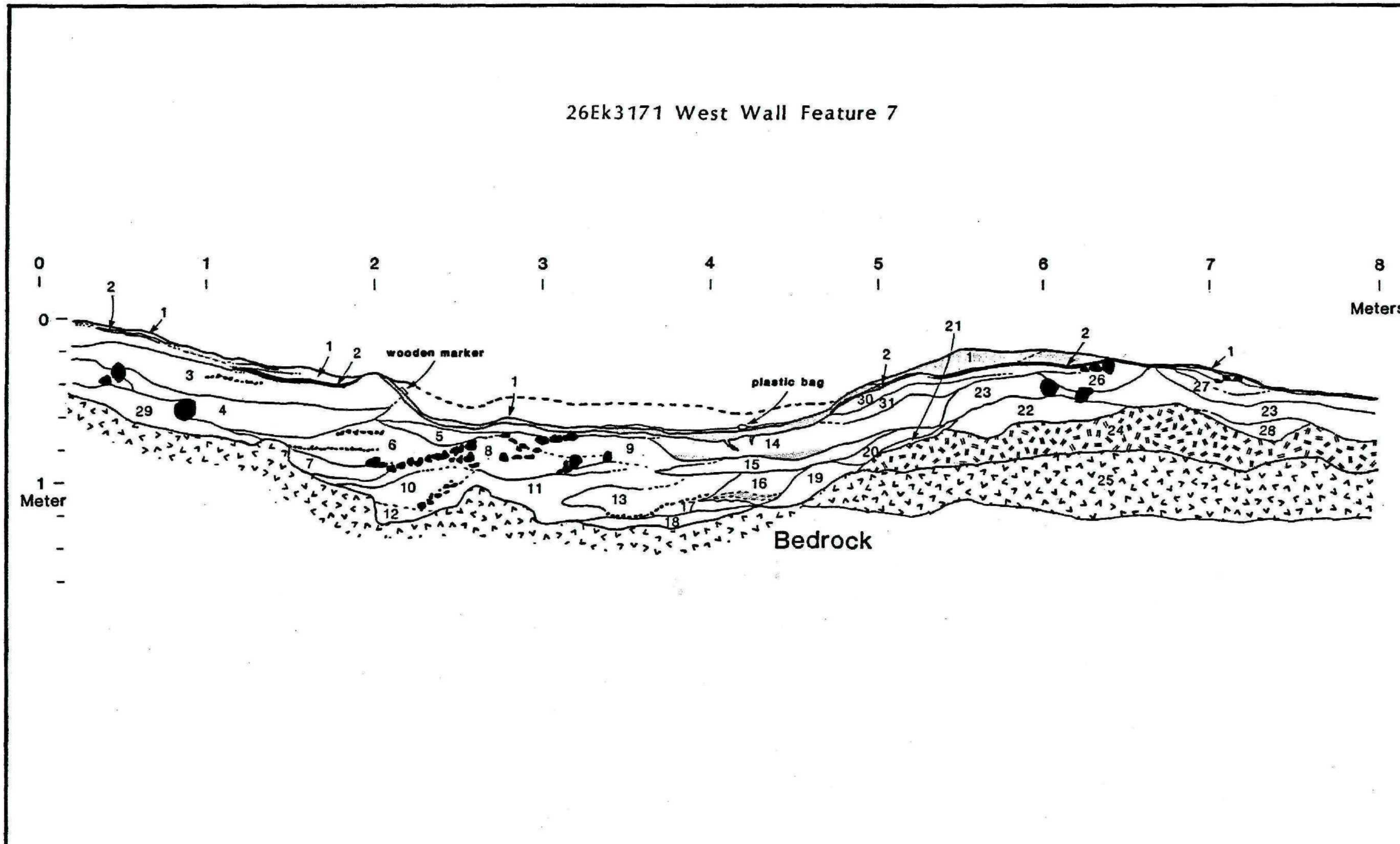
Several units contain small flecks of charcoal. Since we have not recognized burned rock in this feature, we assume that the charcoal has accumulated in the pit layers through natural means after the occurrence of local brush fires.

Perhaps the entire pre-quarry pit soil profile is preserved beneath the berm on the north side of the pit. Here one can see silicified bedrock (Unit 25) overlain by weathered bedrock (Unit 24), overlain by strong brown (7.5YR 4/6) cobbly clay loam (Unit 22), overlain by dark brown (10YR 3/3) silt loam (Unit 23). The upper two units in this sequence suggest in situ A and B horizons, respectively. Unit 3 on the south side of the feature is probably equivalent to Unit 23. The upper 5 to 10 cm of Unit 3 has platy structure common to A horizons observed elsewhere in the study area.

Unit 2 is a layer of charcoal-rich soil about 1 cm thick. Unit 2 directly overlies Unit 3 on the southern margin of the feature, and is at the undisturbed surface on the outside slope of the northern berm. Burned sagebrush stumps and roots are embedded in or extend somewhat above Unit 2, which seems to mark the last large brush fire in the project area during the summer of 1986 (S. Jaynes, personal communication).

There are two types of strata probably representing sediments accumulated as slope wash in the bottom of the pit during intervals when it was not in active use. One type is brown clay loam with varying amounts of opalite and tuff clasts. The origin of fines in such units is probably the clay in the weathered bedrock and the overlying B horizon exposed by the quarrying operations. For instance, Unit 18 in the pit bottom, resting on an excavated bedrock surface (between 3.2 and 4.3 m)

Figure 66. 26Ek3171, Feature 7, west wall profile (stratigraphic units are described in text).


26Ek3171 West Wall Feature 7
0
1
2
3
4
5
6
7
8
Meters
0
1 Meter
wooden marker
plastic bag
Bedrock
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31

is comprised of fine opalite chips and angular fragments in a matrix of brown (10YR 4/3) clay and silt. Similar deposits are Unit 12 and the southern portion of Unit 8. Units with more clay and fewer opalite or tuff clasts are Units 7, 10, 11, 13, and 19.

Another type of slopewash accumulation is represented by dark brown (10YR 3/3) silt loam that closely resembles the undisturbed upper soil horizon. Units 3, 15, 20, and 21 represent this type of deposit.

Layers with large, angular chunks of opalite and tuff, in combination with flakes and cores, are probably quarry waste and processing debris. Such layers are often openwork with little or no finer matrix; clasts in such layers are often fist-sized and larger. As pit fill, such deposits include Units 5, 8, 14, and 16, while Unit 28 is similar material deposited on the outside of the northern pit berm. Unit 20 is comprised mostly of flakes and probably represents only processing debris.

Units 4 and 6 may also represent a mixture of slopewash and debris accumulations; they are redder, and contain more sand and more flakes than the slopewash units previously described.

Feature 7 has suffered recent disturbance, apparently from drilling. A rectangular pit 3 m long, 2 m wide, and 20 cm deep was excavated in its center. The recent pit cut into prehistoric deposits of quarry waste and opalite processing debris. This material was thrown out as backdirt onto the downslope (northern) berm of the prehistoric feature. The high surface density of debitage in the northwest quadrant of the feature is mostly an artifact of the recent pit excavation.

Gray drilling mud and a red slurry apparently comprised of drilling mud and drill cuttings forms a layer in the bottom of the recent pit and lenses at the surface on the pit margins. Slurry is also found in the interstices of prehistoric strata filling the quarry pit, particularly in the layers of coarse openwork quarry debris (Units 14 and 16) on the north side. The slurry either has trickled down into the lower strata from the bottom of the recent pit, or it has moved laterally from the drill hole.

In summary, Feature 7 is a large quarry feature excavated in several episodes through the colluvial soil and weathered bedrock, into a deposit of silicified tuff or opalite toolstone. The quarry pit is filled with a few basic types of sediment either produced by active quarrying and toolstone processing or passive accumulation of material through natural processes of deposition. Dates of quarrying episodes may be obtained from charcoal observed in some strata.

Excavation Units

Three excavation units in non-feature contexts in the western and northwestern portions of the site disclosed that cultural deposits extend to a depth of 40 to 50 cm over a relatively large area. The broad, moderately flat surface of the ridge is devoid of natural exposures of opalite, but appears to have constituted the "workshop" zone in which toolstone extracted from Features 2 and 7 was further reduced (Table 81). Additional to the distinct cultural features, most of the western and northwestern portions of the site are littered with a light to moderate density scatter of debitage exhibiting considerable variety in color and texture. Surficial evidence suggests that the soft silt loams supporting the scatter have undergone significant churning by rodents, perhaps resulting in the dispersal and burial of discrete feature components; our excavation units were placed to test the internal constituency of the deposit.

Table 81. Artifact Collections from Excavation Units 1-3, Site 26Ek3171.

	ARTIFACT CLASSES								
	Reduction			Processing		Opalite Debitage		Other Debitage	
	AP	QB	SB	SC	GS	F	S	F	S
Excavation Unit 1	1	-	-	-	-	138	100	-	-
Excavation Unit 2	2	1	1	1	1	278	95	1	-
Excavation Unit 3	-	-	-	1	-	179	146	1	-

Key to Artifact Classes

Reduction Tools and Artifacts	Maintenance/Processing	Debitage
AP = Assayed Pieces	SC = Scrapers	F = Flakes
QB = Quarry Trajectory Bifaces	GS = Groundstone (mano)	S = Shatter
SB = Small Trajectory Bifaces		

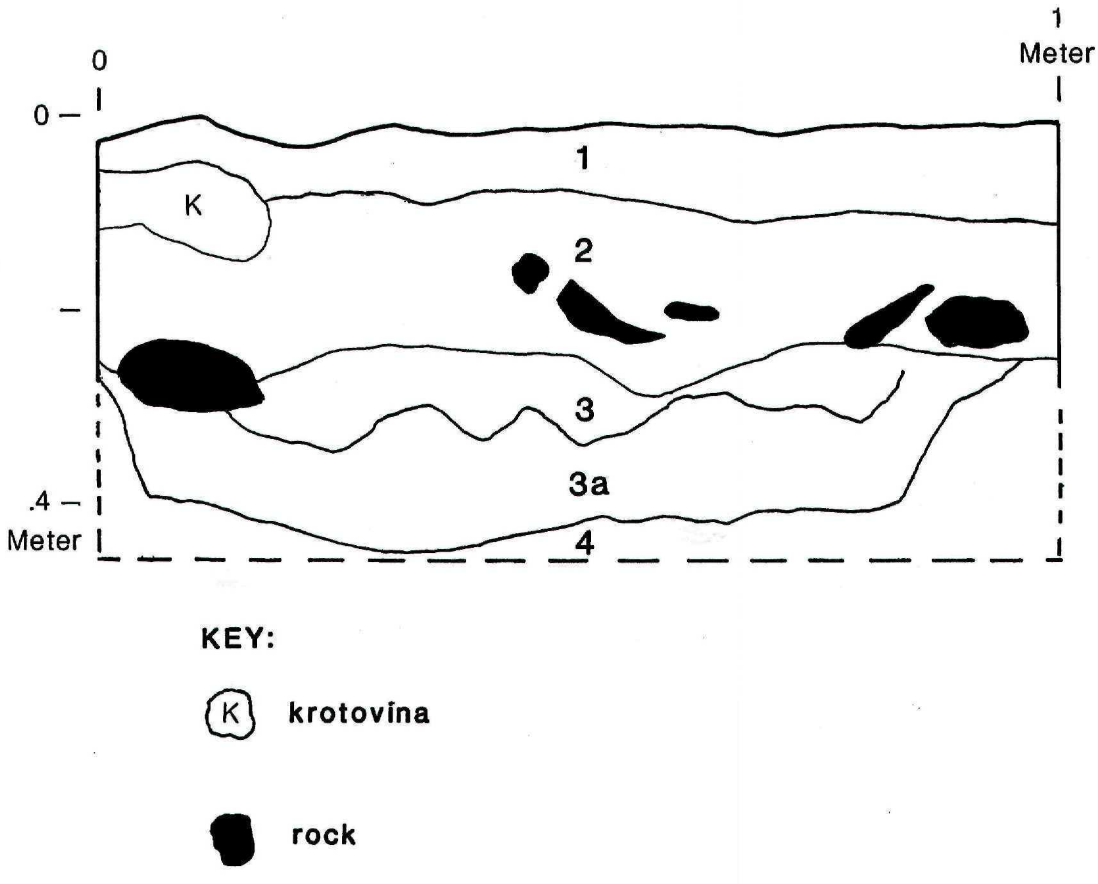
All 3 units exhibit similar profiles, of which a single example (Unit 2) is isolated for discussion (Figure 67). An uppermost zone (5 to 10 cm) of silt loam, incidentally stained by the 1985 brush fire and thus given a dark, midden-like color, contains in all units 30% to 50% of the flakes and shatter recovered. The zone is underlain by about 20 cm of silt loam in which, coincident with a general decline in flakes and shatter, the incidence of larger rocks (opalite and tuff) increases. The lowest zones (25 to 40 cm) comprise indistinctly separated units in which the incidence of clays and large rocks increases to a basal level of weathered bedrock. Small percentages of flakes

Figure 67. 26Ek3171, excavation unit 2, east wall profile.

1. Platy silt loam with rootlets; 10YR 3/2 (wet)
2. Crumb silt loam; 10YR 3.5 (wet)
3 Silty clay loam; 10YR 4/3 (wet)
3a. Silty clay loam, compact, with concentration of large rocks; 10YR 4/3 (wet)
4. Unexcavated; large chunks of butterscotch opalite (weathered bedrock)

26Ek3171

EAST WALL, UNIT 2



and apparently cultural shatter continue to occur to the deepest excavatable levels, although the limited size of our exposures did not allow us to determine whether the opalite beds at these levels had served as primary lithic sources; we suspect that they may have done so, since the size of flakes tends to increase with depth. In addition, Stage I bifaces (two specimens) and a core were recovered below 30 cm in Excavation Unit 3, the only such artifacts yielded by the units.

Summary

Although expressed to varying degrees, both 26Ek3170 and -3171 contain functionally diverse assemblages of artifacts and features which are probably best considered components of general exploration for opalite toolstone and occupation of Ramadan Ridge. Proceeding south uplsope along the ridge from Locality 27 of 26Ek3032 test results suggest that there is a decline in residentiality of sites and an increasing dominance of quarry and early stage reduction activity. It appears that 26Ek3170 is not only coterminous with Locality 27, but also that the two sites share intimate functional relationships. The residential aspect of 26Ek3170 is less strongly developed, probably a function of its somewhat greater distance from the confluence of drainages upon which residential activity appears to have been focused. And while quarry and reduction features occur within 26Ek3170, the overall assemblage and the featureless but artifact-rich northwestern quarter of the site suggest several functions other than the toolstone procurement and processing that dominates many of the other assemblages of the project area. In this respect the site stands functionally (as well as geographically) intermediate between Locality 27 and 26Ek3171. At 26Ek3171, located some 400 m from the drainage confluence supporting habitation at Locality 27, toolstone procurement received greater emphasis and residential attributes, although present (ground stone, ceramics, and relatively high assemblage diversity) are reduced.

The significance of 26Ek3170 and -3171 derives from the degree to which their data may contribute to the suite of research issues developed by Elston (1988 and Chapter 1, this volume) for the Tosawihi Quarries and their immediate vicinity. Among the site's most valuable data categories is likely to be their role as multifunctional activity areas and possible base camps for individuals engaged in both toolstone procurement and in those activities (hunting, gathering, food preparation, equipment maintenance, residence) performed in support of lithic procurement forays. Data in hand suggest that these behaviors are responsible to some degree for the creation of the Ramadan archaeological remains. More extensive exposure of areas on the sites that lack cultural features but contain diverse surface assemblages will help illuminate such activities.

Because the sites contain features of distinct classes (quarry pits, cobble quarries, core and biface reduction workshops) as well as what appear to be large zones that may prove to have residential function, they have potential for investigation of site structure. Comparison of extraction and reduction strategies employed at the open, horizontal quarry pits of Ramadan Ridge with those employed at other kinds of toolstone sources, as well as with those employed at quarry pits that are not coincident with residential functions, will shed light on problems of toolstone economics. In addition, further study of Features 2 and 7 and 26Ek3171 will afford a better understanding of the internal structure of quarry pits and contribute to a clarification of site formation processes.

Chapter 15. CORRAL FAN

by Steven G. Botkin

Corral Fan spans the southeastern quarter of USX-East (Figure 68). It contains the lowest density of sites in the project area and is most distant from documented residential bases (i.e., Locality 27 of 26Ek3032 in Big Meadow). It lacks surface water and is exposed to weather. The local mixed tall sage/low sage community, duplicates that of the immediate surroundings.

The landscape consists of gently undulating north-facing uplands composed of a series of broad finger ridges and intervening shallow gullies forming the mildly dissected northwestern foot slope of the skyline ridge well south of the project area. Corral Fan is a mineralogical transition zone where, as slopes rise southward from the banks of Undine Gorge, opalite outcrops become more rare while exposures of unsilicified tuff become more common. The light brown sandy colluvial soils contain abundant angular cobbles and gravel of rhyolite tuff. They remain unsounded except where trenched at 26Ek3200. There, ca. 30 cm of colluvial deposits cover tuff bedrock. Soils are generally shallow throughout the area.

Descriptive Site Summary

Four sites were recorded in the Corral Fan subarea (Table 82); three, 26Ek3196, 26Ek3194, and 26Ek3199, are large but diffuse lithic scatters occupying the tops of low finger ridges and knolls along the southern fringe of the project area. Assemblages are dominated by opalite secondary flakes and the occasional early stage opalite biface fragments and cores. None of these sites contains lithic concentrations sufficiently dense or discrete to be identified as cultural features (Raven 1988) and none was tested. The only subarea site tested is the quarry pit and associated reduction debris of 26Ek3200.

Table 82. Descriptive Summary, Corral Fan Sites.

Site Number	Type	Maximum Features (n)	Site Area (sq m)
26Ek3176	Diffuse Lithic Scatter [NOT TESTED]	-	4,240
26Ek3194	Diffuse Lithic Scatter [NOT TESTED]	-	8,840
26Ek3199	Diffuse Lithic Scatter [NOT TESTED]	-	1,180
26Ek3200	Quarry Pit/Reduction Complex	1	240

Figure 68. Topographic setting, Corral Fan sites.

TOSAWIHI QUARRIES:
ARCHAEOLOGICAL INVESTIGATIONS AND ETHNOGRAPHIC STUDIES IN NEVADA

Note:

One or more pages have been removed from this part of the report due to sensitivity of specific archaeological site location information. Qualified persons may contact the Nevada Bureau of Land Management, Elko Field Office, to inquire about obtaining additional information.

Site 26Ek3200 is the easternmost and smallest of the open sites tested in USX-East, and is one of the highest elevation (5760 ft amsl); it also is the most isolated. The site rests on a small bench above a minor seasonal drainage, coincident with the outcropping of a pair of opalite ledges (Figure 69).

The site is defined by a scatter of large opalite flakes intermixed with numerous initial stage Quarry Bifaces. Apparently unmodified opalite cobbles and slabs abound. An area centered on the rock outcrops was designated Feature 1 (Figure 70). Here, a dense scatter covers an area 24 m by 14 m, with densest concentrations downslope from the principal bedrock ledge where a roughly circular depression (4m diameter) and associated berm define a quarry pit. A second, smaller depression (3 m diameter) lies immediately north of the quarry pit, and may constitute a more incipient, but abandoned, effort. Much of the toolstone currently exposed on the site surface, including many cultural specimens, exhibits extensive colonies of lichen. In places, this growth nearly blankets the exposed faces of several contiguous stones. Lichen is especially dense and widespread in the vicinity of the lesser depression, suggesting that stones in this area may have lain undisturbed longer than elsewhere.

Testing Strategies

In order to sample the surface composition of the quarry pit and its surrounding accumulation of tailings, a series of 12 25 cm by 25 cm units was shovel-skimmed and screened at one meter intervals along a baseline transect parallel to the slope, extending downslope from above the outcrop ledge, across the pit and berm, to the base of the talus. Then, a one meter wide trench was hand excavated parallel to the surface collection baseline to expose internal stratigraphy. One wall of the trench was drawn in profile, and bulk samples of the principal stratigraphic components were collected (Table 83).

Table 83. Summary of Testing Procedures and Artifact Collections at Quarry Pit/Reduction Site 26Ek3200.

FEATURES RECORDED			FEATURE CONTEXT			RECOVERED COLLECTIONS					
Total (n)	Sampled (n)	Total Area (sq m)	Subsurface Excavation Volume (cu m)	Stratigraphic Profile (n)	Column Samples (n)	Debitage (n)	Reduction HM	Reduction QB	Processing SC	Processing CH	Other BS
1	1	242	1	1	17	1,188	1	12	1	1	1

Key to Artifact Classes:

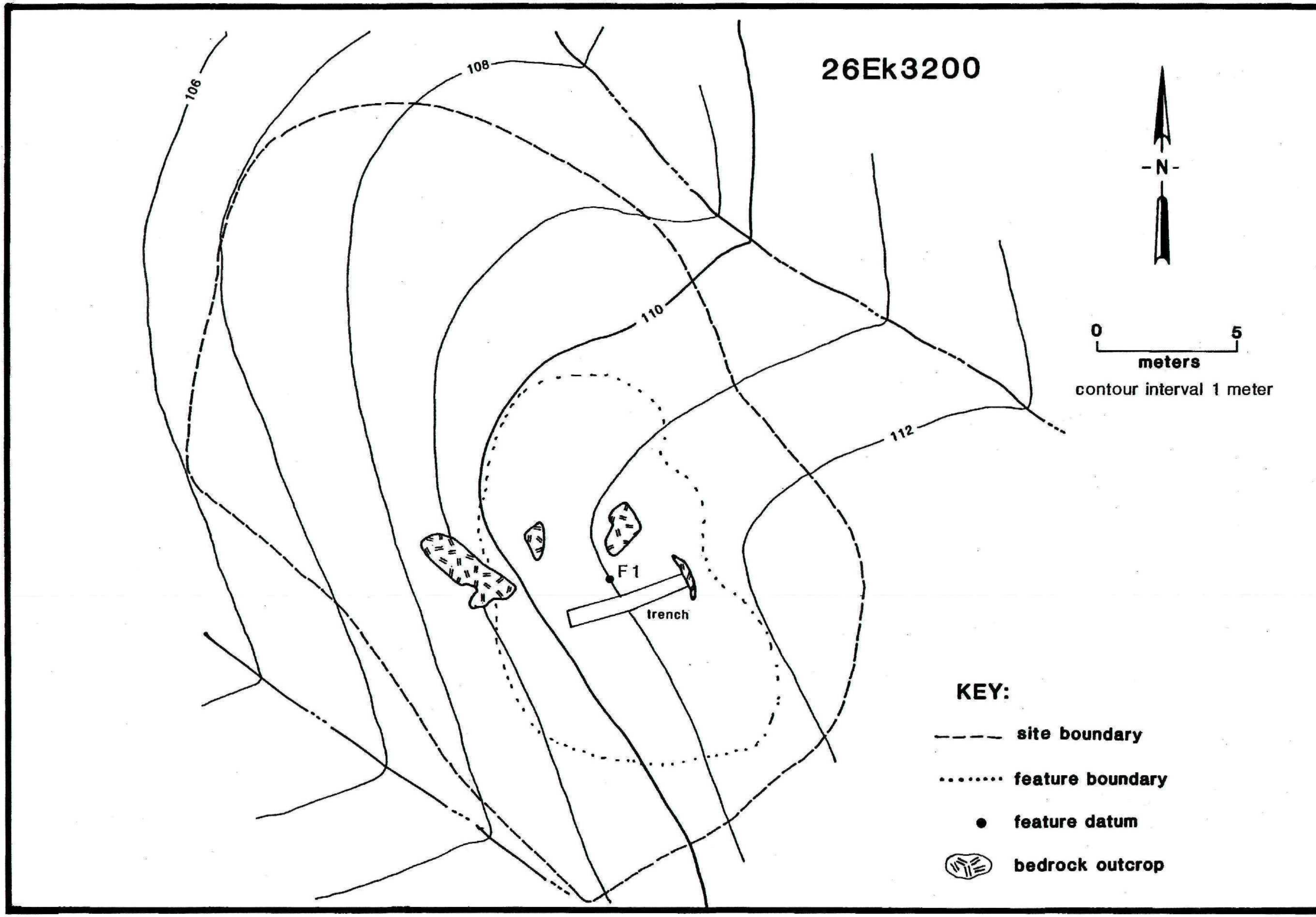
Reduction Tools
HM = Hammerstone
QB = Quarry Biface

Maintenance/Processing Tools
SC = Scraper
**CH = Chopper

Other
**BS = Bison Scapula

** = Possible digging tools

Figure 69. 26Ek3200, site map.


26Ek3200
N
0
5
meters
contour interval 1 meter
106
108
110
112
F1
trench
KEY:
site boundary
feature boundary
feature datum
bedrock outcrop

Chronology

The age of the cultural deposits remains unknown. Neither temporally diagnostic artifacts nor obsidian were recovered. Examination of the trench sidewall bisecting the quarry pit suggests that Unit 10 of Horizon II contains buried charcoal and may, upon further exposure, produce quantities sufficient for radiocarbon assay. If adequate micro-climatic controls could be established for the area, lichenometry might prove informative in chronological assessments of surface contexts.

Assemblage Composition

Formed artifacts are almost exclusively those related to procurement of toolstone and initial stages of its reduction (Table 83). All twelve Quarry Bifaces recovered occurred on the surface; half are Stage 2 forms, five are Stage 3, and one has been thinned secondarily to reduction Stage 4. A large quartzite slab (ca 1.4 kg) with battered, step-fractured edges was found a few meters downslope from the quarry pit. Although categorized on morphological grounds as a "chopper," its tabular shape and damaged edges suggest its possible use as a digging or hoe-like implement, presumably employed in the excavation of the depression.

A quartzite hammerstone and a fragment of the proximal portion of a *Bison* sp. scapula were recovered from the trench sidewall within the quarry pit. The latter piece may represent the remnant of a digging tool; the broad, robust form of the original unfragmented bone could have proven useful in digging or scooping to remove liberated debris from the pit. This inference is supported by the recovery of a similar specimen from site 26Ek3208 at Red Hill in USX-West and from comparable quarry contexts elsewhere (cf Ahler 1986).

The only artifact whose implied function is not attributable directly to toolstone extraction/processing tasks is an opalite flake scraper obtained from shovel-skim Unit 2 located immediately upslope from the quarry pit.

Site Context and Structure

Of all sites tested, 26Ek3200 constitutes the purest expression of unifunctional toolstone procurement. The opalite source material there occurs in relatively isolated geographic context, yet appears to be of superior quality. This probably conditioned use of the place, since numerous much larger (but inferior) sources lie more conveniently along the margin of Undine Gorge.

Like quarry pits explored at other sites at USX-East (cf 26Ek3195 and 26Ek3197) the pit at 26Ek3200 accesses toolstone lying in subsurface contexts at the base of a low opalite outcrop. Presumably, aboriginal miners undertook such labor-intensive toolstone excavation in pursuit of the inherently superior knapability of unweathered material (cf. Elston, Chapter 1, this volume).

As described above, our testing operations collected an assemblage of limited abundance and diversity. However, in some respects, it is lack of diversity, as well as structural clarity (cf. below), that renders the site so highly informative about one aspect of toolstone procurement, i.e., quarry pitting.

Figure 70 depicts the plan structure of the principal quarry pit feature and the distribution of surface artifacts, as well as the disposition of the sample collection units and hand excavated trench along the sampling transect. Table 84 arrays the recovery of debitage from individual units.

Table 84. Debitage from Sample Feature 1, Site 26Ek3200.

SURFACE COLLECTIONS

OPALITE DEBITAGE

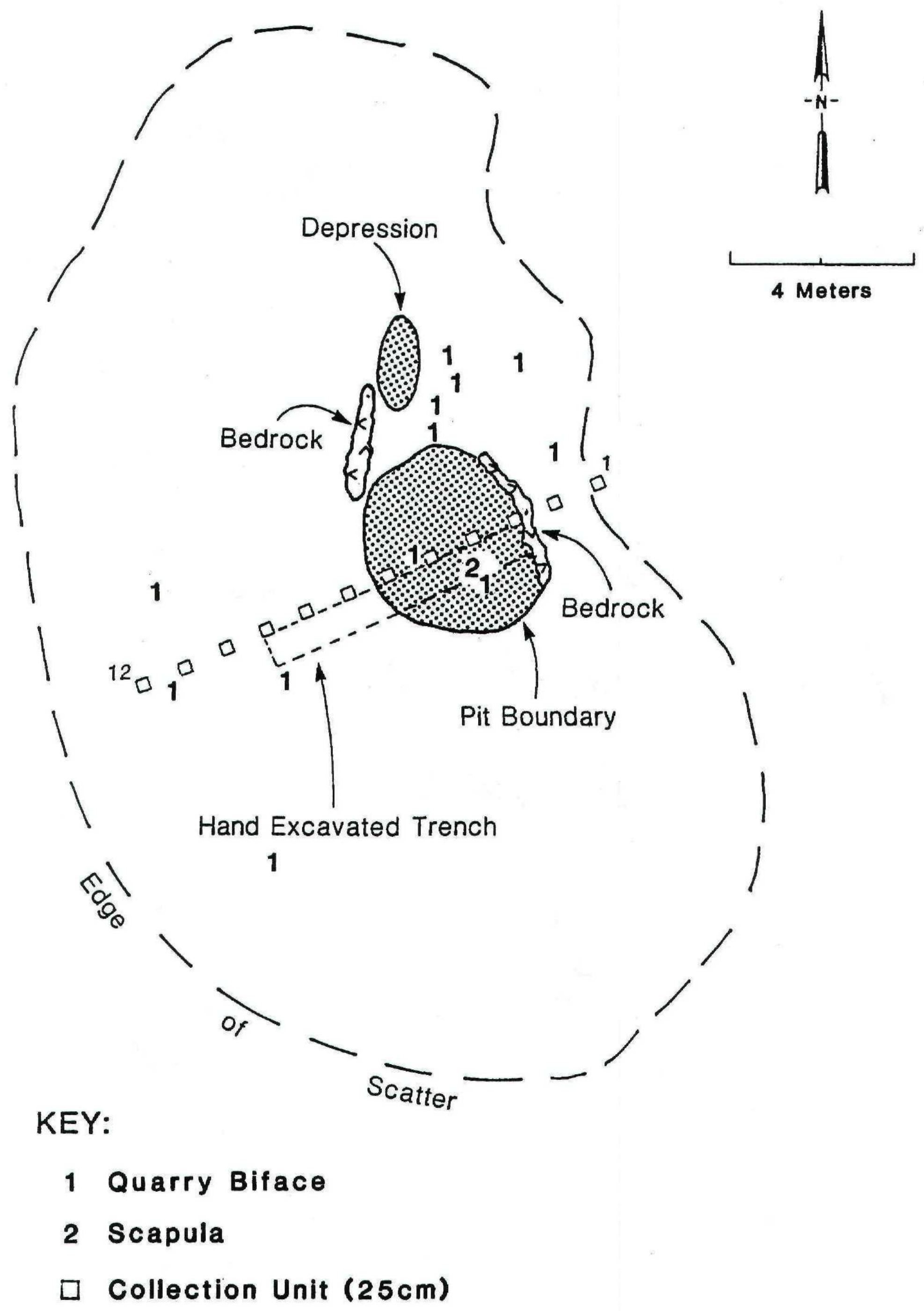
Unit	Flakes			Shatter			
Number	(n)	(%)	(Av Wt)	(n)	(%)	(Av Wt)	Total
1	1	100.0	0.70	-	-	-	1
2	16	31.4	2.04	25	68.6	4.63	41
3	3	75.0	19.96	1	25.0	5.40	4
4	2	50.0	21.85	2	50.0	74.25	4
5	24	80.0	4.72	6	20.0	19.65	30
6	54	29.2	3.37	131	70.8	4.03	185
7	18	13.2	0.99	118	86.8	0.20	136
8	42	77.7	3.23	12	22.3	6.10	54
9	39	10.2	5.48	342	89.8	2.85	381
10	13	16.9	3.50	64	83.1	8.86	77
11	25	15.8	5.86	133	84.2	2.53	158
12	3	2.6	6.36	114	97.4	3.16	117
Total	240	20.0	4.21	958	-	80.00	1188

As shown in Figure 70, the surface occurrence of formed artifacts occurs primarily in contexts adjacent the confines of the pit, and downslope of its berm.

Comparison of Figure 70 to Table 84 suggests that the distribution of waste flakes by number and average individual weights clearly relates to both cultural and post-depositional processes. The small number and size of flakes above the

Figure 70. Plan of Feature 1, site 26Ek3200.

26Ek3200 Feature 1



opalite outcrop (Units 1 and 2) probably represent the remnants of attempts to obtain material from the upper margin of the ledge or perhaps where biface reduction took place. They contrast dramatically with the large flakes recovered immediately below the ledge in Units 3 and 4 that reflect primary quarrying directly against the downslope, pit-side of the rock face. Greater numbers of smaller flakes dominate the remainder of the pit, peaking at the crest of the berm (Unit 6) and then declining irregularly down the steep face of the talus slope. The increasingly large sizes of flakes down the talus, as well as the occurrence of numerous Quarry Bifaces there, suggest redeposition by colluvial action.

The high incidence of shatter to flakes (1.8 to 1) provides a *comparison useful in inferring* the *nature of reduction tasks* at other sites throughout USX-East. At 26Ek3200, obvious quarry use, coupled with the Quarry Biface assemblage and relatively abundant shatter, present in microcosm the full range of toolstone-specific activities displayed within the project area. Compared with test results obtained elsewhere from reduction features further removed from raw material sources, reduction stages expressed by Quarry Biface assemblages are similar, but the ratio of flakes to shatter contrasts markedly; at some of these sites (e.g., 26Ek3183), flakes outnumber pieces of shatter by ca 50 to 1.

Quarry Pit Stratigraphy

The pit apparently was excavated about 80 cm into tuff and silicified tuff bedrock, extracting both white and pink toolstone. The pit excavation apparently started along a tuff-filled fissure which allowed the prehistoric miners a place to get a "handle" on the bedrock. The pit was then worked upslope from the fissure. The texture of strata in the pit fill tends to alternate between fine and coarse, as observed in other quarry pit profiles. The sand to loamy sand fine sediments (Units 3, 5, 7, 10, 12, 15, and 17) probably represent slopewash and aeolian deposits accumulated in open pits between episodes of active quarrying. The coarser layers of angular rubble and/or cores and large flakes (Units 1, 2, 4, 6, 9, 11, 13, 14, 16, and 18) are colluvium and waste from quarrying and toolstone processing.

The highly organic Unit 3, thinly mantled with a layer of flakes and angular shatter, is the present A horizon. The upslope portion appears to have been buried by mostly colluvial Units 2 and 1 in the recent past.

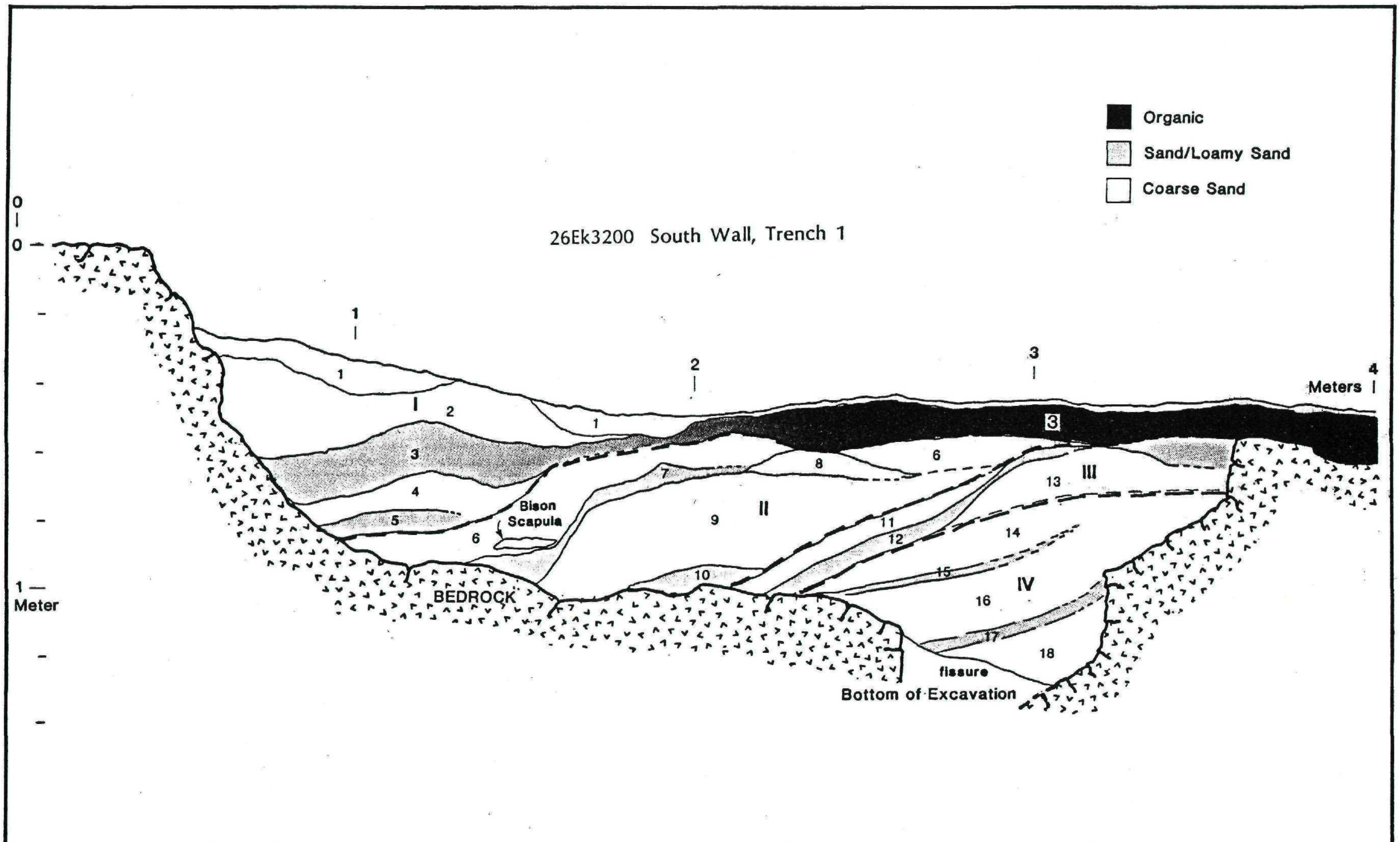
Working upslope and into the outcrop, prehistoric quarrymen backfilled their pits as they went along. Thus, the beds are progressively younger upslope and toward the face. The pit may have been started on the fissure still present in the bottom of the oldest part of the pit.

At least 18 distinct strata are apparent in the profile of the trench wall (Figure 71). Numbered consecutively from the surface, strata are grouped into four time-stratigraphic horizons. Horizon IV (Units 28 through 15), constitutes the oldest group. Truncated by units of Horizon II, they are short and concave upward. The outcrop face was probably nearly 1.4 m west of its present position. Horizon III (Units 11, 12, and 13) marks an interval when the outcrop face probably lay about 1.0 m west of its present position. These units are convex upward, preserving a portion of the pit berm. Horizon II (Units 9 through 6) marks the last intensive episode of quarrying visible in the profile. The profiles of these units are S-shaped, preserving both the pit floor and the berm. The outcrop face assumed its present position during Horizon II. The *Bison* sp. scapula was found in Unit 6. Finally, Horizon I includes the more horizontal layers subsequent to Unit 6, and suggests passive accumulations in the open pit rather than culturally generated deposits.

Summary

In sum, 26Ek3200 appears to have functioned exclusively as a source of high quality opalite toolstone. Positioned as it is, relatively high in the landscape, far from water or base camps, and remote from other toolstone sources, we surmise that the small opalite exposure was attractive chiefly for the extremely fine-grained and uniform quality of its lithic resources. Lacking evidence for activities ancillary to toolstone procurement, i.e., maintenance/subsistence tools (save for the single flake scraper), 26Ek3200 provides not only an informative venue for examination of quarry processes themselves, but offers as well, in its debitage assemblage, potentially useful indices by which the nature of reduction activities at other sites may be evaluated.

Figure 71. 26Ek3200, Trench 1, south wall profile.



26Ek3200 South Wall, Trench 1
Organic
Sand/Loamy Sand
Coarse Sand
0
0
1 — Meter
1
2
3
4
Meters
I
II
III
IV
Bison Scapula
BEDROCK
fissure
Bottom of Excavation

Chapter 16. UNDINE GORGE

by Steven G. Botkin

The Undine Gorge subarea encompasses a topographically diverse landscape subsuming the northernmost tier of sites in USX-East. It is named for the seasonal drainage whose sinuous course transits from east to west to debouche Little Antelope Creek at Big Meadow, just beyond the northwest corner of the study area (Figure 72). Down-cutting of this channel has exposed opalite bedrock which, in concert with the availability of intermittent water, undoubtedly attracted aboriginal use of the area. Undine quarry sites are more numerous, and as a rule, were exploited more intensively than those of the Ramadan and Corral areas. Circumstantial evidence (proximity) hints that opalite originating from Undine sources may have provided a sizeable portion of the raw material processed at source-poor Holeplug Ridge sites.

Topography in the western half of the subarea is dominated by the prominent rim of brecciated and silicified tuff capping the southern terminus of Italian Mesa. Slopes are steep (precipitous, in places) rising from a base of 5600 feet amsl at the bottom of Undine Gorge to crest the brink of Italian Mesa at 5700 feet amsl in only about 200 horizontal feet. Vertical bedrock faces interspaced with narrow rocky ledges and steep talus cones punctuate the escarpment; various points along the rim served prehistorically as sources of toolstone, and several of the crags and overhangs form rockshelters.

Owing to the prevalence of exposed bedrock, vegetation of the western zone is generally more sparse than elsewhere in the project area. The lower slopes of Italian Mesa exhibit the most extensive local coverage, where thin, colluvially transported sandy soils support a patchy growth of mixed low and tall sagebrush and rabbitbrush. Above this, amid increasing exposures of tuff, coverage diminishes. Bunch grasses and phlox occur sporadically in soil-filled cracks and pockets along the otherwise bare rock ledges. Harlequin colonies of lichen face much of the exposed stone.

By contrast, the eastern half of the subarea is characterized by open, more gently rolling terrain. It occupies the lowest slopes of Corral Fan, mildly dissected into a system of broad, relatively flat knolls and projections bounding the southern flanks of Undine Gorge along its upper reach. Opalite exposures are extensive along the footslopes overlooking the Gorge discontinuously occurring as outcrops and overhanging ledges. In many instances these evidence aboriginal toolstone extraction and in at least one location were exploited for shelter. Higher on the slopes, well-developed quarry pits sound near-surface sources and undermine low outcrops, while on the

Figure 72. Topographic setting, Undine Gorge.

TOSAWIHI QUARRIES:
ARCHAEOLOGICAL INVESTIGATIONS AND ETHNOGRAPHIC STUDIES
IN NEVADA

Note:

One or more pages have been removed from this part of the report due to sensitivity of specific archaeological site location information. Qualified persons may contact the Nevada Bureau of Land Management, Elko Field Office, to inquire about obtaining additional information.

knoll tops, toolstone supplies were obtained from bedrock weathered into dense cobble fields. Soils are generally shallow, consisting of a veneer of sandy, very gravelly, colluvium overlain in places by an extensive anthropic talus derived from prehistoric quarrying. In the southwestern quarter of the area (cf. 26Ek3195), colluvial soils are blanketed by thin, very fine-grained, loess-like deposits, similar to those encountered in neighboring portions of Holeplug Ridge (cf. 26Ek3192).

An edaphically determined mosaic of low sagebrush and tall sagebrush typifies the local plant community, the former species dominating the shallow soils of the rocky knoll tops, the latter supported in denser growths by deeper colluvium on the slopes. Abundant bitterbrush complements this assemblage at the highest elevations.

Descriptive Site Summary

Twelve sites were recorded in the Undine Gorge subarea. As summarized in Table 85, two are Quarry Pit/Reduction complexes, four are Outcrop Quarry/Reduction complexes, five are Rockshelters, and one, smallest of the open sites in the vicinity, is a Reduction Station. All save the reduction station and some rockshelters contain exploited opalite sources within their precincts. Ten of the Undine sites were tested; two small rockshelters (26Ek3205 and 26Ek3206) apparently retaining sparse data went untested.

Table 85. Descriptive Summary, Undine Gorge Sites.

Site Number	Type	Features (number)	Maximum Site Area (sq m)
26Ek3177	Rockshelter/Reduction Station	1	70
26Ek3178	Reduction Station	4	910
26Ek3195	Quarry Pit/Reduction Complex	8	8,800
26Ek3196	Outcrop Quarry/Reduction Complex	7	11,800
26Ek3197	Quarry Pit/Reduction Complex	11	4,420
26Ek3198	Outcrop Quarry/Reduction Complex	24	14,700
26Ek3201	Outcrop Quarry/Reduction Complex	4	2,100
26Ek3202	Rockshelter/Reduction Station	1	8
26Ek3203	Outcrop Quarry/Reduction Complex	-	8,230
26Ek3204	Rockshelter/Reduction Station	1	60
26Ek3205	Rockshelter/Reduction Station [NOT TESTED]	-	25
26Ek3206	Rockshelter/Reduction Station [NOT TESTED]	-	28

Testing Strategies

Testing the Undine sites was dictated in part by their functional type as assigned during survey. The discussion which follows is organized along these lines, and is offered in summary form by Table 86. Field methods were comparable to those used elsewhere within the project area; following feature inventories, features selected judgmentally were designated Sample Features. Procedures directed at Sample Features were intensive and invasive, with the result that the bulk of the data underpinning discussions which follow are derived from these sources.

Quarry Pit/Reduction Complexes

At 26Ek3195, two Sample Features were selected. Feature 1 consists of an outcrop quarry and associated reduction area where 5 25 by 25 cm units, spaced at 3 m intervals, were shovel skimmed and screened along a baseline transect parallel to the slope. Feature 2, a 4 m wide quarry pit lies beneath an exposed opalite outcrop that constituted the principal toolstone source within the feature. Surface content was tested by shovel skimming and screening a discontinuous series of 13 25 by 25 cm units spaced at 1 m intervals, from the bedrock outcrop, across the pit and its berm, to the base of the talus slope below. To test the internal structure of the feature, a 50 cm wide trench subsequently was excavated by hand along the same baseline for a distance of 5.5 m. Initiated at the outcrop, it dissected both the center of the pit and the most prominent portion of the berm. Deposits removed from the trench were not screened, the goal of the exercise lying instead in the exposure of stratigraphy and collection of stratigraphic samples directly from the sidewall.

At 26Ek3197, Feature 1, the larger of the two quarry pits was sampled. Slightly elliptical in plan (3.5 m by 2 m) and 50 cm deep, it occupies a relatively steep slope and exhibits a well developed berm along its downhill rim. A moderate to heavy scatter of reduction debris surrounds the pit and reveals greatest densities throughout the area of the berm. To sample this scatter a series of 20 25 cm by 25 cm units were shovel skimmed and screened at 1 m intervals along a discontinuous baseline bisecting the pit, its berms, and extending to an exposure of bedrock well downslope. The baseline was oriented parallel to the primary slope. Two additional features were tested; 1 m by 1 m excavation unit centered on a biface cache of Feature 5 was dug to 20 cm, and a 1 m by 50 cm unit was excavated to a depth of 60 cm into the floor of Feature 10, a small rockshelter.

Table 86. Summary of Testing Procedures, Undine Gorge Sites.

Site Number	FEATURES RECORDED Total (n)	FEATURES RECORDED Sampled (n)	FEATURE CONTEXT Surface Skim Area (sq m)	FEATURE CONTEXT Subsurface Excavation Volume (cu m)	FEATURE CONTEXT Trench Cross Section (n)	FEATURE CONTEXT Stratigraphic Profile (n)	FEATURE CONTEXT Column Samples (n)	NON-FEATURE CONTEXT Surface Skim Area (sq m)	NON-FEATURE CONTEXT Subsurface Excavation Volume (cu m)	RECOVERED COLLECTIONS Debitage (n)	RECOVERED COLLECTIONS Artifacts (n)
26Ek3177	1	1	0.250	0.10	-	-	-	-	-	6285	4
26Ek3178	4	1	5.000	-	-	-	-	-	-	4048	12
26Ek3195	8	1	1.125	-	1	1	6	-	-	1149	63
26Ek3196	7	2	-	5.85	-	-	-	-	-	7407	55
26Ek3197	11	1	1.250	0.50	-	-	-	7.00	-	1794	45
26Ek3198	24	4	37.750	0.15	-	-	-	-	-	6373	99
26Ek3201	4	3	10.500	0.10	-	-	-	-	-	4237	44
26Ek3202	1	1	0.500	0.25	-	-	-	-	-	5868	5
26Ek3203					-	-	-	3.75	-	586	13
26Ek3204	1	1	1.000	0.70	1	1	-	-	-	6160	110

Outcrop Quarry/Reduction Complexes

Two Sample Features were selected at 26Ek3196, both outcrop quarries with associated opalite debris scatters. At Feature 1 surface contexts were tested by means of 11 units, each shovel skimmed and screened. Unit 1, a 1 m by 1 m collection unit, was positioned to test a possible adit, marked by a battered, apparently fire spalled and blackened opalite rim on the edge of a low exposure of bedrock. Units 2 through 11 were 50 cm by 50 cm in size, arrayed along a discontinuous transect at 2 m intervals across the lithic scatter occupying the bedrock exposure in the center of the feature. After shovel skimming, a 1 m by 1 m excavation unit was superimposed on surface collection Unit 1 and dug to a depth of 30 cm to sound subsurface contexts of the possible adit. Feature 2 is an extensive moderate density lithic scatter centered along the top of a low opalite cliff which served as a source of raw material. Tests focused on sampling two high density lithic concentrations within the feature, each of which was shovel skimmed and screened along a discontinuous baseline of 50 cm by 50 cm units placed at 2 meter intervals. The northernmost concentration was sampled by four units; the southern one by nine units.

Four features were treated as Sample Features at 26Ek3198. Feature 1, a relatively diffuse lithic scatter, was selected for 100% surface collection owing to its large number of projectile points and preforms, as well as to its abundant obsidian debitage. A 5 m by 6 m rectangular area was collected by shovel skimming and screening a contiguous block of 30 1 m by 1 m units. Following this, a 1 m by 50 cm excavation unit was centered on the area where the incidence of projectile points and debitage was highest; the unit was dug to a depth of 20 cm. Feature 2 appeared as a small (1.5 m by 0.75 m) but extremely dense concentration of reduction debris. It was tested by a line of three contiguous 1 m by 1 m shovel skimmed and screened units; two were positioned within the concentration, while the third explored just beyond its discernible surface boundary. A much larger lithic concentration, Feature 9, was also tested, owing to three ceramic sherds on its surface. A block of 2 1 m by 1 m units was shovel skimmed and screened at the location of the surface sherds to recover additional fragments and to determine whether greater functional variability in artifact classes would require reclassification of the feature.

The only outcrop quarry at 26Ek3198 lies at the northeastern periphery, where a small bedrock exposure drops to an abrupt rim. Much of the outcrop consists of toolstone quality opalite that, together with nearby boulders and cobbles, was quarried prehistorically. Because primary debitage was difficult to isolate from the background shatter and naturally weathered opalite, we shovel skimmed and screened 10 50 cm by 50 cm units arrayed at 2 m intervals along a baseline transecting the feature from its highest to lowest elevations. Additionally, we collected all surface material (both cultural and non-cultural) from a single 50 cm by 50 cm unit, in order to characterize the size and quality of unmodified toolstone available and the relative proportion of cultural material with which it co-occurs.

All four of the features defining 26Ek3201 were addressed as Sample Features. Feature 1, a lithic scatter containing three dense concentrations of opalite debitage, was sampled by 2 shovel skimmed and screened 1 m by 1 m units. One was placed in the southernmost concentration, where numerous obsidian flakes occurred on the surface; the other was located in the moderate density scatter between two scatters further to the northeast. Feature 2 consists of two dense lithic concentrations surrounded by a moderate density scatter. A block of seven contiguous 1 m by 1 m units was shovel skimmed and screened in the southern portion of the feature where a mano was observed amid the greatest incidence of Quarry Biface fragments visible on the surface. Feature 3 is a small concentration of opalite debitage. Test efforts focused on a cluster of eleven fragments of a single metate which littered the northern edge of the concentration. A 1 m by 50 cm excavation unit explored subsurface contexts beneath the groundstone to a depth of 20 cm. Feature 4 is an outcrop quarry with associated reduction debris perched on a shelf immediately south of and overlying the rockshelter at 26Ek3177. The feature's lithic scatter was sampled by a discontinuous baseline composed of 5 50 cm by 50 cm units shovel skimmed and screened at 2 m intervals. A sixth such unit tested debitage accumulations at the base of one of the battered opalite outcrops in the southern extreme of the feature.

Lacking discernible concentrations of cultural debris identifiable as features, tests at 26Ek3203 sought to sample the artifactual content of the light to moderate density lithic scatter which litters its surface in order to bring to light any spatial patterning in the distribution of these remains that might be obscured by the abundant naturally weathered debris there. To this end 15 50 cm by 50 cm units were arrayed along a baseline parallel to the site slope transecting the scatter and manipulated bedrock outcrops. Each unit was shovel skimmed and screened.

Reduction Station

At 26Ek3178, the dense concentration of opalite reduction debris defining Feature 1 was selected as our Sample Feature. To sample its contents, the scatter was bisected by a collection transect consisting of 5 contiguous 1 m by 1 m units. Arrayed along a baseline parallel to the site slope, each unit was shovel skimmed and screened. The three central units fell entirely within the concentration as revealed on the surface;

these were bracketed by units on either end of the transect which sampled areas immediately outside observed margins of the concentration.

Rockshelters

Test actions at the three rockshelters examined were less areally extensive than those at open sites. Instead, they focused on sounding interior subsurface deposits in order to determine their content and structure, and to ascertain the degree to which the shelters offer protected contexts conducive to the preservation of perishable remains. All excavation measured were 1 m by 50 cm. Digging each commenced with by shovel skimming and screening the upper 2 cm of deposits. Below this, deposits removed from 10 cm arbitrary vertical levels were passed through nested screens of 1/4 in. and 1/8 in. mesh. Owing to the copious quantity of material held by the smaller mesh, contents of these screens were bagged _en masse_ for later sorting in the laboratory.

At the two smaller rockshelters (26Ek3177 and 26Ek3202) one excavation unit was placed in the center of each floor, well inside the dripline. Deposits reached depths of 20 cm and 50 cm, respectively. Digging halted in both units where they bottomed on opalite bedrock or large slabs of roof-fall.

Site 26Ek3204, the largest of the rockshelters, was probed in two locations by units positioned at either end of a common baseline. Excavation Unit 1 was dug in the interior of the shelter to a depth of 60 cm. Excavation Unit 2 was placed on the upper portion of the apron outside the dripline and excavated to a depth of 40 cm. Both units terminated where bedrock or roof-fall was encountered. In order to characterize stratigraphic relationships more clearly, as well as to expose a complete cross-section of the interior deposits and explore for hearths, a trench was dug by hand from the apron to the rear wall, placed to join and extend the formal excavation units. Material from the trench was not screened, although artifacts encountered in situ were retained. The exposed profile was drawn, and samples collected directly from the trench wall.

Chronology

Our current assessment of the aboriginal antiquity of Undine Gorge relies heavily upon relative dates provided by temporally diagnostic artifacts. At present, only one radiocarbon assay has been obtained. However, testing reveals that several sites promise to yield datable remains. Also of potential chronological utility, extant collections include numerous obsidian pieces amenable to source characterization and hydration rim value determinations.

A total of 12 projectile points referable to Thomas's (1981) typological key were recovered from the Undine sites (Table 87). Nine are from site 26Ek3198 (six were found within Feature 1). Temporal affiliation of point styles from all Undine sites generally implies relatively late use of the area, a pattern mirrored by other portions of USX-East.

At Undine Gorge, the only evidence to suggest visitation as early as 3000 B.C. is the occurrence of one specimen each of Gatecliff Split Stem and Humboldt Series projectiles. Aboriginal presence appears to have been more intensive at times post-dating A.D. 1300. Fully 75% of the specimens recovered are attributable to Desert Series types, i.e. Desert Side-notched (n=5) and Cottonwood Series (n=4). Somewhat earlier occupation ca A.D. 700 - A.D. 1300 is hinted by the Rosegate Series point recovered from Level 1 (0-10 cm) in the 26Ek3204 rockshelter. Likewise, four sherds of Snake Valley Grayware ceramics encountered in Feature 9 at 26Ek3198 lend support to a slightly pre-A.D. 1300 occupation (Madsen 1977).

Table 87. Projectile Point Types from Undine Gorge Sites.

Site Number	Classifiable GSS	HBS	RSG	CTN	DSN	Unclassifiable OOK	Total
<u>Outcrop Quarry/ Reduction Complex</u>							
26Ek3198	1	1	-	4	3	-	24
<u>Reduction Station</u>							
26Ek3178	-	-	-	-	2	-	2
<u>Rockshelter/ Reduction Station</u>							
26Ek3177	-	-	-	-	-	2	2
26Ek3204	-	-	1	-	-	-	1

Type Designations (after Thomas 1981)
GSS = Gatecliff Split Stem
HBS = Humboldt Series
RSG = Rosegate Series
CTN = Cottonwood Series
DSN = Desert Side-notched

Other
OOK = Points out of Thomas' key

The radiocarbon assay was derived from a composite charcoal sample recovered from the 20-30 cm level of Excavation Unit 1 located inside 26Ek3204. It obtained a date of 40 ± 50 B.P. (Beta 26828) which, given ambiguities in curves for very young samples, could indicate an age for the sample of between 272 GP (A.D. 1678) and 0 B.P. on the two sigma bases. This recent sample, juxtaposed with a Rosegate Series point recovered two levels above from the same unit, likely reflects turbation of site deposits. The composite nature of the sample, consisting of numerous minute fragments of charred sagebrush and other unidentified wood, introduces ambiguities as well. The abundance of carbon in the deposits at the rockshelter suggest the potential for discovery of hearths which would be especially useful in overcoming problems associated with composite samples, since charcoal from such sources could be attributable to a single cultural event.

Assemblage Composition

The most salient attribute of the assemblages from all Undine sites is, not surprisingly, the phenomenal quantities of opalite flakes and shatter they contain. The obvious emphasis on the manipulation of toolstone is reflected directly by the relative proportions of formed artifact types which comprise the collections (Table 88).

Reduction artifacts (e.g., cores, quarry bifaces) and the processing tools employed for their manufacture (e.g., hammerstones, other percussion implements) comprise the majority of all assemblages. Maintenance tools (scrapers, knives, and other flake tools), as well as subsistence oriented artifacts (projectile points, groundstone) comprise smaller assemblage components. These latter, we assume, are indices of multiple site functions beyond those which strictly address toolstone procurement. The relative proportions of these two sets of artifact classes (lithic processing and reduction vs. maintenance and subsistence) vary in a pattern concordant with functional site types assigned at the time of their original recording. With one notable exception, artifacts related to lithic processing average about 90% of assemblages at quarry sites of both pit and outcrop source varieties. The complements of maintenance and subsistence related items are responsible for roughly 10% of the collections at these sites. The exception to this trend is evident at 26Ek3198, where the ratio of lithic processing to maintenance/subsistence/tools appears less divergent, i.e. 64.2% to 35.5%, respectively. Recall from summary site descriptions that Feature 1 there consists of a rather anomalous lithic scatter made up of an abundance of tools not strictly related to toolstone production. Collection of this Sample Feature biased artifact counts, contributing over 80% of all projectile points and maintenance tools encountered at the site. If, for comparative purposes, Feature 1 artifacts are excluded momentarily from counts, the relative proportion of lithic processing specimens to maintenance/ subsistence artifacts achieves a ratio comparable to the rest of the quarry sites (85% to 15%, respectively).

Table 88. Intersite Artifact Class Frequency Comparisons, Undine Gorge Sites.

ARTIFACT CLASS	ARTIFACT FREQUENCY PER SITE									
	Quarry Pit/ Reduction Complexes		Outcrop Quarry/Reduction Complexes				Rockshelter/Reduction Stations			Reduction Station
	26Ek3195	26Ek3197	26Ek3196	26Ek3198	26Ek3201	26Ek3203	26Ek3177	26Ek3202	26Ek3204	26Ek3178
Lithic Processing/ Reduction Tools										
Hammerstones	6	6	8	2	4	-	1	-	4	-
Scratched Stones	-	-	-	-	1	-	-	-	1	-
Subtotal (%)	6 (9.2)	6 (14.6)	8 (13.8)	2 (1.6)	5 (10.4)	0 (0)	1 (14)	0 (0)	5 (8.7)	0 (0)
Reduction Artifacts										
Assayed Pieces	-	-	1	3	1	-	-	1	1	-
Cores	8	1	24	5	1	5	1	2	17	1
Quarry Bifaces	42	32	17	51	33	4	2	2	15	12
Preform Bifaces	-	-	-	12	-	-	-	-	-	-
Small Bifaces	1	1	1	8	4	2	-	-	4	1
Indeter. Bifaces	-	-	-	-	1	-	-	-	2	1
Subtotal (%)	51 (78.5)	34 (83)	43 (74.1)	79 (62.6)	40 (83.3)	11 (100)	3 (43)	5 (71.4)	39 (68.4)	15 (80)
Projectile Points										
Classifiable	-	-	-	9	-	-	-	-	1	2
Unclassifiable	-	-	-	11	-	-	3	-	-	1
Subtotal (%)	0 (0)	0 (0)	0 (0)	20 (15.8)	0 (0)	0 (0)	3 (43)	0 (0)	1 (1.8)	3 (15.8)
Maintenance and/or Processing Tools										
Abraders	-	-	-	1	-	-	-	-	-	-
Scrapers/Spokeshaves	6	1	3	8	-	-	-	1	6	1
Knives	1	-	1	3	-	-	-	-	-	-
Perforators/Gravers	-	-	-	2	1	-	-	-	1	-
Multipurpose Flakes	1	-	1	6	-	-	-	-	1	-
Indeter. Flake Tools	-	-	1	1	-	-	-	1	3	-
Subtotal (%)	8 (12.3)	1 (2.4)	6 (10.3)	21 (16.6)	1 (2)	0 (0)	0 (0)	2 (28.5)	11 (19.3)	1 (5.2)
Plant Processing										
Manos	-	-	-	-	1	-	-	-	1	-
Metates	-	-	-	-	1	-	-	-	-	-
Indeter. Groundstone	-	-	1	-	-	-	-	-	-	-
Subtotal (%)	0 (0)	0 (0)	1 (1.7)	0 (0)	2 (4)	0 (0)	0 (0)	0 (0)	1 (1.8)	0 (0)
Other										
Ceramic Sherds	-	-	-	4	-	-	-	-	-	-
Subtotal (%)	0 (0)	0 (0)	0 (0)	4 (3.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Site Total	65	41	58	126	48	11	7	7	56	19

At rockshelters, opalite reduction artifacts dominate, but they are augmented by much higher proportions of maintenance tools. Lithic processing tools and their products comprise from 57% (26Ek3177) to 77.2% (26Ek3204) of collections at these sites (x=68.5%), while 22.8% (26Ek3204) to 43% (26Ek3177) are maintenance related tools (x=31%). We assume that these ratios reflect the use of shelters for both toolstone reduction and other ancillary tasks. This is especially likely at the largest shelter, 26Ek3204. There, the comparatively large number of formed artifacts recovered (n=57) and the relatively high incidence of maintenance tools, coupled with a subsurface abundance of non-artifactual constituents (charcoal, faunal remains) imply some measure of residential use of the site.

The relative proportions of formed artifact classes from the one isolated Reduction Station in Undine, 26Ek3178, reveals a situation somewhat intermediate between those expressed at rockshelters and quarry sites. Maintenance tools account for 21% of the assemblage and lithic processing reduction artifacts for the remaining 79%.

Consideration of individual classes of formed artifacts also reflects the emphasis on toolstone processing at the Undine sites. As elsewhere in USX-East, the most common (n=210, 48%) formed artifacts in the Undine collection are opalite quarry bifaces. As well, they constitute the largest number of items within individual site assemblages, save at 26Ek3196, 26Ek3203, and 26Ek3204, where they are outnumbered slightly by opalite cores. Quarry bifaces resulting from early stage reduction predominate; none has progressed beyond secondary thinning (Stage IV; cf. Table 89). Stage II Quarry Bifaces dominate most assemblages. At 26Ek3198 and 26Ek3178, somewhat more reduced Stage III forms are most frequent. These sites appear to emphasize the reduction, rather than primary procurement, of toolstone. In spite of the preponderance of evidence for early biface reduction tasks, quarry biface blanks (Stage I) are rare.

Although comprising differing proportions of total assemblages, maintenance/processing tools occur at all sites save 26Ek3177, a site depauperate in all but debitage. Most of these implements are simple flake tools in a variety of forms augmented occasionally by perforators, gravers, and/or knives. Implements most clearly associated with subsistence tasks are less widely distributed. Fully 82% of hunting oriented tools (projectile points and preforms) occur at 26Ek3198, the majority from Feature 1. This feature contains too, the only shaft abrader encountered in the project area. Ground stone artifacts are rare, a mano at 26Ek3204 lends slight support to our proposition that the rockshelter served at least minimally as a camp site. Contrary to expectations of assemblage composition predicated by functional site type, the small outcrop Quarry/Reduction Complex at 26Ek3201 contains 18 fragments of groundstone, 17 of which represent one metate. Finally, a little-used mano was found on the surface of Feature 3.

Table 89. Quarry Biface Reduction Stage, Undine Gorge Sites.

	Quarry Pit/ Reduction Complexes						Outcrop Quarry/ Reduction Complexes						Rockshelters						Reduction Station			
	26Ek3195		26Ek3197		26Ek3196		26Ek3198		26Ek3201		26Ek3203		26Ek3177		26Ek3202		26Ek3204		26Ek3178		Total	
Reduction Stage	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1 Blank	-	-	-	-	-	-	2	2.0									1	6.7			2	0.95
2 Edge Preparation	27	64.0	27	84.0	14	82.4	12	23.0	18	55.0	4	100.0	1	50.0	1	50.0	7	46.7	3	27.0	114	54.30
3 1 Thinning	11	25.0	4	13.0	1	5.9	26	51.0	14	42.0							4	26.7	9	73.0	69	32.80
4 2 Thinning	-	-	1	3.0	-	-	10	19.6	-	-	-	-	-	-	1	50.0	1	6.7	-	-	13	6.20
5 Shaping	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6 Stage Indeterminate	4	10.0	-	-	2	11.8	2	3.9	1	3.0	-	-	1	50.0	-	-	2	13.3	-	-	12	5.70
TOTAL	42		32		17		51		33		4		2		2		15		12		210	

Quarry Pit/Reduction Complexes: Context and Function

This and the following discussions describe the Undine sites on a site-specific basis, organized according to functional site types.

26Ek3195

Site 26Ek3195, the larger of the Quarry Pit/Reduction Complexes, occupies the crest and western and northern slopes of a broad, rocky knoll top intruding the footslopes of Corral Fan at the southern extreme of the subarea (Figure 73). Two shallow drainage channels topographically isolate the site from others nearby.

Central to the site, the knoll crest and bedrock exposures are paved with primary and secondary debitage, large volumes of opalite shatter, and a few cores and quarry bifaces. Six of the eight cultural features detected are: two shallow quarry pits (Features 3 and 4), three outcrop quarries (Features 1, 6, and 8), and a reduction station (Feature 5). Near the base of the slope at the northwestern periphery occur two additional quarry pits (Features 2 and 7), both deeper and littered with quarrying refuse more dense than those on the knoll above. Most of the knoll outside of feature boundaries appears to have served as a cobble quarry of variable quality opalite. Hundreds of assayed cobbles and scattered primary flakes and shatter lie across the knoll crest and down its slopes.

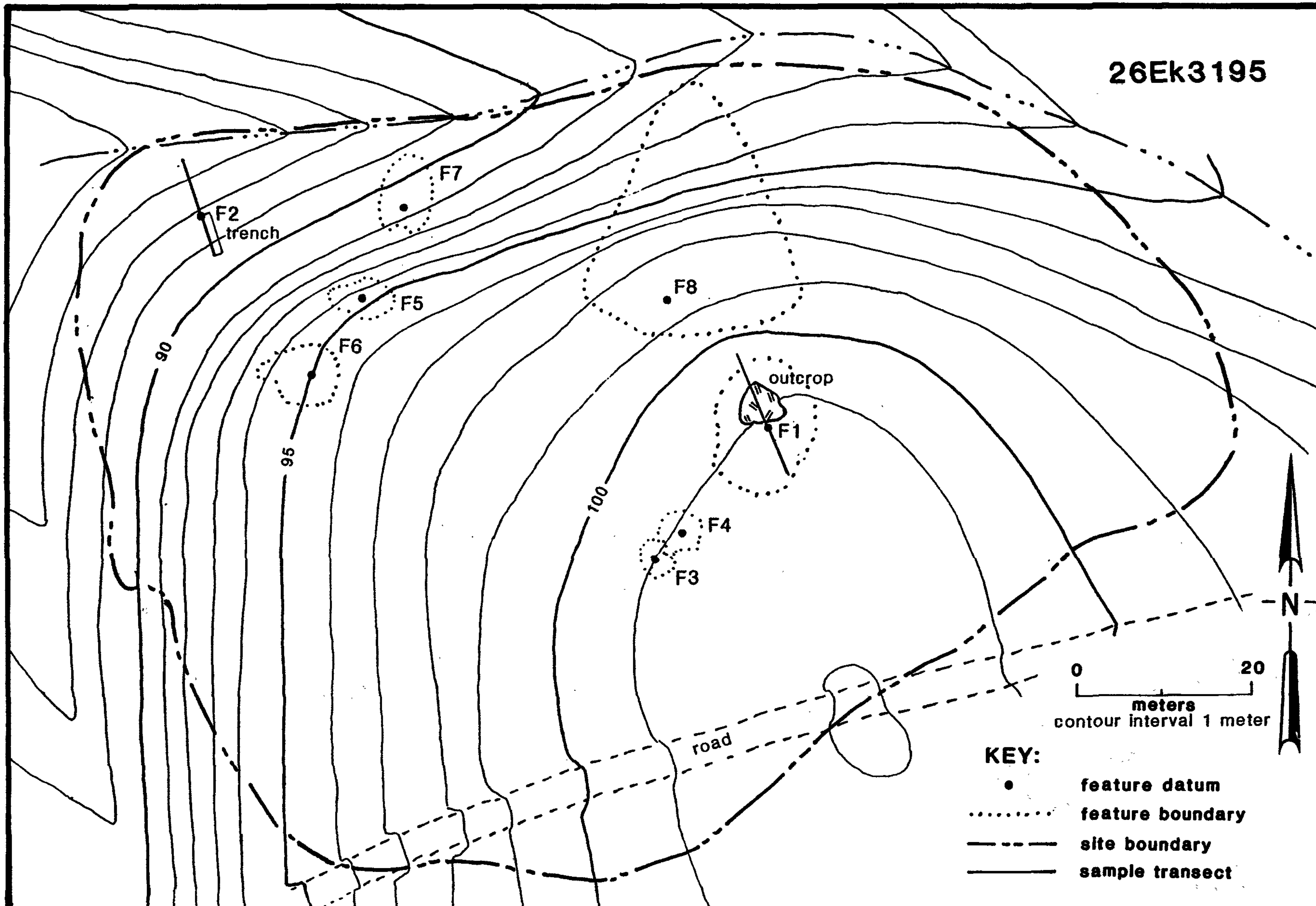
Despite its large size, 26Ek3195 yielded only 1146 cultural items, of which 65 are formed artifacts. Formed artifacts recovered from features and non-feature contexts are summarized in Table 90.

The assemblage reflects a strong focus on toolstone extraction and only the earliest stages of opalite reduction. The majority of quarry bifaces have been subjected only to incipient edge preparation of the blanks; other items have not been reduced beyond primary thinning (Table 89). Toolstone extraction/early stage reduction is reflected by the relatively large average sizes of individual waste flakes and pieces of shatter (cf. below). Sample Features disclosed two different approaches to toolstone procurement at the site.

Feature 1

Centered on a prominent opalite exposure on the knoll top, Feature 1 is a bedrock outcrop quarry and associated reduction area. Procurement focused on both the outcrop and on material from the ground surface adjacent. Opalite that remains in situ appears to be inferior as toolstone; perhaps better material has been exhausted.

Figure 73. Site map, 26Ek3195.



26Ek3195
F7
F2
trench
F8
F5
F6
outcrop
F1
90
95
100
F4
F3
road
0
20
meters
contour interval 1 meter
N
KEY:
feature datum
feature boundary
site boundary
sample transect

Table 90. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Quarry Pit/Reduction Complexes, Undine Gorge.

Site Number	Feature Number	Type	Total Area (sq m)	HM	CR	QB	SB	SC	KN	PG	MP	OT	Total
				ARTIFACT CLASSES									
				Reduction				Processing					
26Ek3195	1*	Outcrop Quarry/Reduction	245	-	1	2	-	2	1	-	1	-	71
	2*	Quarry Pit/Reduction	143	2	6	10	-	3	-	-	-	-	21
	3	Quarry Pit/Reduction	86	1	-	3	-	-	-	-	-	-	4
	4	Quarry Pit/Reduction	49	-	-	1	-	-	-	-	-	-	1
	5	Biface and Core Reduction	50	-	-	4	-	-	-	-	-	-	4
	6	Outcrop Quarry/Reduction	132	-	-	3	-	-	-	-	-	-	3
	7	Quarry Pit/Outcrop Quarry/ Cobble Quarry/Reduction	132	3	1	3	-	-	-	-	-	-	7
	8	Outcrop-Nodule Quarry/ Reduction	795	-	-	2	-	-	-	-	-	-	2
	Extra-Feature Context		N/A	-	-	14	1	1	-	-	-	-	16
26Ek3197	1*	Quarry Pit/Reduction	71	-	-	4	-	-	-	-	-	-	4
	2	Quarry Pit/Reduction	48	-	-	-	-	-	-	-	-	-	0
	3	Core and Biface Reduction	33	-	-	3	-	-	-	-	-	-	3
	4	Outcrop Quarry/Reduction	236	2	-	1	-	-	-	-	-	-	3
	5*	Biface Cache	49	-	-	17	-	1	-	-	-	-	18
	6	Biface Reduction	88	2	-	-	-	-	-	-	-	-	2
	7	Outcrop-Cobble Quarry/ Reduction	17	1	-	1	-	-	-	-	-	-	2
	8	Core Reduction	154	1	1	1	1	-	-	-	-	-	4
	10*	Rockshelter	20	-	-	-	-	-	-	-	-	-	0
	11	Possible Adit		-	-	-	-	-	-	-	-	-	0
	Extra-Feature Context		N/A	-	-	6	-	-	-	-	-	-	6

* Sample Feature

Key to Artifact Classes

Reduction Tools and Artifacts
HM = Hammerstones
CR = Cores
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces

Maintenance/Processing
SC = Scrapers and Spokeshaves
KN = Knives
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
OT = Indeterminate Flake Tool

A line of five sampling units which spanned the feature revealed that the cultural content of the moderate density scatter of opalite debris blanketing the vicinity is quite low; debitage recovery rates in the sample units ranged from only 6 to 61 flakes per unit. Average individual flake size (4.9 gm) is quite high, commensurate with the quarrying and initial reduction inferred for the feature (Table 91).

Table 91. Debitage from Sample Feature Collections, Quarry Pit/Reduction Complexes, Undine Gorge.

SURFACE COLLECTIONS

Site Number	Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	Total
26Ek3195	1	245	.31	672.0	170	80.0	4.90	40	20.0	4.79	210
	2	143	.81	1072.0	449	51.5	5.64	422	48.4	8.38	871
26Ek3197	1	71	1.25	503.2	499	79.5	6.00	130	20.6	11.32	629

SUBSURFACE COLLECTIONS

Site Number	Fea. No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	Total
26Ek3197	5	1 / E	20	0.20	144	70.5	11.76	60	29.4	14.91	204
	10	1 / F	60	0.30	261	43.0	2.80	345	57.0	3.3	606

Key to Excavation Unit Type

A = 1 by 1 m, 1/8 in. screen
E = 1 by 1 m, 1/4 in. screen
D = 50 cm by 1 m, 1/8 in. screen
F = 50 cm by 1 m, 1/4 in. screen

Feature 2

Feature 2, a 4 m diameter quarry pit and affiliated opalite debris, displays a suite of attributes (bedrock exposure, associated pit, surrounding berm, downslope talus of nodules and debris) that characterize numerous quarry features of the Tosawihi vicinity (Figure 74). A transect of 13 sample units tested all of these components, characterizing one dimension of its surface structure. Recovery rates by unit are presented in Table 92.

Comparison of Figure 74 to Table 92 discloses an extreme heterogeneity in the surface distribution of flakes related to the principal morphological components of the feature. The lower extent (Units 1 to 4) of the talus is composed of flakes far larger (mean average individual weight 4.6 gm) than the upper slope (Units 5-8, mean average individual weight 2.2 gm), attributable to colluvial redisposition. The interior of the pit achieves the greatest average flake weight (ca 14.5 gm at Unit 9) and the highest flake count (n=179, Unit 10) observed in the feature. Units 12 and 13, virtually devoid of cultural materials, occupy a zone in which the deepest portion of the pit has trapped more recent slopewash and obscured cultural surfaces.

Figure 74. Plan of Feature 2, site 26Ek3195.

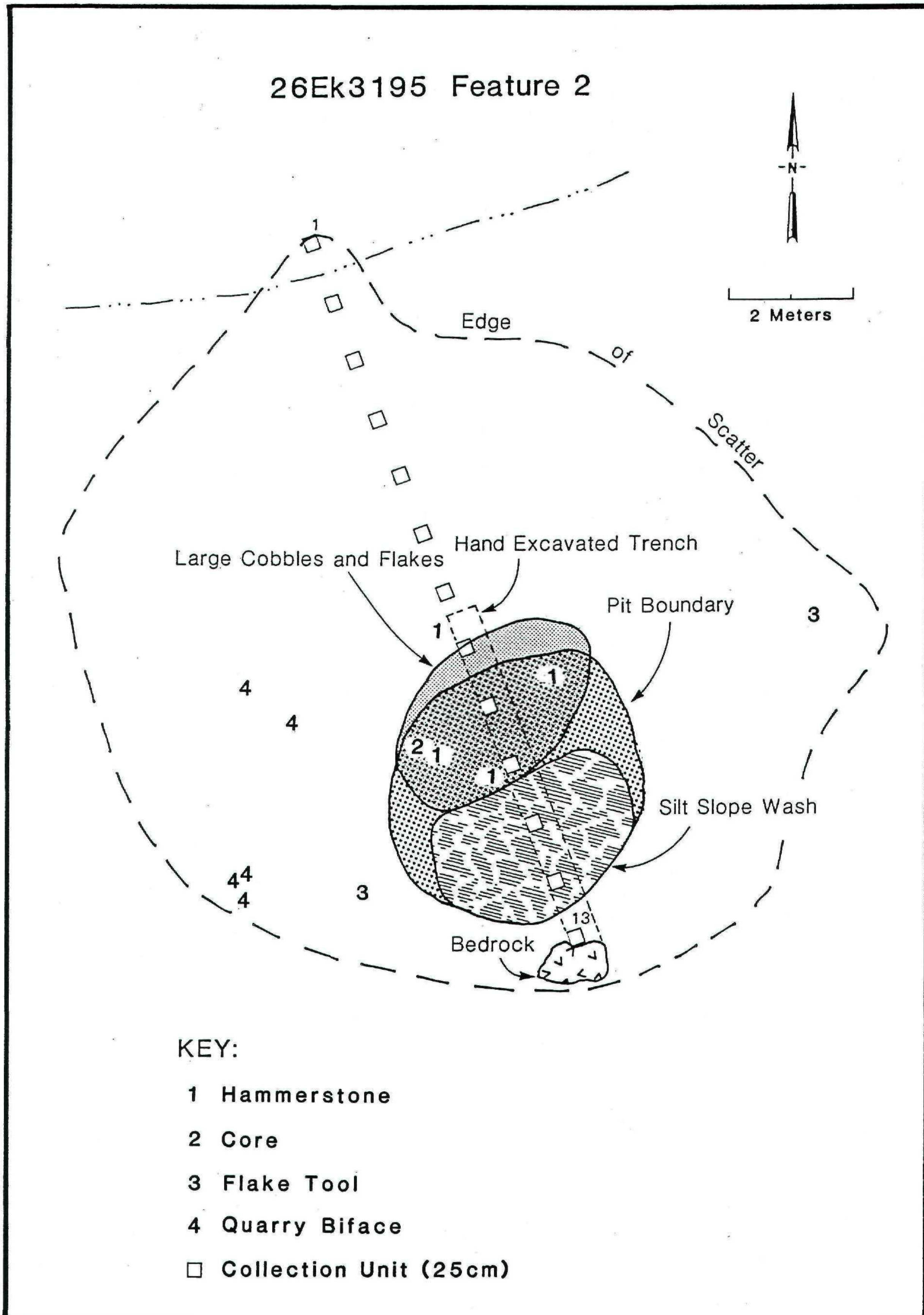

26Ek3195 Feature 2
N
2 Meters
Edge of Scatter
Hand Excavated Trench
Large Cobbles and Flakes
Pit Boundary
Silt Slope Wash
Bedrock
KEY:
1 Hammerstone
2 Core
3 Flake Tool
4 Quarry Biface
□ Collection Unit (25cm)

Table 92. Debitage from Sample Feature 2, site 26Ek3195.

SURFACE COLLECTIONS

OPALITE DEBITAGE

Unit Number	Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	Total
1	21	23.0	5.36	1	77.0	70.00	91
2	4	44.4	1.07	5	55.5	5.86	9
3	33		7.79	25		17.51	58
4	58	62.4	4.21	35	37.6	6.34	93
5	39	39.0	2.97	61	61.0	4.49	100
6	33	57.9	2.57	24	42.1	11.78	57
7	41	39.0	3.73	64	61.0	3.65	105
8	1	25.0	0.20	3	75.0	39.46	4
9	36	48.6	14.48	38	51.4	31.55	74
10	179	59.5	5.81	122	40.5	4.31	301
11	3	75.0	0.13	1	25.0	0.10	4
12	-	-	-	7	100.0	12.60	7
13	1	2.7	0.60	36	97.3	1.52	37
Total	449	51.5	5.64	422	48.5	8.38	871

To clarify details of internal pit structure, a trench was hand-excavated from the base of the opalite outcrop and the profile was recorded (Figure 75).

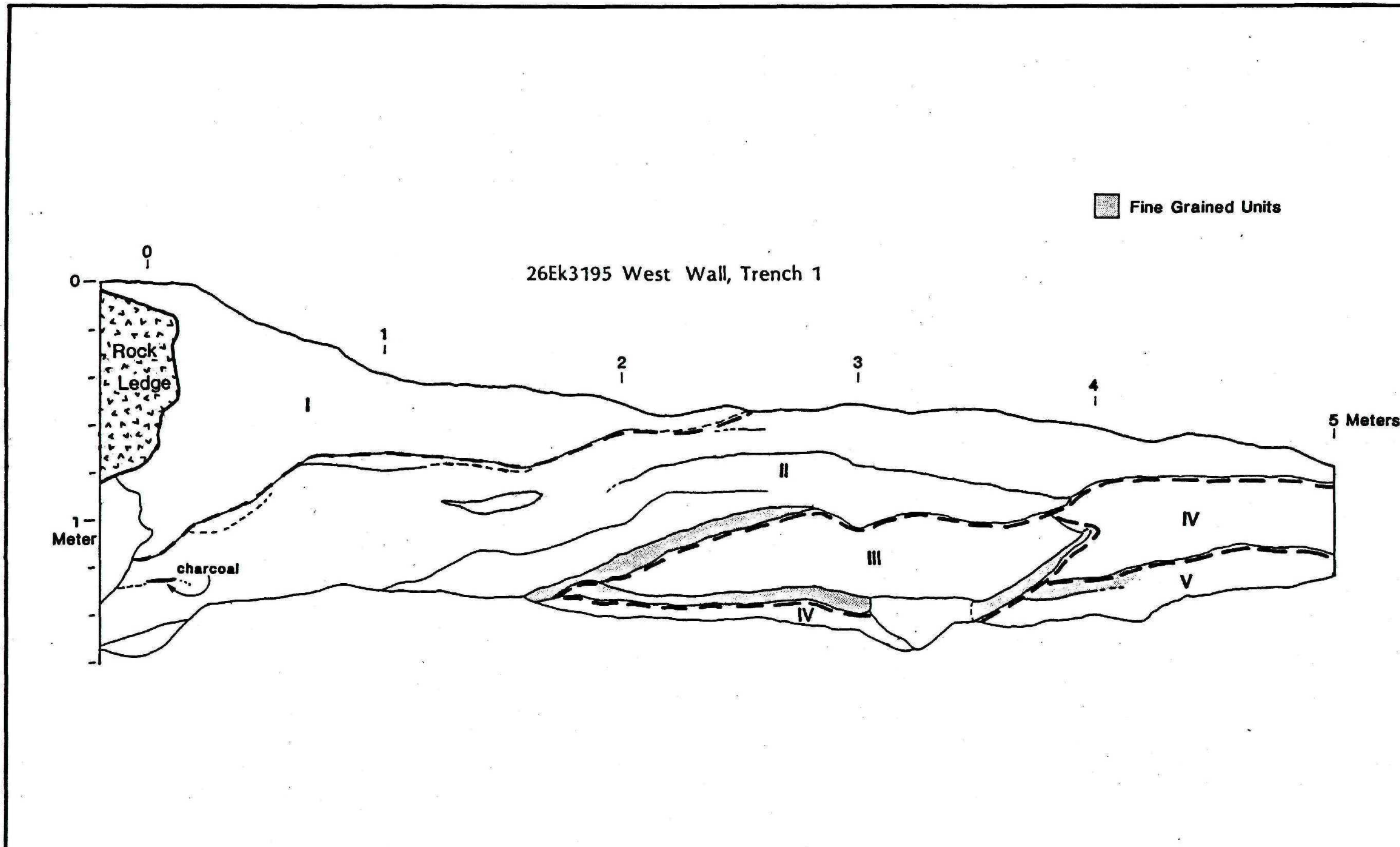
Bedrock was observed only at the outcrop, which is undercut at least 20 cm; we suspect the presence of an adit. The trench floor did not penetrate to bedrock.

Observed in the north end of the trench between 50 cm below the surface and the trench floor, Horizon IV is marked by a layer of rubble with few flakes in a matrix of gray brown soil. This is overlain by a layer of browner soil with few flakes that may represent slope wash accumulation. Both layers slope slightly down toward the outcrop. Horizon IV was also observed in the south end of the trench, extending 10 to 20 cm below the surface to the top of Horizon V, and is comprised of flakes and rubble in a matrix of gray brown soil.

Horizon III fills a pit that truncates Horizons V and VI. Extending 10 cm above the trench floor is a layer of clean, angular opalite, possibly representing quarry waste. This is overlain by a layer about 5 cm thick of dark gray silt and few flakes that probably is slopewash. Finally, the pit is filled with a thick layer of pink angular tuff and opalite rubble containing charcoal.

Horizon II is a thick pile of quarry waste extending from the surface at the berm to over 1 m in depth under the overhang

Figure 75. 26Ek3195, Trench 1, west wall profile.


Fine Grained Units
26Ek3195 West Wall, Trench 1
0
1
2
3
4
5 Meters
0
1
Meter
Rock
Ledge
charcoal
I
II
III
IV
IV
V

in the outcrop. This material fills a pit that truncates Horizon III, and overlies Horizon IV. Horizon II probably can be divided into numerous stratigraphic units, several of which contain charcoal. Charcoal is concentrated in lenses beneath the outcrop, suggesting the possibility that firesetting was used to assist quarrying operations. Horizon I is a thick wedge comprised of gray brown gravelly silt with few, if any, flakes. It probably represents material that filled the pit through colluvial processes since the last time it was used.

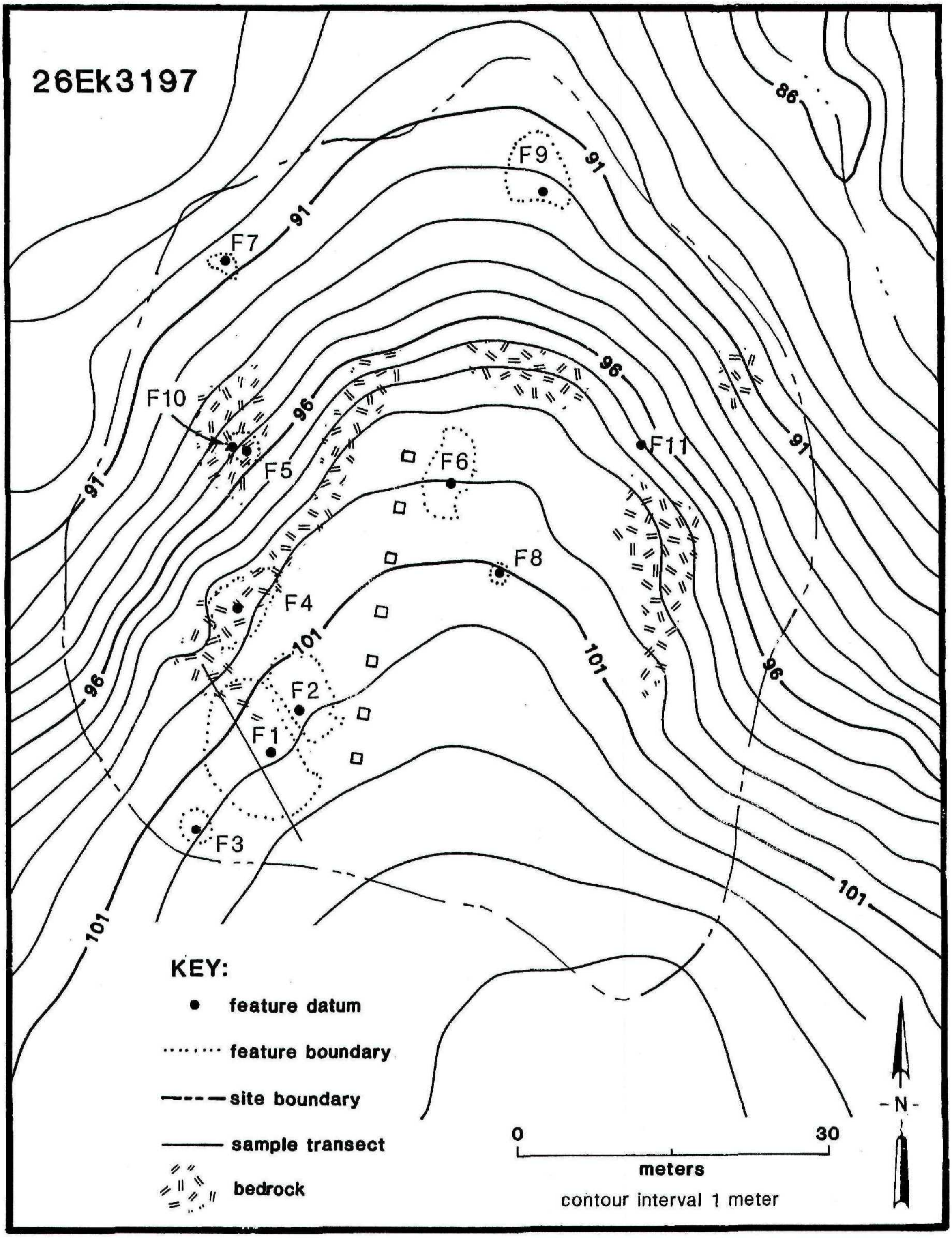
In summary, the feature represents an opalite quarry used during several episodes. The morphology and arrangement of stratigraphic layers suggest movement into the outcrop face; the bedrock overhang suggests the possibility of an adit. The deposits are stratified and have the potential for much greater depth than we actually observed. Charcoal is abundant, offering potential for dating episodes of use.

26Ek3197

The smaller Quarry Pit/Reduction Complex, 26Ek3197, occupies a broad peninsular shelf that juts northward from the foot of Corral Fan requiring a pronounced bend in the upper reach of Undine Gorge (Figure 76). The shelf is bounded on the west, north, and east by the drainage. Extensive exposures of white and grey brecciated opalite bedrock emerge over most of its surface, controlling its principal contours and undoubtedly conditioning its aboriginal use. Eleven cultural features, all directly attributable to primary opalite procurement and reduction, occur on the crest and along the rims of the shelf. These are concentrated in the northwestern quarter of the site, where toolstone extraction and processing efforts focused on surface and near-surface bedrock along the upper and mid-slopes of the landform. Two close-set quarry pits and their associated dense lithic scatters (Features 1 and 2) share the same contour on the upper slopes; below these, outcrop sources are exploited at Features 4 and 7. A bedrock overhang on the steep western mid-slope houses a small rockshelter (Feature 10), and a crag in the rimrock adjacent held a cache of quarry bifaces (Feature 5). Reduction stations (Features 6, 8, and 9) dot the more gentle northern slopes and one, Feature 3, accompanies the quarry pits perched somewhat higher up. On the eastern flank of the shelf, an adit-like excavation (Feature 11) extends about a meter into the base of a bedrock exposure. Examination of this feature failed to clarify its origins; whether it represents activities of historic or prehistoric vintage remains unknown, but its similarity to other recent explorations in the region suggests that it may be a consequence of historic mining.

The relatively flat, uppermost reach of the shelf lacks discernible cultural features. Instead, it is covered by an amorphous expanse of opalite debris in which a diffuse scatter

Figure 76. Site map, 26Ek3197.



26Ek3197
86
91
91
91
96
96
96
91
101
101
101
101
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
KEY:
feature datum
feature boundary
site boundary
sample transect
bedrock
0
30
meters
contour interval 1 meter
N

of cultural debitage is intermingled with a dense blanket of naturally weathered materials.

The recovered assemblage suggests that prehistoric activities at 26Ek3197 focused on toolstone extraction and processing tasks even more narrowly than they did at 26Ek3195. In spite of its moderately large areal extent and numerous cultural features, 26Ek3197 yielded one of the smallest, least diverse collections of all Undine sites (Tables 88, 90). Reduction-related specimens comprise virtually the entire assemblage of 41 formed artifacts; only a single flake scraper suggests ancillary behavior. Quarry bifaces account for most (n=32), and 84% of these (n=27) are attributable to Stage II forms (Table 89). Correspondingly, hammerstones (n=6) comprise the only other sizeable artifact class. Except for debitage, numbers of artifacts in all features is quite low, save for the many bifaces comprising the cache.

Testing addressed a range of these toolstone-oriented activities by sampling the residues of quarry pit excavation (Feature 1) - opalite reduction at a rockshelter (Feature 10), and the stockpiling of partially processed material evidenced by the cache of quarry bifaces at Feature 5. A series of shovel skimmed units sampled the amorphous debris along the shelf.

Feature 1

The two quarry pits, Features 1 and 2, lie adjacent one another along a contour on the upper margin of the site. The dense accumulations of opalite debris surrounding them almost overlap; the abundance of surface debitage in the immediate vicinity is magnified further by the admixture of materials contributed by Feature 3, a reduction station, located just a few meters south. Feature 1, the larger and deeper of the pits (3.5 by 2 m in diameter, ca. 50 cm deep), was selected as our Sample Feature. It shares many attributes with the pit tested at 26Ek3195, including a well developed berm along its downslope edge and related dense lithic scatter around its perimeter. However, Feature 1 is strikingly depauperate of formed artifacts; only four quarry bifaces comprise the assemblage (Table 90).

A transect of 20 collection units sampled a longitudinal cross-section of the feature surface, along a baseline parallel to the site slope. Units 1-5 occur in the lithic scatter upslope of the quarry pit, Units 6-10 sample the pit itself, and Units 11 and 12 occupy the berm. The debris concentration below the berm was tested by Units 13-15 and Units 16-20 occur well downslope of the surface boundary of the feature. Table 93 summarizes debitage recoveries.

Table 93. Debitage from Sample Feature 1, Site 26Ek3197.

SURFACE COLLECTIONS

OPALITE DEBITAGE

Unit Number	Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	Total
1	9	75.0	1.44	3	25.0	1.60	12
2	6	85.7	1.81	1	14.3	11.80	7
3	23	95.8	1.35	1	4.2	1.30	24
4	26	96.3	4.43	1	3.7	144.70	27
5	80	86.9	4.71	12	13.1	5.25	92
6	37	52.1	10.35	34	47.9	5.45	71
7	43	71.6	5.54	17	28.3	2.25	60
8	10	83.3	3.05	2	16.7	3.05	12
9	37	80.4	2.39	9	19.6	1.55	46
10	29	85.3	1.97	5	14.7	26.50	34
11	42	67.7	1.07	20	32.3	9.65	62
12	18	100.0	0.68	-	-	-	18
13	14	73.7	21.74	5	26.3	14.60	19
14	28	90.3	14.58	3	9.7	34.36	31
15	22	88.0	4.10	3	12.0	16.56	25
16	17	80.9	4.23	4	19.1	94.82	21
17	30	85.7	3.98	5	14.3	10.00	35
18	8	80.0	6.61	2	20.0	4.15	10
19	7	70.0	76.92	3	30.0	3.20	10
20	13	100.0	3.08	-	-	-	13
Total	499	79.3	6.01	130	20.7	11.32	629

Results of the exercise disclose some fluctuations in the diversity and size of debris but, perhaps as a result of converging materials from adjoining features and the relatively steep slope, the levels of debris accumulation are less clearly partitioned than at 26Ek3195. The density of waste flakes tends to diminish downslope while individual average weights increase. Flakes appear to be somewhat more numerous within the pit and on its berm, and their incidence drops markedly beyond the visible limits of the concentration. While much of this density and size sorting may be attributable to colluvial action, the berm is composed of flakes smaller than those encountered in adjacent contexts. Possibly the berm was created by the aggregation of biface reduction debris, while the more robust pieces in areas surrounding the berm apparently are products of quarry pit excavation, toolstone assay, and the opalite blank preparation.

Feature 5

Feature 5 was manifested on the surface as a cluster of nine opalite quarry bifaces occurring within a 0.6 m^2 area on the floor of a small, sheltered crag in the rimrock. A 1 m by 1 m excavation unit, centered on the cluster, revealed an additional 8 specimens just below surface at a depth of < 10 cm, all of them resting just above the bedrock substrate (ca. 15 cm B.S.). No stratigraphic evidence of intentional burial was observed in unit sidewalls.

The seventeen bifaces appear to represent a stockpile of items quarried and reduced elsewhere, then transported and secreted beneath the bedrock ledge, presumably in anticipation of further processing. All are of the same, bluish grey coarse-grained opalite. Material of this type does not occur in the bedrock surrounding the cache, nor is it represented in the debitage scatter that litters the immediate vicinity of the feature. Exclusively early reduction stages are represented by the bifaces; 82% (n=14) are Stage II forms, and the remainder are Stage III.

Feature 10

Lying some 20 m westward along the rimrock from the biface cache is Feature 10, a small rockshelter created by an overhang of brecciated opalite bedrock. Although 5 m wide, its aperture is presently only 90 cm high at the dripline and its ceiling slopes steeply downward to converge with the floor just 2 m inside the outer lip, a configuration offering little space accessible to human occupants. Perhaps reflecting its meagre shelter, cultural remains in the shelter are correspondingly sparse; it appears to have served as a repeatedly but never intensively used reduction station.

None of the local bedrock displays evidence of quarry use. The shelter floor is strewn with cobbles and small boulders apparently derived from roof-fall, and it is littered by a light, amorphous scatter of opalite debitage. Two denser accumulations of reduction debris occur on the rocky shelf just outside the overhang. All these scatters are composed exclusively of opalite waste flakes and shatter.

A 1 m by 50 cm excavation unit straddled the dripline on the shelter floor. Until bedrock was encountered at 60 cm, all vertical levels of the unit yielded similarly monothematic cultural materials consisting of opalite waste flakes and shatter (Table 91). These were distributed homogeneously, but diffusely, through the deposit. Their average weight, ca. 2.8 grams, is generally smaller than at quarry sources examined and is consistent with the toolstone reduction functions posited for the feature.

Soils within the unit consist of gravelly colluvial sand augmented by abundant slabs and cobbles of roof fall. Rodent turbation is extensive and pronounced. This, combined with minimal human use of the shelter, has left little distinct stratigraphy. Minute flecks of charcoal are scattered diffusely throughout, and occur in slightly higher numbers only within a krotovina ca 10 cm below the surface; consequently, the feature offers little opportunity for the recovery of reliable samples for radiometric dating. Even those deposits located within the dripline are moist, making preservation of perishable materials unlikely. Bone fragments appear to be the remains of recently deceased rodents and contributions by carnivore scat.

The series of seven surface collection units arrayed across the amorphous scatter of opalite debris on the upper portions of the site illuminate the dispersed nature of its cultural component. The density of waste flakes ranges from 7 to 89 per m^2, and that of shatter, from 6 to 24 pieces per m^2. Average sizes of the remains are quite large (ca. 5 gm for flakes and 54 gm for shatter). Prehistoric use of the location appears to have been more sporadic and transitory than elsewhere on the site. The large average size of debitage suggests that toolstone was obtained in raw form from adjacent quarry features and transferred to the shelf for reduction, or that bedrock exposed on-site and weathered into cobbles was assayed and processed on the spot.

Summary

Site 26Ek3197 appears to have attracted prehistoric use principally for its toolstone quality opalite; evidence for behaviors other than toolstone procurement and processing is almost entirely lacking. The reduction of toolstone is testified primarily by the quantities of debitage left at the site. Quarry bifaces, presumably the focus of this task, are rare (if the cache is excluded) in comparison to most other sites, and those that do occur are predominantly early stage specimens. This suggests that much of the toolstone quarried and initially reduced at 26Ek3197 was transported elsewhere for further processing. The several Large Reduction Complexes on nearby Holeplug Ridge, which lack primary sources but evidence copious quantities of reduction debris, are plausible destinations for these minimally processed "toolstone packages."

Outcrop Quarry/Reduction Complexes: Context and Function

Cultural features of the four Outcrop Quarry/Reduction Complexes reflect aboriginal mining and processing of toolstone. Generally, they are differentiated from Quarry Pit/Reduction sites by the narrower range of toolstone extraction techniques employed; at none of them was toolstone accessed by excavation. Instead, raw material was liberated from opalite ledges and, to a lesser degree, from exposures of opalite cobbles. Too, site precincts of Outcrop Quarry/Reduction complexes typically subsume larger numbers of distinct lithic debitage concentrations (i.e., reduction features) than do the Quarry Pit/Reduction sites (cf. Tables 90 and 95).

26Ek3196

Site 26Ek3196 occupies the western extreme of the principal knoll in the eastern half of the Undine Gorge area. It is topographically isolated from 26Ek3195 on the south by a shallow ephemeral drainage, and shares the knoll with most of the other open Undine sites that occur slightly upslope and further east on the landform (see Figure 72).

Seven cultural features define the site. Three of its four outcrop quarries (Features 1, 2, and 7) occur on the relatively steep western slopes of the knoll, and a smaller utilized bedrock exposure (Feature 4) occurs higher, on more level ground, where it is surrounded by three reduction stations, Features 3, 5, and 6. The two largest and apparently most intensively used of the quarries, Features 1 and 2, were selected as Sample Features. The manipulated bedrock outcrops at each of them are capped by extensive, dense pavements of natural and culturally derived opalite debris.

As at other quarry sites, recovered assemblages reflect toolstone extraction and early stage biface reduction (cf. Tables 88, 94). A relatively high incidence of cores and hammerstones highlights these activities, as does the prevalence (82%) of Stage 2 quarry biface (Table 89). A single groundstone fragment of unidentified function and several flake tools offer minimal evidence for ancillary maintenance tasks.

Feature 1

The battered facets of many opalite outcrops subsumed by Feature 1 testify to aboriginal toolstone exploitation; however, a possible prehistoric adit, representing a somewhat different approach to toolstone extraction, warranted special scrutiny.

The adit is a small declivity gouged into the bedrock at the base of a low opalite buttress on the southern flank of the knoll. Its aperture is 30 cm high and 1 m wide, and the excavation extends into the outcrop approximately 1 m. Its floor and the ground surface immediately outside are obscured by a dense accumulation of opalite debitage and non-cultural lithic debris. The ceiling of the recess appears fire-blackened and spalled. The bedrock is composed of high quality toolstone; apparently it had sufficient value to inspire a great expenditure of extraction effort. The bedrock exposed elsewhere on the outcrop is highly weathered, softer and grainier in texture, and of lower toolstone utility.

Table 94. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Quarry/Reduction Complexes, Undine Gorge.

Site Number	Feature Number	Type	Total Area (sq m)	ARTIFACT CLASSES Reduction								Processing						Total
				HM	SS	CR	AS	QB	SB	PB	IB	SC	KN	PG	MP	OT	GS	
26Ek3196	1*	Adit/Outcrop Quarry/Reduction	905	3	-	14	1	5	1	-	-	2	-	-	1	1	-	28
	2*	Outcrop Quarry/Reduction	2592	4	-	5	-	8	-	-	-	1	1	-	-	-	1	20
	3	Core Reduction	35	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
	4	Outcrop Quarry/Reduction	16	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2
	5	Core and Biface Reduction	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	6	Core and Biface Reduction	31	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
	7	Outcrop Quarry/Reduction	528	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
	Extra-Feature Context		N/A	1	-	4	-	-	-	-	-	-	-	-	-	-	-	5
26Ek3201	1*	Biface Reduction	102	-	1	-	-	9	3	-	1	-	-	1	-	-	-	15
	2*	Biface Reduction	151	1	-	-	-	21	1	-	-	-	-	-	-	-	1	23
	3*	Biface Reduction	38	1	-	-	-	3	-	-	-	-	-	-	-	-	1	5
	4*	Outcrop Quarry/Lithic Scatter	679	1	-	1	-	-	-	-	-	-	-	-	-	-	-	2
	Extra-Feature Context		N/A	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
26Ek3203	NO FEATURES																	
	Extra-Feature Context		N/A	-	-	5	-	4	2	-	-	-	-	-	-	-	-	11

* Sample Feature

Key to Artifact Classes

Reduction Tools and Artifacts

HM = Hammerstones
SS = Scratched Stones
CR = Cores
AS = Assayed Stones
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces
PB = Preform Trajectory Bifaces
IB = Indeterminate Biface Fragments

Maintenance/Processing

SC = Scrapers and Spokeshaves
KN = Knives
PG = Perforatores and Gravers
MP = Multipurpose Flake Tools
OT = Indeterminate Flake Tool
GS = Groundstone

Table 95 summarizes the results of our 1 m by 1 m shovel skim and coterminous excavation unit that sampled the area immediately outside the adit; our discontinuous baseline of collection units sampled the dense blanket of lithic debris upslope.

Table 95. Debitage from Sample Feature Collections, Outcrop Quarry/Reduction Complexes, Undine Gorge.

SURFACE COLLECTIONS

Site Number	Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	OTHER DEBITAGE (n)	OTHER DEBITAGE (%)	Total
26Ek3196	*1	N/A	1	691.0	394	57.0	3.21	297	43.0	9.60	-	-	691
	1	905	2	435.0	419	38.5	3.75	669	61.4	10.00	-	-	1088
	2	2592	3.25	540.9	1443	82.0	5.98	315	18.0	29.20	-	-	1758
26Ek3198	1	24	30	91.7	2442	88.7	1.07	279	10.0	4.40	31	1.3	2752
	+2	0.9	3	220.6	598	90.3	3.24	64	9.7	1.87	-	-	662
	9	239	2	62.5	107	85.6	2.30	18	14.4	2.72	-	-	125
	14	151	2.75	298.2	702	85.6	5.56	118	14.4	70.20	-	-	820
26Ek3201	1	102	2	656.0	1257	95.8	1.20	30	2.2	3.80	25	2.0	1312
	2	151	7	383.5	2616	97.4	1.05	69	2.6	2.40	-	-	2685
	4	679	1.50	128.0	164	85.4	10.70	28	14.5	42.16	-	-	192
26Ek3203	N/A		3.75	149.6	387	69.0	3.90	174	31.0	11.52	-	-	561

SUBSURFACE COLLECTIONS

Site Number	Fea. No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	Flakes (%)	Flakes (Av Wt)	Shatter (n)	Shatter (%)	Shatter (Av Wt)	OTHER DEBITAGE (n)	OTHER DEBITAGE (%)	Total
26Ek3196	*1	1 / E	30	0.3	2911	75.0	3.25	976	25.0	17.6	-	-	3887
26Ek3198	1	1 / AA**	20	0.2	154	57.8	0.75	35	13.1	2.3	77	28.9	266
26Ek3201	1	1 / F	20	0.1	24	100.0	1.80	-	-	-	-	-	24

Key to Excavation Unit Type

A = 1 by 1 m, 1/8 in. screen
D = 50 cm by 1 m, 1/8 in. screen
E = 1 by 1 m, 1/4 in. screen
F = 50 cm by 1 m, 1/4 in. screen

* Adit within Feature 1
** Level 2 reduced to Unit Type D
\+ 1/8 in. screen

Recovery rates reveal accumulations of formed artifacts and opalite debris fronting the adit that appear to support our assumptions of its prehistoric origin. Until bedrock was reached at ca 30 cm depth, each vertical provenience of the deposit yielded opalite debris in such high densities that it comprises almost the entire volume of the excavated sample; soils contribute a minor intervening matrix amid the lithic waste. As might be expected with primary extraction efforts, average individual size of debitage is quite large; waste flakes weigh on average 3.25 gm, and shatter a robust 17.6 gm per item. As a class, shatter comprises about one-third the total material recovered, but makes up some 67% of the weight of the assemblage. Formed artifacts reflect toolstone processing exclusively. Composition of the collection suggests that, upon liberation of toolstone from the adit walls, it was rendered into cores (n=12) and reduced as far as Stage 2 Quarry Bifaces (n=2) on the spot. Apparently, these were then transported elsewhere for later stages of reduction.

The dense cultural content of deposits associated with the adit is emphasized further when retrievals there are compared to the sample obtained by our discontinuous baseline of 10 1 m x 1 m collection units that spanned the lithic scatter immediately upslope of the feature (Table 95).

Although the area sampled is densely blanketed by opalite debris, its cultural component is rather diffuse, containing on average only 41 waste flakes and 67 pieces of shatter per m (cf. the adit shovel skim densities of 394 flakes and 297 shatter). The average flake size (3.7 gm) is comparable to those at the adit, that of shatter, somewhat lower. Two cores, a pair of hammerstones, and one Stage 2 and one Stage 3 quarry biface suggest that here, as well, reduction focused on early processing of opalite raw materials; these most likely derived from cobbles within the scatter and from the battered outcrops that flank it.

Feature 2

Feature 2 encompasses a prominent bedrock ledge that has been battered in several locations for the liberation of opalite toolstone. Processing of this material appears to have occurred primarily upon the relatively flat bench immediately above the ledge, as evidenced by two dense scatters of reduction debris. Presumably by means of colluvial action, bedrock-free gaps in the ledge have allowed quantities of debris to be transported downward onto the steep slopes below; this in large part appears to account for the feature's extreme size (>2500 m^2).

Our discontinuous series of 50 by 50 cm collection units sampled both of the dense patches of lithic debris as well as contexts within the more diffuse scatters upslope. Units 1-9 examined the southern component, with Units 6-9 falling within the concentrated portion of it; Units 10-13 were each located within the concentrated portion of the northern scatter. Recoveries are summarized in Table 95.

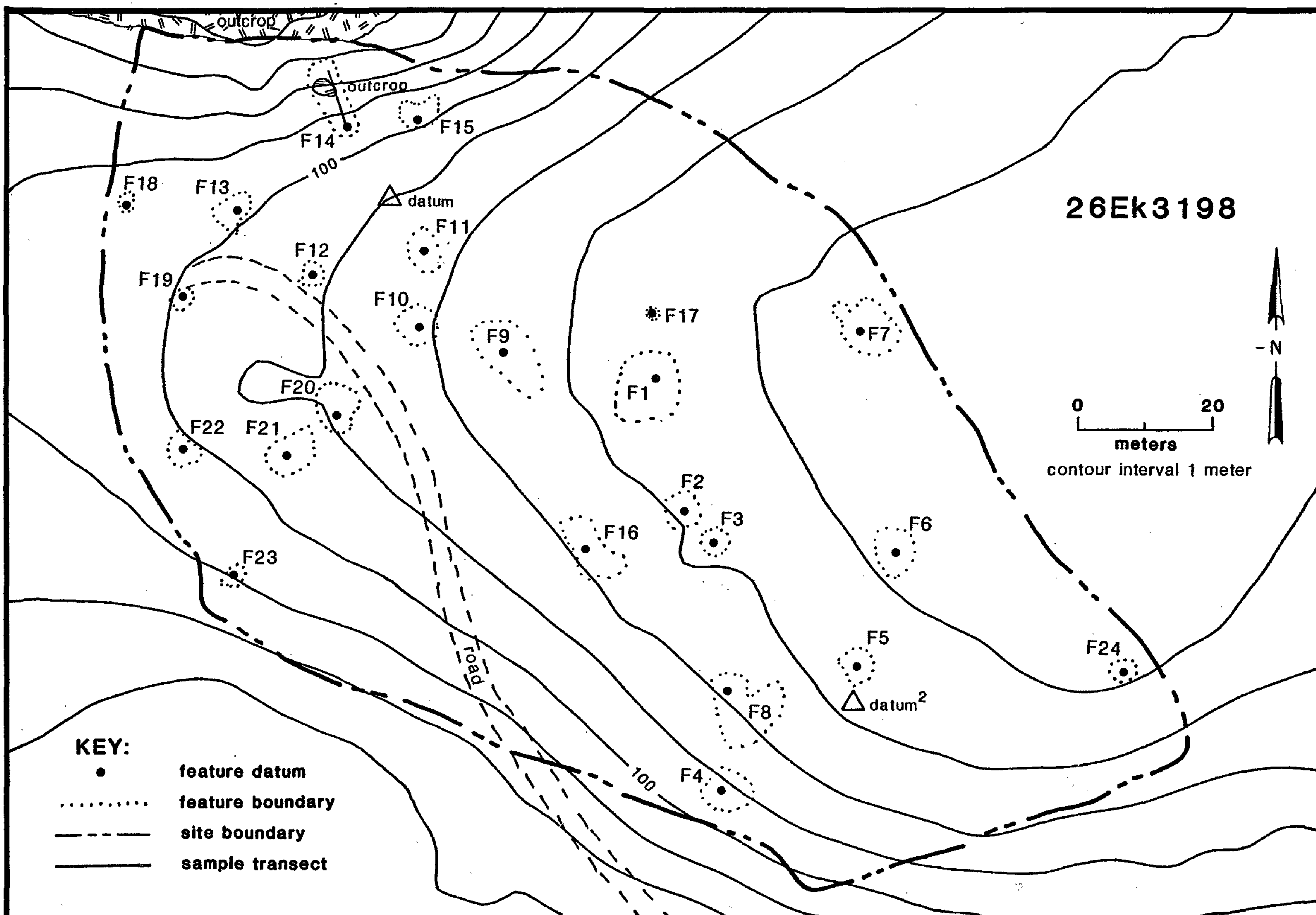
Debitage yielded by samples of both concentrations appear quite similar in character. The densities and average sizes of waste flakes recovered from the two concentrations are roughly identical (ca. 180 flakes per unit and 7.6 gm per flake in the southern concentration, 171 flakes per unit and 7.8 gm per item in the northern). As well, each concentration is augmented by very large specimens of opalite shatter weighing on average ca 49 gm and 33 gm respectively. Formed artifacts are less evenly distributed in the sample. The northern concentration yielded 4 cores, a hammerstone, and 2 Stage 2 quarry bifaces; the southern concentration contained a single core. Those units falling beyond the visible surface concentration of the southern scatter manifest markedly reduced flake densities (ca. 7 flakes per unit), and these are of somewhat smaller size (5.3 gm) than those encountered in either of the concentrations. Like the scatter defining the upper portions of Feature 1, Feature 2 also appears to reflect quarrying and initial biface preparation; the distribution of cultural materials at Feature 2, however, suggests that toolstone extraction and processing were more spatially focused there.

26Ek3198

26Ek3198 occupies the crest of the principal knoll overlooking the eastern reach of Undine Gorge (Figure 72). In our original survey report (Raven 1988), this site was designated a "large reduction complex." Closer scrutiny during testing, though, revealed several toolstone sources within its precincts, leading us to reclassify the site. Still, however, aboriginal use of the locality appears to relate primarily to the reduction, rather than the extraction, of lithic raw material.

Of the 24 cultural features comprising the site (twice the number detected originally), 19 consist of single reduction stations. Varying in size and composition, they are strewn over the central, nearly flat portion of the knoll top (Figure 77). Quarrying, by contrast, occurs in only four locations; most seem to represent minor extraction efforts. Feature 14 resulted from use of a low outcrop at the site's northwestern extreme, and several small exposures of opalite cobbles were exploited in widely scattered places throughout the site (Features 8, 15, and 24). Only the outcrop quarry Feature 14 contains evidence of substantial toolstone procurement.

Figure 77. Site map, 26Ek3198.



26Ek3198
outcrop
outcrop
datum
datum2
road
100
100
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F15
F16
F17
F18
F19
F20
F21
F22
F23
F24
0
20
meters
contour interval 1 meter
N
KEY:
feature datum
feature boundary
site boundary
sample transect

Feature 1 reflects activities ancillary to, but supportive of, toolstone manipulation. Here, an abundance of projectile points and maintenance tools appears to represent a hunting stand, temporary camp, or a special activity area.

Inventory and sampling operations at 26Ek3198 resulted in the collection of 5571 cultural items, including the largest (n=126) assemblage of formed artifacts recovered from the Undine sites (Tables 88, 96); predictably, the vast majority of the collection is composed of opalite debitage.

The collection is notable in several respects. First, quarry bifaces appear to have been more fully reduced at 26Ek3198 than they were elsewhere (cf. Table 89); more than half of the specimens from 26Ek3198 are Stage 3 forms and almost 20% have been processed to Stage 4, suggesting an emphasis on intermediate stages of reduction. The relatively high frequency of cores and assayed pieces in the assemblage would seem to contradict this suggestion, save that <u>all</u> of the cores and assayed pieces collected at the site were recovered from Feature 14, the small outcrop quarry. We suspect that most of the material reduced at 26Ek3198 was imported to the site in the form of Stage 2 bifaces obtained from neighboring quarry sites that flank it on three sides.

Feature 1

Already distinctive for the large numbers of projectile points and obsidian flakes visible before testing, shovel-skimming the entire surface of the feature, followed by the excavation of a 1 m by 1 m unit centered on its zone of greatest concentration, served to amplify the abundance and diversity of its contents. The assemblage looks much like the accumulation predictable for a small hunter's temporary camp or tool maintenance station; the 6 quarry bifaces recovered comprise a miniscule portion of the formed artifact collection. The assemblage includes over 80% (n=6) of the projectile points and all, save one, of the projectile point preforms recovered from the site. As well, 14 of the 17 flake tools and all of the knives (n=3) found at the site are contributed by the feature. A shaft abrader, unique among USX-East collections, was also encountered there. Our subsurface probe suggests that the feature is confined largely to the upper 10 cm of the deposit; below this level artifact yields are markedly reduced. Debitage retrievals are summarized for both surface and subsurface samples in Table 96.

Feature 2

Feature 2, appearing on the basis of very limited surface exposure to consist of a buried core-reduction station, was

Table 96. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Site 26Ek3198.

Feature Number	Type	Total Area (sq m)	ARTIFACT CLASSES															
					Reduction				Points		Processing						Other	
			HM	CR	AS	QB	SB	PB	PT	FG	SC	KN	PG	MP	OT	AB	CE	Total
1*	Lithic Scatter/Hunting Camp	24	-	-	-	6	2	11	6	11	7	7	1	5	1	1	-	54
2*	Core Reduction	0.9	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	3
3	Biface Reduction	22	-	-	-	3	2	1	1	-	-	-	-	-	-	-	-	7
4	Core and Biface Reduction	86	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2
5	Biface Reduction	50	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	5
6	Biface Reduction	26	-	-	-	5	-	-	-	-	-	-	-	1	-	-	-	6
7	Core Reduction	123	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
8	Cobble Quarry/Reduction	297	-	-	-	3	-	-	1	-	-	-	-	-	-	-	-	4
9*	Core Reduction	239	-	-	-	2	-	-	-	-	-	-	-	-	-	-	4	6
10	Core Reduction	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
11	Core and Biface Reduction	19	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
12	Biface Reduction	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
13	Core and Biface Reduction	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
14*	Outcrop Quarry/Reduction	151	2	5	3	8	-	-	-	-	-	-	-	-	-	-	-	18
15	Cobble Quarry/Reduction	33	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
16	Biface Reduction	170	-	-	-	5	1	-	-	-	-	-	1	-	-	-	-	7
17	Biface Reduction	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
18	Biface Reduction	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
19	Core and Biface Reduction	14	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
20	Biface Reduction	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
21	Biface Reduction	24	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	5
22	Core and Biface Reduction	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
23	Biface Reduction	5	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2
24	Cobble Quarry/Reduction	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Extra-Feature Context		N/A	-	-	-	2	2	-	1	-	-	-	-	-	-	-	-	5

* Sample Feature

Key to Artifact Classes

Reduction Tools and Artifacts
HM = Hammerstones
CR = Cores
AS = Assayed Stones
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces
PB = Preform Trajectory Bifaces

Projectile Points
PT = Classifiable Points
FG = Unclassifiable Fragments

Other
CE = Ceramic Sherds

Maintenance/Processing
SC = Scrapers and Spokeshaves
KN = Knives
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
OT = Indeterminate Flake Tool
AB = Abraders

found upon testing to be composed of a dense cluster of fairly small opalite flakes and shatter, a scraper, and a single Stage 2 quarry biface. The surface distribution was found, in fact, to map rather accurately the distribution of artifacts immediately below the surface (i.e., 0-2 cm), although the latter were considerably more abundant. The "off-feature" 1 m by 1 m collection units placed just beyond the apparent limit of the surface scatter produced dramatically less debitage (6 flakes, and no shatter) than the units centered on the visible scatter. Large average individual sizes of flakes (ca 3.2 gm) appears to substantiate our original identification of the feature as a core-reduction locale (Table 96).

Feature 9

Testing of Feature 9 was predicated on the surface occurrence of three ceramic sherds and the implied possibility that the feature might contain greater diversity than suggested by the surface scatter of opalite debitage. Our 1 m by 2 m sample produced one additional sherd, a pair of Stage 2 quarry bifaces, 107 opalite flakes, and 18 pieces of opalite shatter. We suspect that the ceramic vessel may have been broken in transit and may bear no intrinsic functional relationship to the feature. The average individual size of flakes (2.3 gm) is commensurate with the reduction stages displayed by the small collection of quarry bifaces, and suggests early stage toolstone processing functions for the feature.

Feature 14

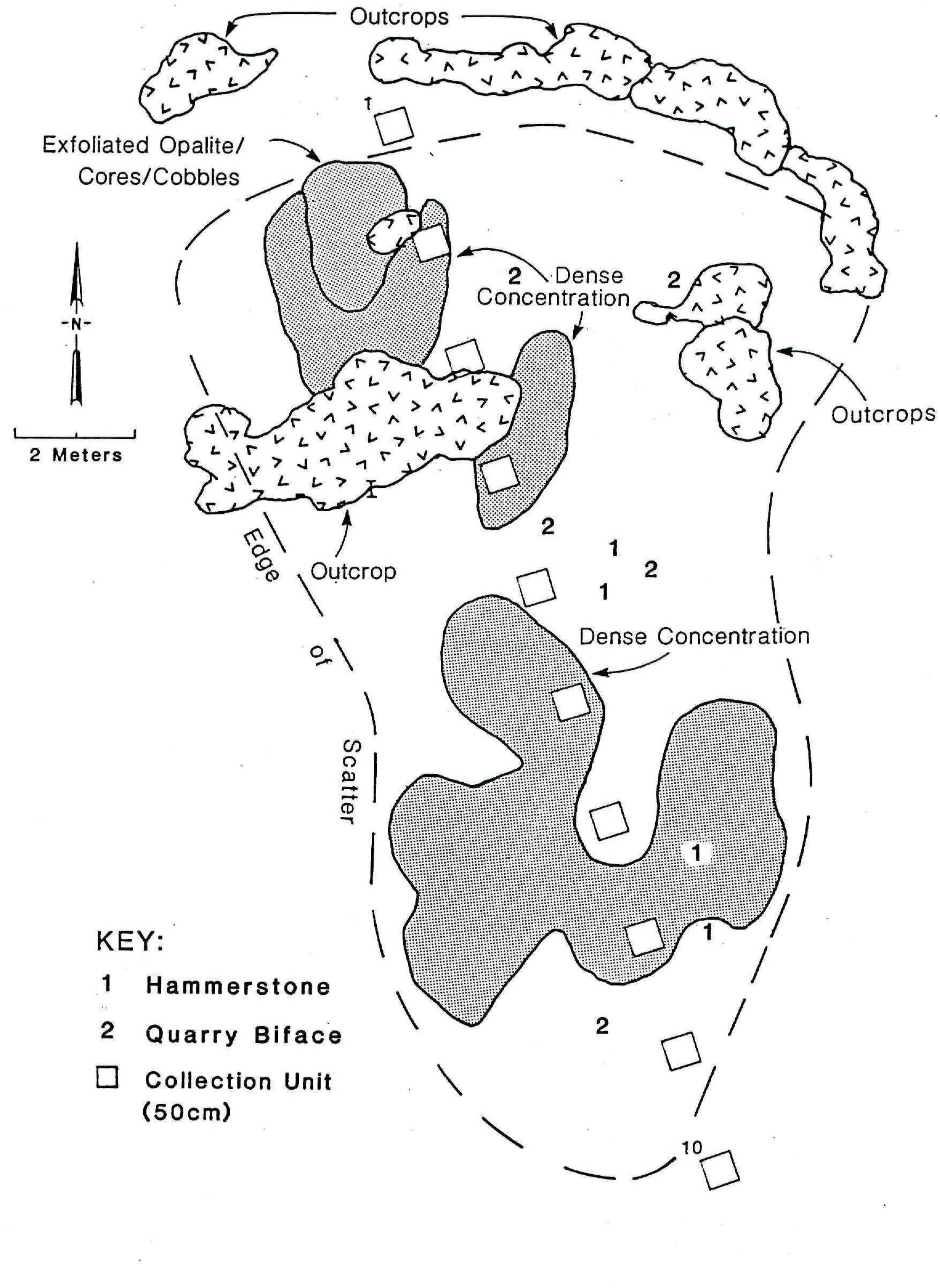
Feature 14 is the only major quarry located within 26Ek3198. It occurs at an opalite outcrop on the northern brink of the knoll (Figure 78). Toolstone exploitation is reflected in several concentrations of debris, and our discontinuous transect of sampling units was placed to test the artifact content both within and between recognizable concentrations. Table 97 presents recovery rates by unit.

The densest concentrations occur just downslope of the principal outcrop (Unit 2) and about an equal distance upslope from it (Unit 5); average flake weights (4.4 gm and 5.7 gm, respectively) are fairly robust in both cases.

Noting an apparent concentration of cores and large shatter just off our sample line, we imposed an additional sampling unit (Unit 11) to increment the range of variability tested. This unit produced all 5 of the cores recovered from the site, as well as its only Stage 1 quarry biface. Average weights for the 11 opalite flakes (ca 34 gm) and 56 pieces of shatter (ca 118 gm) obtained from Unit 11 are very high. Clearly, this portion of the feature reflects some of the earliest stages in

Figure 78. Plan of Feature 14, 26Ek3198.

26Ek3198 Feature 14



extraction and reduction. The large fragments utterly blanketing the surface suggest they may continue to significant depth. Alternately, since no pit has been developed, yet the topographic relationship of the outcrop and the surrounding landform reflects that of quarry pits elsewhere in the project area (cf. 26Ek3170, -3171, -3196, and 3200), it may be that Feature 14 represents an earlier point in the sequence of site formation that eventually results in quarry pits. On the other hand, earlier episodes of quarrying may be buried beneath the overburden of primary debitage and shatter.

Table 97. Debitage from Sample Feature 14, Site 26Ek3198.

SURFACE COLLECTIONS

	OPALITE DEBITAGE						
Unit	Flakes			Shatter			
Number	(n)	(%)	(Av Wt)	(n)	(%)	(Av Wt)	Total
1	24	92.3	3.57	2	7.7	168.65	26
2	231	95.1	4.41	12	4.9	32.89	243
3	13	100.0	1.86	-	-	-	13
4	50	96.1	4.44	2	3.9	19.35	52
5	115	100.0	5.74	-	-	-	115
6	80	87.0	3.56	12	13.0	6.45	92
7	81	93.1	5.51	6	6.9	42.48	87
8	43	75.4	8.75	14	24.6	26.59	57
9	50	78.1	8.24	14	21.9	13.65	64
10	4	100.0	0.60	-	-	-	4
11	11	16.4	33.9	56	83.6	118.29	67
Total	702	85.6	5.56	118	14.4	70.25	820

In sum, the composition of the majority of cultural features at 26Ek3198 relate overwhelmingly to intermediate stages of opalite toolstone reduction. Although opalite sources occur in sufficient numbers to classify the site an "Outcrop Quarry/Reduction Complex," these are apparently little used save at Feature 14. The seeming low intensity of quarrying evidenced by the on-site sources leads us to assume that most of the toolstone processed at the site originated at other nearby sources. In addition to its temporally diagnostic artifacts, the informative but anomalous lithic scatter of Feature 1 contributes the majority of non-quarry artifacts to the assemblage. These tools are concentrated in a single, spatially discrete feature, which may inform us about prehistoric activities coincident with more narrowly focused aboriginal mining tasks.

26Ek3201

Site 26Ek3201 overlooks the upper reach of Undine Gorge from the northern flank of the principal knoll in the eastern half of the study area (see Figure 72). It encompasses only three Reduction Stations and an Outcrop Quarry (Figure 79). Like 26Ek3198, sharing the knoll top just to the west, the opalite source at 26Ek3201 appears little used; aboriginal occupants seem instead to have employed the site primarily as a base for toolstone reduction convenient to other nearby sources. As at 26Ek3198, a relatively high proportion of quarry bifaces processed at 26Ek3201 appears to have been reduced further than those at other Undine sites (cf. Table 89). Although more quarry bifaces in the collection are early reduction products (Stage 2 forms n=18, 55%), the relative proportion of specimens advanced to intermediate reduction stages (Stage 3 n=14, 42%) is larger than that at any other site in the area save 26Ek3178 and 26Ek3177.

Opalite debitage makes up the bulk of the 4162 cultural items recovered. The formed artifact assemblage (n=48) is dominated by implements directly related to toolstone processing (93.7%, n=45); maintenance/subsistence oriented items comprise the scant remainder. The distribution of formed artifacts is restricted almost exclusively to the confines of features; only a single hammerstone was encountered in a non-feature context (Table 94).

Feature 1

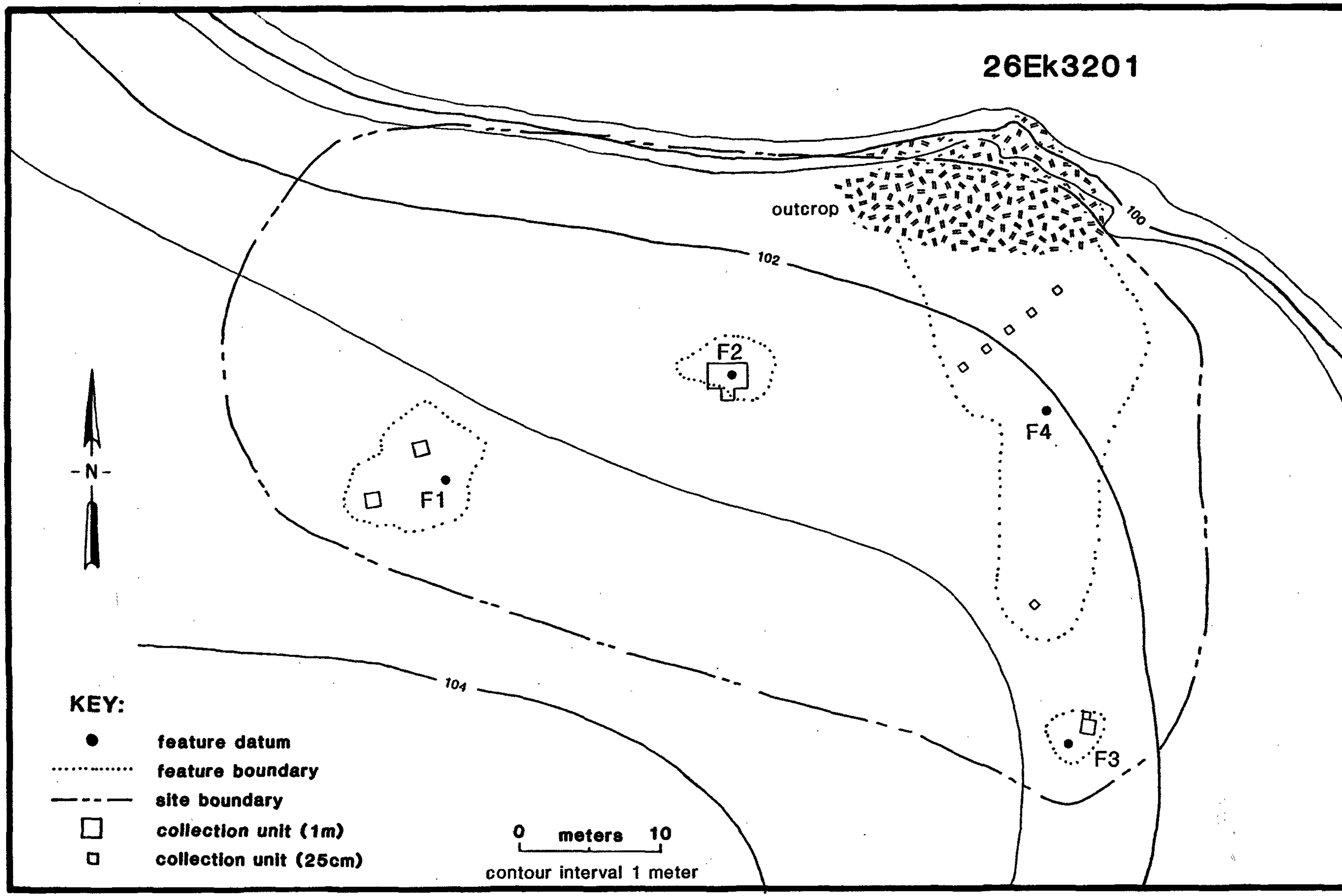
Three dense, close-set concentrations of opalite reduction debris, interspaced by a moderate density lithic scatter, define Feature 1. One of these concentrations, which displayed several pieces of obsidian debitage on its surface, was sampled by our 1 m by 1 m collection Unit 1. Unit 2 was placed in the moderate density scatter between concentrations. Recovery rates are offered in Table 95 and 98.

Table 98. Debitage from Sample Feature 1, Site 26Ek3201.

SURFACE COLLECTIONS

Unit Number	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
1	900	94.4	1.37	28	2.9	4.07	25	2.7	953
2	357	99.4	0.78	2	0.6	1.25	-	-	359

Figure 79. Site map, 26Ek3201.


26Ek3201
outcrop
100
102
104
F1
F2
F3
F4
N
KEY:
feature datum
feature boundary
site boundary
collection unit (1m)
collection unit (25cm)
0 meters 10
contour interval 1 meter

The resulting collection is informative two ways. First, the strikingly different yields of the units imply that the concentrations visible on the surface are spatially very discrete; densities observable by surface inspection alone predict those immediately below the surface (i.e. < 2 cm). Second, the relatively low average weight of individual flakes (ca 1 gm per item), coupled with the comparatively low incidence of shatter, appears to be consistent with the types of quarry bifaces recovered. Of the 9 quarry bifaces most (n=5, 56%) display attributes of intermediate reduction (Stage 3), while Stage 2 forms comprise one-third (n=3) of the set (one specimen is of indeterminate stage). We take the lack of cores, as well as its paucity of large waste flakes and shatter, to suggest that opalite arrived at Feature 1 in the form of either flake blanks or, more likely, Stage 2 quarry bifaces.

Feature 2

Except for the absence of obsidian debitage, the artifact content of the reduction station at Feature 2 appears similar to that at Feature 1. Surface manifestations, however, are not reliable indicators of the distribution of remains lying immediately out of view (< 2 cm depth). Our collection grid of 7 1 m by 1 m units centered on and exceeded the visible horizontal limits of the largest of two dense lithic concentrations which define the feature (Table 95). Some units external to the feature yielded higher debitage returns than some units within it. Mechanisms accounting for these discrepant distributions probably have to do with post-deposition processes; this is one of the issues to be addressed by further data recovery.

Amounts of debitage appear to be concordant with the types of Quarry Bifaces recovered. The occurrence of 12 Stage 2 specimens (57%) and 9 Stage 3 specimens (43%) is consistent with the relatively small flake sizes and minor quantities of shatter encountered.

Feature 3

A small, moderate density scatter composed largely of opalite reduction debris, Feature 3 was sampled by a 1 m by 0.5 m excavation unit because a dozen metate fragments were observed on its surface. Their presence hinted that activities additional to toolstone processing occurred there, but results of our probe were equivocal.

The two excavation levels, both heavily turbated, yielded a very few (n=24) opalite waste flakes, and five additional metate fragments. In addition, they exposed an amorphous charcoal stain of ambiguous vintage. The charcoal stain appeared similar to ones observed on the ground surface elsewhere which were clearly attributable to recent burning of sagebrush roots. The stain in Unit 1 is somewhat more diffuse, a result, perhaps, of ostensible rodent churning. All seventeen fragments pertain to the same metate; some of the pieces are heavily fire affected while others, refitted adjacent to burned ones, appear pristine. The contrasting condition of the fragments may reflect re-use of some of them as cooking stones. However, given the recent and certainly long history of range fires in the region, natural causes fragments' condition as well as for the shallow zone of charred soils cannot be ruled out.

Feature 4

Feature 4 is an extensive but apparently little-used outcrop quarry located on a broad expanse of rimrock that immediately overlies the 26Ek3177 rockshelter. Two bedrock outcrops evidence minor battering; elsewhere, the feature is defined by a diffuse scatter of debitage intermixed with denser accumulations of natural opalite debris (Table 99).

Table 99. Debitage from Sample Feature 4, Site 26Ek3198.

SURFACE COLLECTIONS

OPALITE DEBITAGE

Unit	Flakes			Shatter			
Number	(n)	(%)	(Av Wt)	(n)	(%)	(Av Wt)	Total
1	100	100.0	14.80	-	-	-	1
2	119	87.5	10.58	17	12.5	4.46	136
3	4	100.0	30.20	-	-	-	4
4	1	100.0	13.90	-	-	-	1
5	1	100.0	2.80	-	-	-	1
6	38	100.0	9.04	-	-	-	38
Total	164	90.6	10.7	17	9.4	4.46	181

Units 1-5 spanned the diffuse lithic scatter. Their meager cultural content, save in Unit 2, suggests minimal use of the area. The large average size of the flakes recovered (14.5 gm) echoes its principal function as a quarry source where apparently only the earliest stages of opalite processing (core and/or possibly blank preparation) took place. Unit 6 sampled a more concentrated scatter of debitage surrounding one of the battered opalite outcrops. Here waste flakes are more numerous, and their large average size and the concomitant abundance of large shatter are commensurate with those anticipated for quarrying debris.

Formed artifacts are exceedingly scarce; A core and a hammerstone make up the entire assemblage.

26Ek3203

Site 26Ek3203 occupies a narrow shelf of rimrock at the brink of Italian Mesa on the north side of Undine Gorge, affording a good view of the confluence of Undine Gorge and Little Antelope Creek to the southwest. The site appears to have been utilized only minimally in comparison to most other nearby quarry sources. Few formed artifacts occur there, all of them (n=13) related directly to toolstone procurement and early stages of opalite processing. The distribution of artifacts is diffuse; they occur in a moderately dense scatter of naturally liberated opalite fragments strewn over the entire site area. Nowhere are they sufficiently concentrated to form discernible cultural features.

Our discontinuous transect of 15 50 cm by 50 cm collection units sampled the cultural content of the scatter across the entire downslope axis of the site. The uppermost units (Units 1-5) span a relatively flat area, and those below (Units 6-15) cross a steeper (ca. 4-5%) grade. Unit-specific debitage retrievals are summarized by Table 100.

The relatively large size of individual debitage items and the abundance of shatter reflect quarrying and early stage lithic reduction. Units yielded an average of only 26 flakes and 12 pieces of shatter; and these items are relatively large, flakes averaging ca. 4 gm and shatter, 12 gm. Due either to colluvial processes or the more commodious working contexts offered by the relatively flat upper portion of the site, units there contain a somewhat greater abundance of smaller debitage than occurs downslope. Upslope units (1-5) returned on average 34 waste flakes and 18 pieces of shatter, weighing 3 gm and 5 gm, respectively. Downslope, Units 6-15 yielded on average of 21 flakes and 7 pieces of shatter per unit, flakes weighing an average of 5 gm, shatter, 13 gm.

The formed artifact assemblages reflect emphasis on early stages of toolstone processing and the dispersed rather than spatially focused nature of the remains. Five cores were encountered in surface collection units suggesting relatively high incidence throughout the site. Conversely, only one of four quarry bifaces (all Stage 2 forms) was recovered in a collection unit; the remainder were recovered from widely scattered locations.

Table 100. Debitage from Discretionary Surface Collection Units, Site 26Ek3202.

SURFACE COLLECTIONS

Unit Number	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	Total
1	62	56.8	4.26	47	43.2	9.90	109
2	19	100.0	0.57	-	-	-	19
3	46	51.1	1.80	44	48.9	9.90	90
4	21	67.7	4.96	10	32.3	3.20	31
5	21	77.7	3.50	6	22.2	2.46	27
6	37	69.8	3.59	16	30.2	16.70	53
7	5	55.5	4.78	4	44.4	1.85	9
8	58	61.0	1.60	37	38.9	16.48	95
9	3	100.0	0.46	-	-	-	3
10	19	86.4	2.73	3	13.6	21.26	22
11	31	88.6	4.07	4	11.4	19.90	35
12	25	100.0	6.27	-	-	-	25
13	23	92.0	10.43	2	8.0	12.70	25
14	8	100.0	14.16	-	-	-	8
15	9	99.0	4.90	1	1.0	1.70	10
Total	387	68.9	3.90	174	31.1	11.50	561

Rockshelters: Context and Function

Of the three rockshelters tested at USX-East, two, 26Ek3177 and -3202, appear to be comparatively little used, as testified by their depauparate and functionally limited artifact assemblages. Each assemblage is dominated by items indicative of toolstone processing, but less so than elsewhere in the project area. Although collections from all of the rockshelters are augmented by maintenance and/or subsistence related tools, only the largest rockshelter, 26Ek3204, offers these implements in quantities and varieties suggestive of at least some degree of residentiality (cf. Tables 88 and 101).

26Ek3177

The smallest of the rockshelters, 26Ek3177, occurs in the rimrock just below the outcrop quarry at 26Ek3201. An overhang of opalite bedrock provides limited protection over an area of ca. 5 m^2 within its 1 m high dripline. Several places on the shelter's opalite walls and bedrock exposures just outside it are battered, suggesting at least minor toolstone extraction. A moderate density lithic scatter floors the shelter and occupies the apron immediately outside. For the most part, our meager collection of formed artifacts was encountered in these surface contexts. Two quarry bifaces were collected from the floor of the shelter, and a core and hammerstone occurred on the rocky shelf just outside the dripline.

Table 101. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Rockshelter Reduction Stations, Undine Gorge.

				ARTIFACT CLASSES														
			Total	Reduction							Points		Processing					
Site Number	Fea. No.	Type	Area (sq m)	HM	SS	CR	AS	QB	SB	IB	PT	FG	SC	PG	MP	OT	GS	Total
26Ek3177	1*	Rockshelter/Reduction	71	1	-	1	-	2	-	-	-	2	-	-	-	-	-	6
		Extra-Feature Context		-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
26Ek3202	1*	Rockshelter/Reduction	8	-	-	2	1	2	-	-	-	-	1	-	-	1	-	7
26Ek3204	1*	Rockshelter/Reduction	16	-	-	2	-	15	4	2	1	-	5	1	1	3	-	34
		Extra-Feature Context		4	1	15	1	-	-	-	-	-	1	-	-	-	1	23

* Sample Feature

Key to Artifact Classes

Reduction Tools and Artifacts
HM = Hammerstones
SS = Scratched Stones
CR = Cores
AS = Assayed Stones
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces
IB = Indeterminate Biface Fragments

Projectile Points
PT = Classifiable Points
FG = Unclassifiable Fragments

Maintenance/Processing
SC = Scrapers and Spokeshaves
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
OT = Indeterminate Flake Tools
GS = Groundstone

Our 1 m by 0.5 m excavation unit and coterminous shovel skim revealed deposits in the interior of the shelter that are shallow and whose artifactual content is made up almost exclusively of opalite debitage. Bottomed by bedrock between 15 and 20 cm, the overlying gravelly colluvium produced only two formed artifacts, both unclassifiable projectile points: one in the 0-2 cm shovel skim; and another from the 2 to 10 cm level. The deposit lacks discernible stratigraphy, and rodent turbation is extensive. Small particles of charcoal are scattered diffusely throughout the unit. Soils were moist at all depths, suggesting little likelihood for the preservation of organic remains. Debitage recovered by the exercise is summarized by Table 102.

After taking into account the differential volumes sampled by the surface scrape and the excavation levels, Table 102 reveals that the overwhelming majority of cultural material retained in the 1/4" mesh resides in the upper 2 cm of the deposit. Moderate average flake sizes and abundant shatter mirror both the early stage of reduction reflected by the single classifiable quarry biface (a Stage 2 form), as well as the minor toolstone extraction suggested by the battered opalite exposures at the site.

Table 102. Debitage from Sample Feature Collections, Rockshelters, Undine Gorge.

SURFACE COLLECTIONS

Site Number	Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
26Ek3184	1	71	0.5	1502	115	15.4	1.89	636	84.6	2.25	-	-	751
26Ek3202	1	8	0.5	530	228	86.0	0.61	37	14.0	10.55	-	-	265
26Ek3204	1	16	1.0	1736	1548	89.1	3.02	188	10.8	8.50	-	-	1736
				3345	[2759]	[82.5]	[0.06]	[580]	[17.3]	[68.3]	[6]	[0.2]	[3345]
				(5081)	(4307)	(84.8)	(1.12)	(760)	(15.1)	(2.2)	(6)	(0.1)	(5081)

SUBSURFACE COLLECTIONS

Site Number	Fea. No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
26Ek3177	1	1 / G	20	0.10	255	72.4	1.38	97	27.6	5.05	-	-	352
					[356]	[96.7]	[0.04]	[12]	[3.3]	[0.13]	-	-	[368]
					(611)	(84.7)	(0.60)	(109)	(15.3)	(4.51)	-	-	(720)
26Ek3202	1	1 / G	50	0.25	830	85.0	1.62	146	15.0	4.05	-	-	976
					[2,051]	[78.5]	[0.05]	[561]	[21.5]	[0.10]	-	-	[2,612]
					(2,881)	(80.3)	(0.50)	(707)	(19.7)	(0.92)	-	-	(3,588)
26Ek3204	1	1 / G	60	0.30	14,680	89.6	1.67	1651	10.1	5.46	41	0.3	16,372
					[52,616]	[91.8]	[0.05]	[4632]	[8.1]	[0.09]	[33]	[0.1]	[57,281]
					(67,296)	(91.4)	(0.40)	(6283)	(8.5)	(1.50)	(74)	(0.1)	(73,653)
		2 / G	40	0.20	1,765	86.1	3.30	284	13.9	11.86	1	0.05	2,050
					[252]	[83.4]	[0.10]	[50]	[16.6]	[0.13]	-	-	[302]
					(2,017)	(85.8)	(2.92)	(334)	(14.2)	(10.13)	-	-	(2,351)

Key to Excavation Unit Type
A = 1 by 1 m, 1/8 in. screen
D = 50 cm by 1 m, 1/8 in. screen
G = 50 cm by 1 m, 1/4 in. and 1/8 in. screen

Key to Mesh Size Retrievals
n = 1/4 in. fraction
[n] = 1/8 in. fraction
(n) = 1/4 in. + 1/8 in. combined

26Ek3202

Encompassing a slightly larger and somewhat more protected area within its dripline (ca 8 m^2), the rockshelter at 26Ek3202 encloses deposits that are deeper but otherwise comparable to those sounded at 26Ek3177. Also like the smaller shelter, 26Ek3202 is manifest on the surface by a moderate density opalite scatter within and immediately outside its dripline, but it lacks evidence of on-site toolstone procurement. A pair of cores and an assayed fragment of opalite found on the apron just outside the shelter comprise the surface assemblage of formed artifacts. Table 102 presents debitage retrievals from our 1 m by 0.5 m shovel skim and coterminous excavation unit.

Again, after imposing controls for the differential volumes and screen mesh sizes employed for shovel skims and excavated levels, the shallowest contexts of our sample (i.e., <2 cm deep) are seen to contain the densest accumulations of cultural materials. The presence of both a Stage 4 quarry biface in Level 2 and a Stage 2 biface in Level 4 hint weakly that a wider range of reduction tasks were hosted by the site than was the case at 26Ek3177. Given the lack of evidence for toolstone extraction from opalite outcrops at 26Ek3202, however, the abundance and relatively large size of shatter encountered there suggest that reduction was initiated on relatively early-stage raw materials (i.e., cores or unmodified opalite nodules). The close proximity of Outcrop Quarry 26Ek3202, located several meters upslope, is the probable source of opalite reduced at the rockshelter.

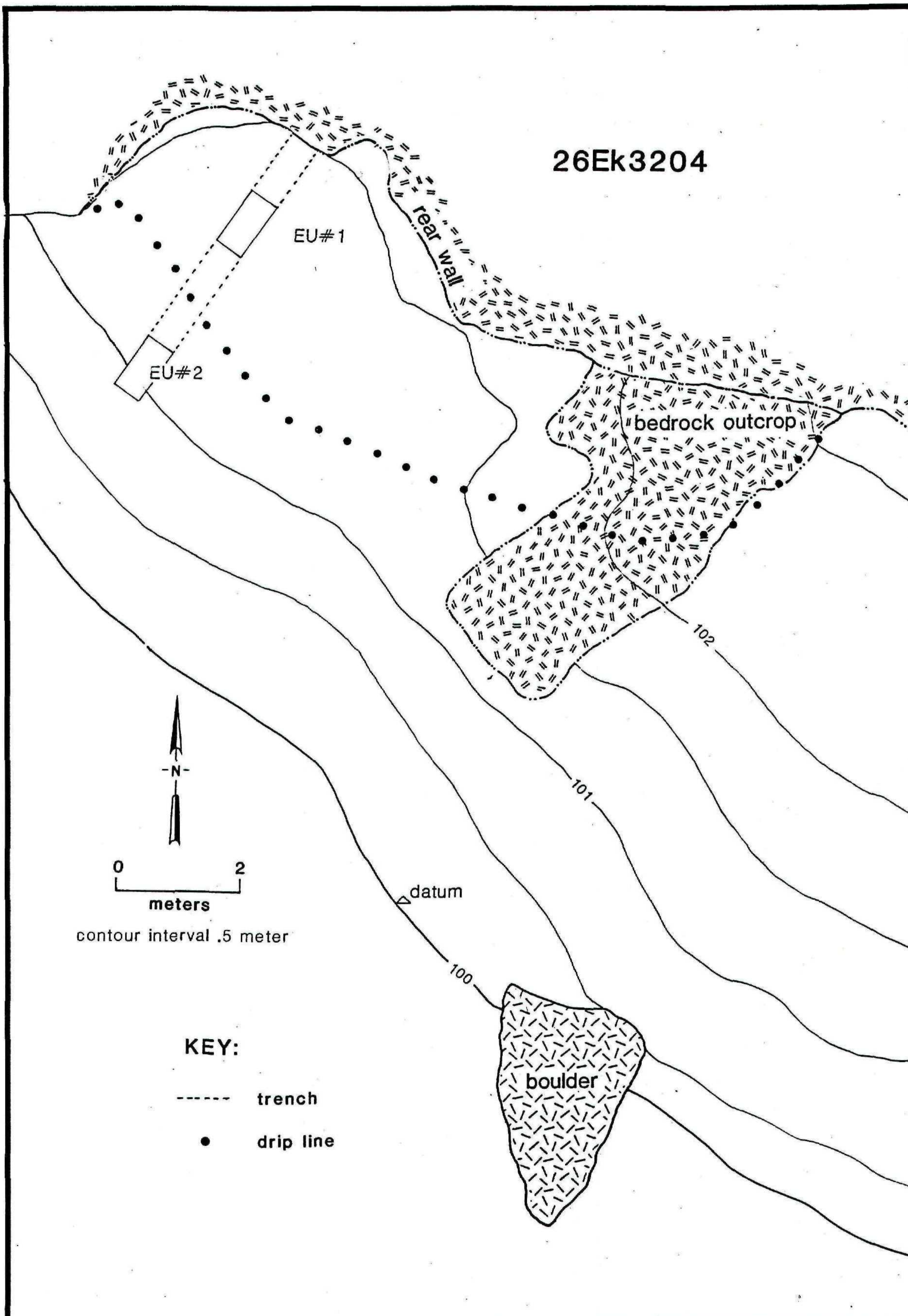
In sum, the two smallest rockshelters appear to have functioned primarily as minimally sheltered reduction stations. Although both assemblages include tool classes suggestive of additional functions, only a very few of these implements occur in our sample, and this, combined with the wet soil encountered in subsurface probes at each site, dampens hope that they contain perishable materials.

26Ek3204

26Ek3204, the largest of the Undine shelters, exhibits the greatest intensity of prehistoric use, expressed both in the abundance and diversity of surface cultural material and in apparent accumulation of vertical deposit (Figure 80, Table 101 and 102).

Back of the dripline, ca 18 m^2 of flat surface are covered with a virtually unbroken pavement of opalite debitage and lesser frequencies of obsidian waste flakes, quarry bifaces, cores, hammerstones, and flake tools. The opalite walls of the shelter appear to have served as a source of toolstone. Outside the dripline, the apron is littered with a similar, though less

Figure 80. Site map, 26Ek3204.


26Ek3204
EU#1
EU#2
rear wall
bedrock outcrop
102
101
100
datum
boulder
N
0
2
meters
contour interval .5 meter
KEY:
trench
drip line

dense, assemblage; quarry bifaces and cores are especially abundant. The surface scatter of cultural materials extends ca 12 m beyond the mouth of the shelter, growing more diffuse in contexts furthest downslope.

Deposits at both the interior and exterior of the shelter appeared upon initial reconnaissance to hold considerable potential for buried cultural remains. Moreover, the deposits appeared to be largely dry, although two small patches of Great Basin wildrye grow near the rear wall, indicating some localized collection of moisture. We noted also that subsequent to the snows in June 1988, fissure seepage from the roof of the shelter dampened these areas, but the preponderance of the surface is unvegetated and seems seldom to receive moisture. The exterior deposits, appear to be greater than a meter deep. They are, however, exposed to weathering and are unlikely to retain organic components.

Our inventory and limited testing resulted in the recovery of some 110,345 cultural items, the highest number yielded by any site in the USX-East project area. Within this collection, only 57 formed artifacts occur; the remainder is composed of lithic debitage, chiefly opalite waste flakes and shatter. The assemblage of formed artifacts is summarized by Table 101, and Table 102 provides average recovery rates for our two 1 m x 0.5 m excavation units.

Considering both the formed artifact and debitage assemblages, it would appear that the full opalite reduction scenario was played out at the shelter. Toolstone procurement, evidenced by the battered state of the rear wall of the shelter, where opalite nodules appear to have been liberated from the brecciated matrix, is asserted as well by the great abundance of shatter encountered. Early reduction stages are witnessed both by the high incidence of cores as well as by the quarry biface collection which, although encompassing forms representative of reduction through Stage 4, is dominated by Stage 2 and Stage 3 specimens (Table 89). Later toolstone reduction is reflected principally by the debitage assemblage alone. Within the shelter, the high numbers of debitage pieces recovered by the 0.3 m^3 of excavation Unit 1 are the consequence of a dense packing of very small items. Over 78% (n=52,616) of the flakes and 74% (n=5198) of the shatter recovered by Unit 1 were retained in the 1/8" mesh fraction; the average weight of these flakes is 0.05 gm and that of pieces of shatter is 0.09 gm. Such miniscule debitage implies a finishing workshop not evident in the recovered assemblage of formed tools. It may be, however, that repeated occupation of the shelter and trampling of its surface have resulted in the fragmentation of larger secondary flakes, but this seems unlikely in light of the number of pieces involved. Detailed debitage analysis will be required to resolve the issue.

Comparison of debitage yielded by the 1/4" samples from within the shelter (Unit 1) to that recovered outside it (Unit 2) suggests some differences in the prehistoric use of these locations. Accumulations inside the shelter are probably denser than those tested on the apron, and average sizes of flakes and shatter from the interior (1.6 gm and 5.5 gm, respectively) are substantially smaller than those of items encountered outside (3.1 gm and 8.9 gm, respectively). While it is possible that these differences represent some spatial separation of tasks, (i.e., relatively early reduction tasks on the apron, and later reduction undertaken within the shelter) they could also be due to size sorting occurring as a consequence of site maintenance. Both units disclose a general reduction in the number of cultural items per level as depth increases, but no clear trend in the distribution of average flake weights.

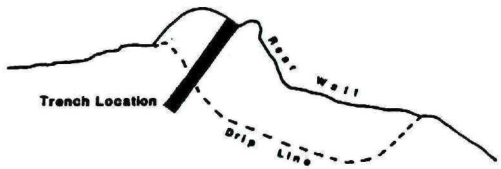
Other components of the assemblage, particularly the wide variety and comparatively large numbers of maintenance/ subsistence tools encountered on the interior surface suggest that the site served occasionally as shelter for small, temporary camp groups. This speculation inspired our digging of two excavation units in hopes of defining hearths and other subsurface cultural features as well as recovering a sample of perishable materials. These goals were only partially accomplished by unit excavation.

No hearths were discerned in unit excavations. Although charcoal is abundant, it occurs as very small particles distributed diffusely throughout the deposits. Of the ca. 500 bones recovered, there is little evidence for cultural origins. The assemblage consists chiefly of rodents, with a few artiodactyls, miscellaneous reptiles, and 2 fish. Only 4% of the bones are burned, while 40% of them exhibit diagnostic traits (e.g., pitting, rounding of fractured surfaces) marking them as carnivore scat bones (Schmitt and Juell 1989). Most of the others appear to be recent inclusions, probably representing rodent burrow deaths.

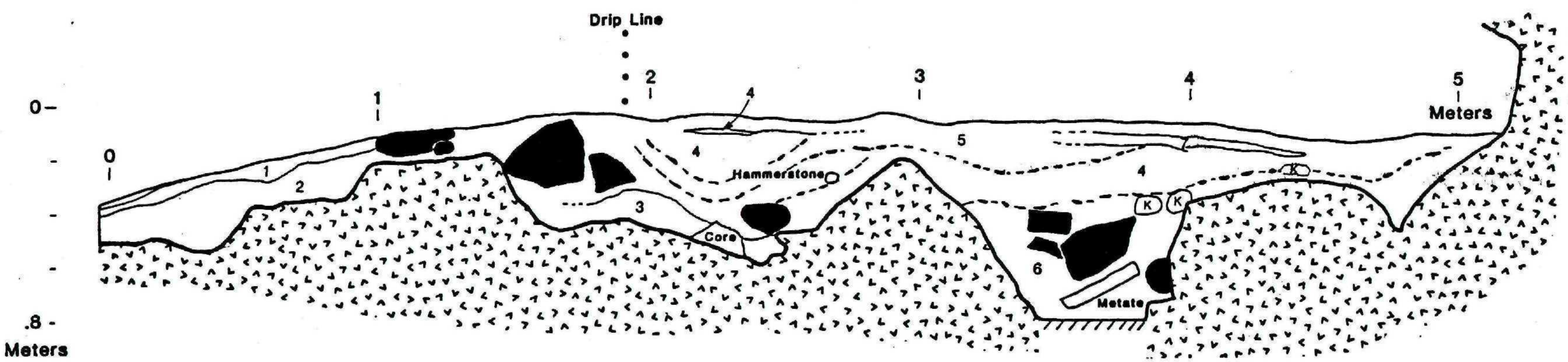
The hand excavated stratigraphic trench extended through the two 1.0 by 5 m test units, from the rear wall of the shelter to the apron and colluvial slope below. The excavation units and the trench all revealed a shallow cultural deposit overlying an irregular floor comprised of bedrock and large blocks that have fallen from the ceiling (Figure 81). It is difficult to distinguish bedrock from roof-fall in limited excavations, and we cannot estimate how much cultural deposit remains beneath the collapsed material.

On present knowledge, cultural deposits in the shelter occur over a narrow range of depths from 10 cm to over 80 cm. Due to the presence of charcoal and other organics, all deposits are black (10Yr 2/1). Most are sandy loams or loamy sands.

Figure 81. 26Ek3204, Trench 1, west wall profile.



26Ek3204 West Wall, Trench 1



In the discussion that follows, stratigraphic unit numbers do not reflect their relative position in the profile (Figure 81). However, the discussion is organized from outside to inside and from top to bottom of the profile. No attempt is made to group units into horizons.

Unit 1 is a layer of black sand loam about 5 cm thick mantling the colluvial slope outside the dripline. Unit 1 is overlain in places by a thin layer of sagebrush duff. Unit 2 is a layer of black loam with a maximum thickness of 25 cm laying on bedrock below Unit 1 outside the dripline.

Unit 5 is the uppermost layer inside the dripline of the shelter. It is black sand about 5 cm thick. Unit 7 is a discontinuous layer of compact, brown dung between 2 and 4 cm thick, found only in the shelter interior, just below Unit 5. This material was deposited during use of the shelter by some large ungulate, most likely mountain sheep (Ovis canadensis). Unit 4 is black loamy sand overlain by Unit 7 and/or Unit 5. About 40 cm of Unit 4 fills a crevice or pocket between 2.2 and 3.4 m out from the rear wall, as well as a larger pocket between 1.2 and 2.3 meters from the rear wall. Flake lines suggest the presence of basin-shaped features in both pockets, filled in several discrete episodes. In the outermost pocket, a hammerstone can be seen in the profile resting on the lowest flake line. The trench excavators noticed an abundance of bifaces and hammerstones when they went through this section, suggesting the possibility of a cache.

Unit 3 is a layer of black clay loam about 10 cm thick, appearing to rest on bedrock. If so, this unit may represent residual clay from weathered bedrock we have observed elsewhere in the study area. Although flakes were not observed in Unit 3, a large opalite core is embedded in it.

Unit 6 is black loamy sand filling the lower portion of the rear-most pocket, below about 30 cm BS. The bottom of this feature was not penetrated, and it may be considerably deeper. Unit 6 contains several large blocks of stone, including a flat, tabular piece of basalt that appears to be a metate. A cache seems possible in this location as well.

In sum, 26Ek3204 is unique in constituting the densest concentration of cultural material encountered in the project area. The low incidence of formed artifacts within the deposits limits the kinds of inferences that can be made regarding the suite of activities carried out there, but the surface assemblage suggests that some (recent?) episodes of use may have been residential. Despite the failure of our excavations to locate hearths or informative collections of faunal remains, it seems likely that they may be present in other quadrants of the shelter.

Reduction Station: Context and Function

The single site of its kind in the Undine area, 26Ek3178, is noteworthy primarily for its similarity to, but isolation from, sites that typify the archaeological record at Holeplug Ridge. Each of its four cultural features is composed of dense concentrations of opalite reduction debris; evidence of toolstone procurement is absent. It is, however, on the eastern flank of the knoll dominating the upper reach of Undine Gorge, adjacent several nearby opalite sources (i.e., 26Ek3198, -3197, and -3178). On the basis of proximity, we suspect that toolstone processed at 26Ek3178 was derived from these neighboring sources (Figure 72).

Feature 1, our Sample Feature, inspired closer scrutiny for the relative abundance of formed artifacts on its surface and its apparent spatial integrity. Surface inspection of Feature 1 revealed five Stage 3 quarry bifaces, a flake scraper, one Desert Side-notched projectile point, and a projectile point fragment within the debris concentration. The remainder of the features are defined by concentrations of opalite debitage only, save for an additional Desert Side-notched projectile point recovered from the surface of Feature 1 (Table 103).

Table 103. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Site 26Ek3178.

Feature Number	Type	Total Area (sq m)	ARTIFACT CLASSES: Reduction CR	QB	SB	IB	Points PT	FG	Processing SC	Total
1*	Core and Biface Reduction	44	1	11	1	1	1	1	1	17
2	Unspecified Reduction	64	-	-	-	-	1	-	-	1
3	Biface Reduction	10	-	-	-	-	-	-	-	0
4	Biface Reduction	8	-	-	-	-	-	-	-	0
Extra-Feature Context		N/A	-	1	-	-	-	-	-	1

* Sample Feature

Key to Artifact Classes

Reduction Tools and Artifacts
CR = Cores
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces
IB = Indeterminate Biface Fragments

Projectile Points
PT = Classifiable Points
FG = Unclassifiable Fragments

Maintenance/Processing
SC = Scrapers and Spokeshaves

Our set of 5 contiguous 1 m by 1 m collection units bisected the scatter of Feature 1; 3 central units (2, 3, and 4) were positioned wholly within the concentration, and Units 1 and 5 fell just outside the concentration at its upslope and downslope extremes. Unit-specific debitage recovery rates are summarized by Table 104.

Table 104. Debitage from Sample Feature 1, Site 26Ek3178.

SURFACE COLLECTIONS

Unit Number	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
1	90	91.8	2.10	8	8.2	2.28	-	-	98
2	1523	98.1	1.59	28	1.8	22.21	1	0.10	1552
3	1538	86.9	1.84	230	13.1	2.79	-	-	1768
4	481	92.9	1.62	37	7.1	4.11	-	-	518
5	104	88.1	1.96	14	11.1	1.70	-	-	118
Total	3736	92.2	1.80	317	7.8	4.62	1	0.02	4054

The distribution of cultural materials revealed by this exercise suggests that the observed surface limits of the feature are echoed by the relative densities of remains immediately below the ground surface. The units within the visible concentration are clearly more densely packed with debris than those outside. This implies that the present configuration of the feature approximates its original state and suggests that it represents the results of spatially focused opalite reduction events rather than accumulation by post-depositional processes. In addition, the apparent integrity of the feature, at least circumstantially, supports the contemporaneity of the reduction episode with Desert Series projectile points.

The Quarry Biface assemblage, coupled with attributes of the debitage, suggests that the feature served primarily as a station for early and intermediate stages of opalite reduction. In addition to the five Stage 3 Quarry Bifaces retrieved during inventory, 3 more of these specimens, as well as 3 Stage 2 forms, and a Stage 3 small biface were recovered by shovel skims within the concentrations. The average size of waste flakes (ca 1.8 gm) and the comparatively small quantity of opalite shatter is consistent with the types of debris anticipated to have been created during the manufacture of Stage 2 and 3 quarry bifaces.

In sum, based on our detailed scrutiny of one of its features and a general perusal of its others, 26Ek3178 appears to have served largely as a station for the reduction of toolstone. The raw materials for this were likely obtained and initially processed into cores and/or flake blanks at quarry sites nearby. As observed at similar sites elsewhere in the project area, the presence of maintenance/subsistence tools (the scraper and projectile points) suggest that reduction activities were supplemented by additional tasks not directly addressing toolstone processing.

Summary

Of the twelve sites in the Undine Gorge subarea all, save the single Reduction Station 26Ek3178 and some of the smaller rockshelters, contain exploited opalite sources within their precincts; these are accompanied by numerous reduction features, many of which evidence early stages of toolstone processing. Opalite procurement methods employed at the Undine sites duplicate the full range of techniques in evidence at the Tosawihi Quarries proper. These include the excavation of quarry pits, exploration of exposed outcrops, utilization of surface accumulations of cobbles and, in at least one instance perhaps, the creation adit-like excavations in the rimrock. While the archaeological record of the subarea is dominated by the remains of opalite extraction and processing, maintenance and subsistence artifacts suggestive of activities ancillary to and supportive of prehistoric mining occur within most site assemblages and are particularly salient components of 26Ek3204 and Feature 1 at 26Ek3198.

Three of the Undine sites proved to be particularly informative and promise to contribute significantly to the address of Research Domains developed by Elston (1988; Chapter 1, this volume) for the Tosawihi Quarries and its immediate surrounds. At 26Ek3195, trenching to the basal levels of various of the quarry pits would provide necessary horizontal as well as vertical controls to isolate units for volumetric analyses of the quantities of toolstone processed and the levels of effort expended. Tests of Feature 2 there suggest that it is eminently suited to the investigation of the relation between extraction techniques and site formation processes. Such data might be achieved via exposure of the original source material outcrop, identification of the techniques used to reduce it (firing, direct percussion, etc.), close examination of the relative lithology of the outcrop in terms of toolstone quality, and attempted correlation with the stratigraphic units composing the pit and berm. The presence of charcoal in the stratigraphic units of Feature 2 also promises the opportunity to provide an absolute chronological framework for identifying temporal variation in quarry use and knapping techniques.

At 26Ek3198, the place of the quarries in the regional economy might be addressed by further investigation of the hunting camp represented by Feature 1. Closer examination of the spatial configurations of the feature, together with a better characterization of assemblage diversity and sourcing of a large sample of obsidian debitage would allow observations on group size, activity focus, and site function.

The rockshelter 26Ek3204 proved to be unique, constituting the densest concentration of debitage encountered in the project area, however it remains unknown whether the bulk of this reduction debris originated from the processing of opalite from its surrounding walls or from other off-site sources. The distinction is important to the question of the quantity of toolstone processed, the level of effort expended, and ultimately the function of the site. Resolution of the issue could be approached through further exploration for hearths, fuller characterization of assemblage variability, and comparison of debitage with known toolstone sources. Despite the failure of our excavations to locate hearths, it seems possible that they may be present in other quadrants of the shelter; their utility as sources of both directly datable materials as well as dietary remains is obvious. The preservation of bone, although largely non-cultural, suggests that the site may yield paleo-environmental data as well.

Chapter 17. HOLEPLUG RIDGE

by Steven G. Botkin

The Holeplug Ridge testing arena occupies the central portion of the project area (Figure 82). Mildly rolling and ascending gradually to the south between elevations of 5600 and 5750 ft. amsl, the subarea incorporates elements of three locally prominent landforms. Its southwestern quadrant includes the relatively flat uppermost bench on the crest of Ramadan Ridge. Holeplug Ridge, a broad, gently sloping appendage originating from the eastern flank of these highlands, arcs northeastward and then northwestward through the midsection of the area. Near its base, the ridge coalesces with the westernmost foot slopes of Corral Fan and terminates in a series of low knolls at the southern margin of Undine Gorge.

Soils over most of the area are shallow (where tested, ca 30 cm deep) sandy colluvial silts. They vary chiefly in the quantities of cobbles and gravels of rhyolite tuff they contain. These inclusions are most abundant on the lower ridgecrests and slopes at the extreme northern edge of the area. Somewhat higher, on the knolls along the southern margin of Undine Gorge, this colluvium is overlain by aeolian silt or loess-like deposits that appear to have buried some cultural features in the vicinity (cf 26Ek3192).

Vegetation of Holeplug Ridge is essentially identical to that found elsewhere in the project area, an edaphic mosaic of low sage and big sage communities, with smaller components of phlox, rabbitbrush, and perennial grasses.

Factors attracting aboriginal use of the Holeplug area remain unclear. The composition and distribution of sites suggest that people located there more in response to the proximity of natural resources just outside than to distinctive attributes of the subarea itself. This appears to be the case, particularly, when the nature of the Holeplug sites is compared to the distribution of toolstone and sources of potable water.

Cultural features comprising the nineteen Holeplug sites are almost entirely the consequence of opalite toolstone reduction. However, primary sources of this material are virtually absent from the area. Although several small outcrops do occur sporadically within the precincts of Holeplug sites located on the slopes immediately above Undine Gorge, for the most part they evidence apparently episodic, expedient use, rather than the more intensive exploitation observed elsewhere in the project area. Apparently none of these sources was of sufficient quality, or their toolstone contents in high enough demand, to have inspired the excavation of quarry pits or other intensive extraction efforts.

Figure 82. Topographic setting, Holeplug Ridge Sites.

TOSAWIHI QUARRIES:
ARCHAEOLOGICAL INVESTIGATIONS AND ETHNOGRAPHIC STUDIES
IN NEVADA

Note:

One or more pages have been removed from this part of the report due to sensitivity of specific archaeological site location information. Qualified persons may contact the Nevada Bureau of Land Management, Elko Field Office, to inquire about obtaining additional information.

In spite of the paucity of lithic raw material, the incidence and density of reduction features is greatest along this northern fringe of the Holeplug area. Here, sites defined by large numbers of well defined concentrations of reduction debris and functionally diverse artifact assemblages occur in an almost continuous band coincident with the relatively flat knoll tops overlooking Undine Gorge. From these locations high quality toolstone is available in abundance and is easily accessible at nearby quarries within the Ramadan and Undine subareas. This northern tier of Holeplug sites also lies within easy reach of at least seasonally available water. Pools remained in the drainage of Undine Gorge for several days following summer storms in 1988.

Upslope and southward from Undine Gorge, the archaeological record changes (see Figure 82). Comparatively far removed from opalite sources and water, sites there consist of progressively fewer and less densely clustered reduction features. These upland sites are all quite small, and they occur at widely spaced intervals on relatively steeper slopes. Their artifact assemblages are somewhat less functionally diverse than those at the margin of Undine Gorge.

The Holeplug area seems to have attracted most use primarily to its northern margin, where low knolls provide relatively flat workshop zones proximal to water and conveniently positioned for the reduction of toolstone from elsewhere. Its elevated southern portion forms a less intensively used, apparently less frequently visited, hinterland.

Descriptive Site Summary

The nineteen sites within the area sort into four site types. These include Outcrop Quarry/Reduction Complexes (n=2), Large Reduction Complexes (n=3), Small Reduction Complexes (n=5), and Reduction Stations (n=9). Almost all are defined by concentrations of opalite processing debris. They are differentiated chiefly by the presence or absence of manipulated toolstone outcrops and by the number of reduction features they contain (Table 105). All save one was tested. The exception, Reduction Station 26Ek3182, was excluded from our sample after close inspection revealed that its shallow depositional context and sparse artifactual contents offered little useful data not obtainable from other sites close by.

Located in the northeast corner of the Holeplug area, the two Outcrop Quarry/Reduction Complexes (26Ek3191 and 26Ek3193) are confined to the knolls of the westernmost spur of Corral Fan overlooking Undine Gorge. Both sites include small bedrock exposures that evidence only minimal exploitation. At 26Ek3193, a battered opalite rim surrounded by a litter of angular shatter and primary flakes (Feature 1) offers the only clear indication of toolstone extraction at the site. The six additional features are concentrations of reduction debris. Quarrying efforts are even less pronounced at 26Ek3191. There, owing perhaps to the diminutive size and weathered state of its solitary opalite outcrop, toolstone acquisition appears to have been directed instead toward a diffuse field of exposed cobbles. Many of the cobbles evidence assay and the presence of later stage debitage suggests that some were reduced further on the spot. However, nowhere has the resulting debris accumulated in sufficient densities to be identifiable as reduction features; overall, the site displays one of the sparsest lithic scatters observed within USX-East. Moreover, the single feature recorded at the site is not clearly associated with opalite processing. It consists of a small cluster of obsidian flake tools and debitage isolated at the margin of the cobble field.

Table 105. Descriptive Summary, Holeplug Ridge Sites.

Site Number	Type	Features (n)	Maximum Site Area (sq m)
26Ek3172	Small Reduction Complex	6	2,420
26Ek3173	Small Reduction Complex	4	530
26Ek3174	Reduction Station	2	590
26Ek3175	Reduction Station	1	90
26Ek3179	Reduction Station	2	110
26Ek3180	Reduction Station	1	12
26Ek3181	Reduction Station	1	235
26Ek3182	Reduction Station [NOT TESTED]	1	--
26Ek3183	Reduction Station	1	90
26Ek3184	Large Reduction Station	24	12,680
26Ek3185	Small Reduction Station	7	910
26Ek3186	Reduction Station	2	185
26Ek3187	Reduction Station	1	40
26Ek3188	Small Reduction Complex	1	95
26Ek3189	Small Reduction Complex	4	1,320
26Ek3190	Large Reduction complex	11	7,450
26Ek3191	Outcrop Quarry/Reduction Complex	1	6,600
26Ek3192	Large Reduction Complex	5	3,190
26Ek3193	Outcrop Quarry/Reduction Complex	7	3,610

The three Large Reduction Complexes adjoin the Outcrop Quarries and likewise occupy the flat knoll tops and shelves that verge on the southern bank of Undine Gorge. Site 26Ek3192 lies between the two Outcrop Quarries at the base of Corral Fan; 26Ek3184 and -3190 are positioned immediately to the west, along the lowest extensions of Holeplug Ridge. Each site covers an area in excess of 2000 m^2 and is punctuated by from 6 to 24 cultural features. With two notable exceptions, these features are composed of concentrations of opalite reduction debris; many include a variety of processing and maintenance tools as well. The noteworthy examples occur at 26Ek3184 and 26Ek3192, where reduction stations are augmented by single features consisting of discrete piles or cache-like clusters of opalite quarry bifaces. Boundaries of all three sites are lines enclosing clusters of these features and conform closely to the principal contours of the landforms, encircling the flattest, uppermost portions of the knolls above Undine Gorge.

The five Small Reduction Complexes appear to have functional similarity to Large Reduction Complexes, but, owing perhaps to topographic constraints imposed by relatively steeper slopes and/or greater distance from material sources, they include fewer, sparser concentrations of opalite debitage. They are defined by from 1 to 7 reduction features and cover total areas <700 m^2. Three of them (26Ek3185, -3186, and -3189) occupy microtopographic flats on the slopes surrounding a gully that separates lower Holeplug Ridge from Corral Fan. Two, 26Ek3172 and -3173, occur on the almost level, highest bench, of Ramadan Ridge.

Smaller still are the nine Reduction Stations. All but 26Ek3174 are located on the midslopes of Holeplug Ridge; the exception is perched on the crest of Ramadan Ridge at the southwestern corner of the study area. Relatively far from opalite sources and water, they are composed only of concentrations of reduction debris surrounded by lower density scatters, encompassing generally less than 300 m^2. Their internal composition appears equivalent to that of individual features within the Larger Reduction Complexes, from which they are distinguished chiefly by their isolation.

Testing Strategies

The Holeplug sites were tested by methods identical to those employed elsewhere in the project area. Table 106 summarizes actions applied to the Holeplug Ridge sites; these are described in more detail basis below.

Outcrop Quarry/Reduction Complexes

At 26Ek3191, the single cultural feature, a small obsidian scatter, was collected in its entirety by shovel-skimming and screening a square grid of four contiguous 1 m^2 units. Two of the seven features at 26Ek3193 were sampled. The lithic scatter upslope of the battered opalite ledge of Feature 1 was sampled by shovel skimming and screening a series of four 50 cm by 50 cm units placed at three meter intervals along a baseline bisecting the scatter and oriented parallel to the ground slope. The entire northern half of Feature 4 was shovel skimmed in six 1 m by 1 m collection units. The southern half of the feature was occupied by a large harvester ant mound. Its occupants, aroused somewhat by our initial efforts on the north, and of sufficient size and/or tenacity to be retained in 1/4" screen mesh, inspired alteration of our original strategy which had called for 100% collection of the feature. The southern half of Feature 4 remains in situ, available for additional study in the future, by others.

Table 106. Summary of Testing Procedures, Holeplug Ridge Sites.

Site Number	Features Recorded Total (n)	Features Recorded Sampled (n)	FEATURE CONTEXT Surface Skim Area (sq m)	FEATURE CONTEXT Subsurface Excavation Volume (cu m)	RECOVERED COLLECTIONS Debitage (n)	RECOVERED COLLECTIONS Formed Artifacts (n)
26Ek3172	6	1	8	-	1252	5
26Ek3173	4	1	40	.075	4346	14
26Ek3174	2	0	-	-	-	2
26Ek3175	1	0	-	-	-	1
26Ek3179	2	1	13	-	1295	6
26Ek3180	1	0	-	-	-	1
26Ek3181	1	1	24	.050	3822	18
26Ek3183	1	1	15	-	2316	4
26Ek3184	26	4	9	.200	5557	131
26Ek3185	7	1	20	.050	2118	36
26Ek3186	2	0	-	-	-	1
26Ek3187	1	0	-	-	0	0
26Ek3188	1	0	-	-	0	0
26Ek3189	4	0	-	-	1	5
26Ek3190	11	2	40	.100	11617	93
26Ek3191	1	1	4	-	35	34
26Ek3192	5	2	29.5	-	24872	271
26Ek3193	7	2	7	-	3700	24

Large Reduction Complex

Owing in part to their large size, but as well to the variety and composition of the features they subsume, Large Reduction Complexes dominated the testing program at USX-East.

At 26Ek3184, Feature 1, a biface cache, consisted on the surface of a small, tightly clustered assemblage of six opalite quarry biface fragments and an obsidian biface. A block of two 1 m by 1 m units was shovel skimmed and screened to test the composition of the assemblage, and a 1 m by 50 cm excavation unit was opened to a depth of 10 cm in the zone of greatest artifact density. Selected as a typical reduction station, Feature 2 was collected totally by shovel skimming and screening four contiguous 1 m by 1 m units. Feature 3, a larger reduction station with seven discernible concentrations of reduction debris, was tested by a discontinuous transect of eight 50 cm by 50 cm collection units spaced at 2 m intervals; each unit was shovel skimmed and screened. Feature 8, also a reduction station, but distinguished from most by a small cluster of early stage opalite quarry bifaces and cores, was shovel skimmed over a 1 m^2 area and subsequently excavated to a depth of 20 cm.

Two features at 26Ek3190 were sampled. Feature 1, a moderately large concentration of reduction debris, was selected for closer scrutiny because of the abundance of quarry biface fragments observed on its surface as well as for its dense accumulation. Arrayed to cover the entire surface of the feature, a grid of 28 contiguous 1 m by 1 m collection units was shovel skimmed and screened. Following this, a 1 m by 50 cm excavation unit sounded its depths to 20 cm in an area of high artifact density. A smaller reduction station, Feature 2, was collected completely by shovel skimming a block of 12 1 m x 1 m units.

Tests at 26Ek3192 focused most intensive field efforts at two features. Feature 1 was marked on the surface by a scatter of opalite debitage and a cluster of 6 early stage quarry bifaces that we took to represent a biface cache. A rectangular area 4 m by 6 m in extent centered on the biface cluster was shovel skimmed and screened in 24 1 m x 1 m units. Subsequently, an initial 1 m by 50 cm excavation unit was dug to 20 cm in order to expose the cache more completely. Expanding from this, additional excavation units were added, to expose a hearth-like stain and an underlying layer of large debitage and chunks of opalite. By the close of the testing phase, 12 m^2 had been dug within the feature to depths of between 20 and 40 cm.

Feature 2 comprised an opalite reduction station dotted by two dense lithic concentrations that displayed a diversity of material types and artifacts. The feature was first sampled by a discontinuous transect of 20 50 cm by 50 cm units arrayed at 1 m intervals. Each unit was shovel skimmed and screened; 7 of them fell within the larger of the feature's lithic concentrations. Additionally, a 1 m by 50 cm excavation unit was placed near the baseline and excavated to a depth of 20 cm. Results of augering probes in the vicinity prompted the excavation of another unit, 1 m by 1 m in size, to a depth of 80 cm.

Small Reduction Complexes

At 26Ek3172, the entire surface content of Feature 1, a reduction station, was collected by shovel skimming and screening a block of 8 1 m by 1 m units. Feature 1 at 26Ek3173 was selected for complete surface collection due to the observation of two (unclassifiable) projectile points within the scatter of opalite reduction debris. This was accomplished by superimposing a grid of 40 1 m by 1 m shovel skim units over the feature's visible horizontal extent. A 1 m by 0.5 m excavation unit, its contents screened through 1/8" mesh, sounded subsurface contexts to a depth of 20 cm. Likewise at 26Ek3185, Feature 1 was chosen as Sample Feature for its abundance of formed artifacts (Quarry Bifaces, projectile points, and flake tools). A block of 20 contiguous 1 m by 1 m collection units was shovel skimmed and screened, covering the entire feature. Following this a 1 m by 0.5 m unit was excavated to a depth of 10 cm where surface artifacts appeared to be most densely concentrated. Subsurface soils were passed through 1/8" mesh. The remaining two Small Reduction Complexes, 26Ek3188 and -3189, were tested via inventory procedures alone.

Reduction Stations

Only three of the eight Reduction Stations tested were scrutinized by Sample Feature methods. A cluster of debitage concentrations at 26Ek3179 (Feature 1) was sampled by a grid composed of 13 1 m by 1 m shovel skimmed units. These subsumed the feature's entire area. At 26Ek3181, the site's single feature - a dense accumulation of reduction debris accompanied by a pair of ceramic sherds and several flake tools was collected by means of shovel skimming a rectangular area composed of 24 1 m by 1 m units. Where this exercise revealed flake densities to be the highest, a 1 m by 0.5 m excavation unit was dug to a depth of 10 cm, the deposits screen through 1/8" mesh. The single feature at 26Ek3183, a scatter of reduction debris, was collected in its entirety by a block of 15 1 m by 1 m units. Each square was shovel skimmed and screened.

The remaining Reduction Stations tested (26Ek3174, -3175, -3180, -3186, and -3187) were subjected only to inventory level examination of their features.

Chronology

Given the nature of data presently at hand, we can address the chronology of aboriginal use of the Holeplug sites only with reference to projectile points and ceramic sherds. Table 107 summarizes projectile point recoveries on a site by site basis.

Most specimens (n=27) were unclassifiable, in terms of Thomas' (1981) due to fragmentation (n=16), unfinished state (n=10), or deviant morphology (n=1).

The 13 classifiable projectile points suggest a relatively late prehistoric use of Holeplug Ridge. More than three-quarters of the specimens are of Desert Series styles (Desert Side-notched n=4, Cottonwood n=3) dating from post-A.D. 1300. Several points from 26Ek3192 hint at earlier occupation; a Great Basin Stemmed projectile recovered from the surface of Feature 2 and a Humboldt Series piece from excavation Level 2 of Feature 1 imply visitation as early as 9000 B.C. and from 3000 B.C. - A.D. 700, respectively. Further, although less reliable, evidence of early site use is implied by the recovery of three fragments of a single, rather robust, edge ground basalt biface from the surface of Feature 2. These, we speculate, may represent an additional Stemmed Series specimen but they are highly weathered and fragmentary. An episode of pre-A.D. 1300 site use is suggested as well at 26Ek3184 by the Large Side-notched point recovered from Feature 24.

Table 107. Summary of Projectile Point Types from Holeplug Ridge.

Site Number	Classifiable STM	HBS	LSN	CTN	DSN	Other PPT	FRG	Total
Outcrop Quarry/ Reduction Complex								
26Ek3193	-	-	-	-	-	-	-	0
Cobble Quarry								
26Ek3191	-	-	-	-	-	-	-	0
Large Reduction Complex								
26Ek3184	-	-	1	1	-	-	1	3
26Ek3190	-	-	-	-	2	1	3	6
26Ek3192	1	1	-	1	3	-	8	14
Small Reduction Complex								
26Ek3172	-	-	-	-	-	-	-	0
26Ek3173	-	-	-	-	-	-	2	2
26Ek3185	-	-	-	1	2	-	2	5
26Ek3188	-	-	-	-	-	-	-	0
26Ek3189	-	-	-	-	-	-	-	0
Reduction Station								
26Ek3174	-	-	-	-	-	-	-	0
26Ek3175	-	-	-	-	-	-	-	0
26Ek3179	-	-	-	-	-	-	-	0
26Ek3180	-	-	-	-	-	-	-	0
26Ek3181	-	-	-	-	-	-	-	0
26Ek3182	-	-	-	-	-	-	-	0
26Ek3183	-	-	-	-	-	-	-	0
26Ek3186	-	-	-	-	-	-	-	0
26Ek3187	-	-	-	-	-	-	-	0
Totals	1	1	1	3	7	1	16	30

Type Designations (after Thomas 1981)
STM = Great Basin Stemmed
HBS = Humboldt Series
LSN = Large Side-notched
CTN = Cottonwood Series
DSN = Desert Side-notched

Other
PPT = Points out of Thomas' key

The assemblage of pottery sherds is comprised exclusively of Shoshone Brownware. Most of the 43 specimens were recovered from 26Ek3192 (Feature 2, n=39; Feature 1, n=1). Two sherds occur at 26Ek3181 (Feature 1), and a single specimen was encountered at 26Ek3174. Their presence at the Holeplug sites corroborates the post-A.D. 1300 occupation of the area implied by the majority of the projectile points (Madsen 1986).

The open aspect and shallow soils of most of the Holeplug sites offers little likelihood for the recovery of remains directly datable by radiocarbon assay. Tests at 26Ek3192, however, suggest that it may contain a buried living surface; exploration of this area may result in the exposure of hearths and charcoal. Obsidian artifacts and debitage occur in several sites but have not yet been submitted for sourcing and hydration rim evaluations.

Assemblage Composition

The overwhelming bulk of the assemblages along Holeplug Ridge consists of the waste products of toolstone processing. Of the approximately 59,000 cultural items recovered during testing, only 705 are formed artifacts; the remainder consists of waste flakes (principally opalite) and pieces of shatter. Table 108 summarizes the formed artifact assemblages of each of the Holeplug Sites.

The relative proportions of formed artifact classes mirror the prominent role played by toolstone production in the formation of the local archaeological record. Formed artifacts directly related to the manipulation of toolstone - cores, quarry bifaces, and other reduced forms of opalite raw material - combined with the implements presumably employed to produce them (hammerstones, etc.) make up the largest proportion of all assemblages except at 26Ek3181 and 26Ek3174, where they occur in numbers equal to other implements.

Most sites subsume features whose assemblages reveal multiple uses additional to toolstone procurement. These activities are indicated by the occurrence of maintenance tools (scrapers, knives, and other flake tools) and subsistence related artifacts (projectile points, groundstone, and ceramics). Although the contemporaneity of these activities and toolstone production itself has not yet been established, we infer that tasks such as hunting and food and materials processing were supplementary to and supportive of opalite procurement.

Sites containing features whose assemblages display sizeable relative proportions of maintenance/subsistence tools are geographically widespread; they occur throughout the Holeplug area and occupy virtually all topographic contexts there. They are most numerous, however, and most densely clustered within the Large Reduction Complexes that rim the southern flank of Undine Gorge.

Table 108. Intersite Artifact Class Frequency Comparisons, Holeplug Ridge Sites.

ARTIFACT FREQUENCY PER SITE																		
	Quarry Pit/ Reduction Complexes		Large Reduction Complexes			Small Reduction Complexes					Reduction Stations							
ARTIFACT CLASS	26Ek 3191	26Ek 3193	26Ek 3184	26Ek 3190	26Ek 3192	26Ek 3172	26Ek 3173	26Ek 3185	26Ek 3188	26Ek 3189	26Ek 3174	26Ek 3175	26Ek 3179	26Ek 3180	26Ek 3181	26Ek 3183	26Ek 3186	26Ek 3187
Lithic Processing/ Reduction Tools																		
Hammerstones	-	-	1	-	3	-	-	2	-	-	-	-	-	-	-	-	-	-
Scratched Stones	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Other Percussion	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal (%)	0(0)	0(0)	2(1.4)	0(0)	3(0.9)	0(0)	0(0)	3(6.3)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Reduction Artifacts																		
Assayed Pieces	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Cores	2	2	5	4	15	-	-	2	-	1	-	-	1	-	-	-	-	-
Quarry Bifaces	4	17	87	48	123	4	7	18	-	2	1	1	1	1	9	4	1	-
Preform Bifaces	-	-	2	1	2	-	-	4	-	1	-	-	-	-	-	-	-	-
Small Bifaces	3	3	11	11	13	2	3	4	-	-	-	-	2	-	-	-	-	-
Indeterminate Bifaces	-	-	2	6	17	-	1	-	-	-	-	-	1	-	1	-	-	-
Subtotal (%)	9(53)	22(92)	107(77)	70(68)	172(55.8)	6(100)	11(61)	28(58.3)	0(0)	4(80)	1(50)	1(100)	5(62.5)	1(100)	10(50)	4(100)	1(100)	0(0)
Projectile Points																		
Classifiable	-	-	2	2	6	-	-	3	-	-	-	-	-	-	-	-	-	-
Unclassifiable	1	-	1	4	8	-	2	2	-	-	-	-	-	-	-	-	-	-
Subtotal (%)	1(6)	0(0)	3(2.2)	6(5.8)	14(4.5)	0(0)	2(18.2)	5(10.4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Maintenance and/or Processing Tools																		
Scrapers/Spokeshaves	5	2	18	19	61	-	5	9	-	-	-	-	3	-	6	-	-	-
Knives	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perforators/Gravers	-	-	3	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Multipurpose Flakes	2	-	3	1	8	-	-	2	-	-	-	-	-	-	1	-	-	-
Indeterminate Flakes	-	-	1	-	3	-	-	-	-	1	-	-	-	-	-	-	-	-
Abraders	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal (%)	7(41)	2(8)	26(18.7)	26(25.2)	76(24.7)	0(0)	5(27.8)	11(22.0)	0(0)	1(20)	0(0)	0(0)	3(37.5)	0(0)	7(35)	0(0)	0(0)	0(0)
Plant Processing																		
Manos	-	-	-	-	1	-	-	1	-	-	-	-	-	-	1	-	-	-
Metates	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal (%)	0(0)	0(0)	0(0)	1(1)	2(0.6)	0(0)	0(0)	1(2)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(5)	0(0)	0(0)	0(0)
Other																		
Stone Pipes	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Ceramic Sherds	-	-	-	-	40	-	-	-	-	-	1	-	-	-	2	-	-	-
Subtotal (%)	0(0)	0(0)	1(0.7)	0(0)	41(13.3)	0(0)	0(0)	0(0)	0(0)	0(0)	1(50)	0(0)	0(0)	0(0)	2(10)	0(0)	0(0)	0(0)
Site Total	17	24	139	103	308	6	18	48	0	5	2	1	8	1	20	4	1	0

Relative proportions of individual artifact types also reflect an emphasis on toolstone processing. As elsewhere in USX-East, the most common formed artifacts occurring in the Holeplug assemblages are quarry bifaces, accounting for nearly half (n=328; 47%) of the 705 specimens recovered by tests there. At all sites save two, quarry bifaces also are the most numerous items in individual site collections. At 26Ek3191 and -3179 they are outnumbered slightly by scrapers, a product perhaps of the intentional sampling of atypical features at these sites. Two sites, 26Ek3184 and -3192, are noteworthy for the unusually high numbers of quarry bifaces they contain; yielding 87 and 123 specimens respectively, they account for ca 64% of the total Holeplug quarry biface assemblage. A majority of these pieces were encountered in clustered concentrations, presumably representing caches.

The range and relative proportions of reduction stages represented by the quarry bifaces from Holeplug sites are similar to those expressed at other areas within USX-East; as elsewhere, Stage 2 (37%) and Stage 3 (41%) forms dominate. Relatively few specimens reveal Stage 4 attributes (6.7%), and none are more fully reduced. Absent as well are Stage 1 forms.

Among other classes of reduction artifacts, small bifaces occur at virtually all sites sampled. Preform bifaces, (incipient projectile points) are likewise widespread and tend to occur in greatest numbers at sites which yielded finished points.

Of the maintenance and processing tools in the collection, scrapers (n=128; 78%) are the most widely distributed and, where encountered, are the most numerous of the tools of this class in site assemblages. A number of end scrapers occur at several of the close-set sites along the northern edge of Holeplug Ridge (26Ek3184, -3185, -3190, and -3192). These are robust, steep-edged, carefully executed pieces that, in appearance, are identical to end scrapers thought to be diagnostic of pre-Archaic assemblages throughout the Desert West. Perforators and gravers occur exclusively within the collections from Large Reduction Complexes.

Subsistence-related artifacts (projectile points, groundstone, and ceramics) tend to co-occur at sites that contain the most abundant remains of other tasks ancillary to toolstone processing activities. These sites include the three Large Reduction Complexes and the neighboring Small Reduction Complex, 26Ek3185. Unexpectedly, given its isolated location, the maintenance/processing tools at Reduction Station 26ek3181 are augmented by both ceramic sherds and a mano.

The only esoteric piece from Holeplug Ridge is a stone (schist) pipe fragment recovered from Feature 8 at 26Ek3184.

The following section describes the nature of the Holeplug Ridge sites as revealed by the results of testing. Organized by functional site type, it presents findings on a site specific basis. Note that discussions focus on data garnered from our judgmentally selected "Sample Features" which may not provide a representative sample.

Quarry/Reduction Complexes

Overlooking Undine Gorge from the relatively flat knoll-top formed by the western terminus of Corral Fan, both 26Ek3191 and 26Ek3193 appear to represent two of the most minimally exploited opalite sources at USX-East. All sites lie within easy access from localities throughout the project area; their location did not inhibit their use. Instead, light use appears to be a function of low toolstone quality. Bedrock surfaces and cobbles presently exposed are coarse-grained, highly weathered opalite suggesting that better-quality materials have been exhausted or never existed there. A related possible explanation for the minimal use of the sites derives from the completion of alternate higher quality opalite sources available within easy reach at several Undine quarries to the east and north. Table 109 summarizes formed artifact retrievals from both of the Outcrop Quarry/Reduction Complexes; Table 110 presents debitage recoveries from all their cultural features.

Table 109. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Outcrop Quarry/Reduction Complexes, Holeplug Ridge.

				ARTIFACT CLASSES							
			Total	Reduction			Points	Processing		
Site Number	Feature Number	Type	Area (sq m)	CR	QB	SB	FG	SC	MP	Total
26Ek3191	1*	Obsidian Scatter	16	-	-	3	1	5	2	11
	Extra-Feature		N/A	2	4	-	-	-	-	6
26Ek3193	1*	Outcrop Quarry/ Reduction Station	226	1	3	-	-	-	-	4
	2	Biface Reduction	112	-	4	-	-	-	-	4
	3	Biface Reduction	14	-	2	-	-	-	-	2
	4*	Core and Biface Reduction	9	1	3	-	-	1	-	5
	5	Biface Reduction	43	-	1	1	-	-	-	2
	6	Core and Biface Reduction	44	-	-	-	-	-	-	0
	7	Biface Reduction	9	-	-	-	-	-	-	0
	Extra-Feature		N/A	-	4	2	-	1	-	7

* Sample Feature

Key to Artifact Classes

Reduction Tools and Artifacts
CR = Cores
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces

Projectile Points
FG = Unclassifiable Fragments

Maintenance/Processing
SC = Scrapers and Spokeshaves
MP = Multipurpose Flake Tools

Table 110. Debitage from Sample Feature Collections, Outcrop Quarry/Reduction Complexes, Holeplug Ridge.

SURFACE COLLECTIONS

Site Number	Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
26Ek3191	1	16	4	10	21	51.2	3.40	18	43.9	22.60	2	4.9	41
26Ek3193	1	226	1	340	289	85.0	4.89	51	15.0	14.37	-	-	340
	4	9	6	576	3006	87.0	3.45	452	13.0	6.62	-	-	3458

26Ek3191

Close order reconnaissance of 26Ek3191 failed to disclose accumulations of opalite debitage sufficiently dense or discrete to be identified as cultural features. A low exposure of bedrock covers an area of ca 50 m^2 on the northwestern midslope of the site knoll that displays a battered appearance characteristic of quarrying; it is surrounded by a diffuse scatter of waste flakes and shatter that nowhere exceeds 5 items/m^2. Additional source material occurs as small opalite clasts included in the colluvial deposits throughout the site surface; some of these appear to have been assayed and rejected from further consideration on the spot. Evidence of somewhat further reduction of local opalite is offered by the pair of cores and 4 quarry biface fragments recovered from wide spread locations throughout the site. Three of the quarry bifaces are Stage 3 forms; 1 is a Stage 2.

Feature 1, the site's only cultural feature, is not clearly associated with toolstone processing, but was marked by a score of obsidian flakes and several obsidian tools and bifaces. After retrieving the obsidian visible on the ground, our 4 1 m by 1 m shovel skim collected the entire feature, returning one additional obsidian waste flake and the feature's single opalite tool (a scraper). Formed tool recoveries are presented in Table 109. Opalite debitage yields from shovel skimming were low (ca. 5/m^2), similar to those of the site as a whole (Table 110). As might be expected, flakes and shatter are robust (3.4 gm and 22.6 gm, respectively).

Feature 1 appears to represent a single episode, perhaps by hunters or others engaged in maintenance and/or subsistence chores, employing obsidian tools and cores brought to the site. The opalite scraper, a minimally used specimen, likely selected for some expedient task from amid the general debris scatter, offers the only evidence of their interest in the toolstone supply available at the site. This suggests that this particular group was at the site in pursuit of non-toolstone resources and perhaps, their time in the area was limited.

26Ek3193

The moderate density lithic scatter dotted by 6 reduction stations, and the single exploited outcrop at 26Ek3193, suggest its somewhat more intense aboriginal use. Opalite reduction, rather than extraction, appears to have engrossed most visitors. The battered outcrop located on the northeastern slope of site 26Ek3195 is not heavily used, but cultural debris is sufficiently concentrated on its uphill side to allow its delineation as Feature 1. Our discontinuous transect of 4 50 cm by 50 cm collection units that spanned the feature revealed it to be relatively dense, homogeneous and composed exclusively of opalite debitage (Table 110). The large average size of flakes and shatter (ca. 4.9 gm and 14 gm, respectively) is predictable for quarrying debris. The scant formed artifact assemblage of the feature (3 quarry bifaces and a core) was recovered from general surface contexts surrounding the outcrop. These, combined with the character of the debitage, suggest that activities centered on the quarry included both toolstone extraction and processing The relatively high density of debitage (ca. 289 m^2 for flakes and 51 m^2 for shatter) is probably due to cultural deposition alone. Given the location of the feature on the midslope and the potential dam-like effect of the outcrop below the concentration, we suspect colluvial redisposition was in part responsible for Feature 1.

Sample Feature 4 was manifest on the surface as a very dense concentration of large opalite debitage with a single core on its surface. Our initial inspection suggested its use as a core and early stage biface reduction station. Subsequent collection of the entire northern half of the feature via 6 1 m by 1 m shovel skims appears to confirm our original identification.

Debitage accumulations were found to be quite dense but heterogeneous. Unit yields of flakes range from ca. $1600/m^2$ to ca. $70/m^2$ ($x=501/m^2$) and for shatter from ca. $235/m^2$ to ca. $8/m^2$ ($x=75.3/m^2$). The density of flakes and shatter reflected that visible on the surface. Moderate mean size of flakes and shatter (ca. 3.5 gm and 6.6 gm) and three Stage 2 quarry bifaces recovered during testing suggest the processing of cores into early reduction stage bifaces (Table 109).

Large Reduction Complexes

The three Large Reduction Complexes, and 26Ek3184 and -3192 in particular, are noteworthy for the abundance and variety of their cultural features and for abundant artifacts these contain. One half of all of the reduction station features encountered at Holeplug Ridge occur within the precincts of these three sites. In addition, sites 26Ek3184 and -3192 contain caches of quarry bifaces. The high incidence of features and their close-set distribution along the flat knolltops bounding the southern rim of Undine Gorge attest to the intensive aboriginal use of this segment of the project area. For the most part, the structure and content of the individual reduction features comprising the Large Reduction Complexes are comparable to those that occur at other Holeplug sites.

26Ek3184

The 26 cultural features and intervening moderate density lithic scatter that defines 26ek3184 is confined primarily to the relatively flat knoll top at the northernmost extension of Holeplug Ridge. Occupying some 12,680 m^2, it is the second largest site at USX-East and is exceeded in size only by 26Ek3170, which lies on lower Ramadan Ridge immediately adjacent to the west, across a shallow drainage channel (Figure 83). Like most locations in the area, site soils are generally shallow sandy, gravelly colluvial deposits with abundant tuff clasts. However, on the somewhat higher portions of the eastern quarter of the site, these deposits are overlain by shallow accumulations of loess. Bedrock daylights sporadically along the slopes bordering Undine Gorge, but none evidences use.

Features all appear to be consequences of toolstone reduction. Quarry biface reduction stages suggest that over the site as a whole, intermediate (Stage 3 and 4) reduction tasks dominate.

The surface of Feature 1 consisted of seven opalite quarry biface fragments and an obsidian small biface (Table 111). The virtual absence of opalite reduction flakes from the immediate vicinity of the bifaces suggested that the feature might represent a biface cache or discard pile. Shovel skimming recovered seven additional opalite quarry biface fragments and a paltry debitage collection: seven opalite waste flakes, and two of obsidian (Table 112). The 1 m by 50 cm excavation unit dug immediately below the biface cluster yielded only 2 additional flakes by a depth of 10 cm below the surface.

Of the fourteen total quarry bifaces contained by Feature 1, 10 are Stage 3 forms, 3 are Stage 2 forms, and 1 is of indeterminate reduction stage. All of the specimens are fragmentary; most are about 50% complete and all are about the same size and shape. We surmise that the feature may represent a discard pile rather than a cache. Biface caches elsewhere in the project area (i.e. at 26Ek3192 and -3197) and at USX-West (26Ek3095) consist almost exclusively of whole specimens. Given, however, that the biface cluster is confined essentially

Figure 83. Site map, 26Ek3184.

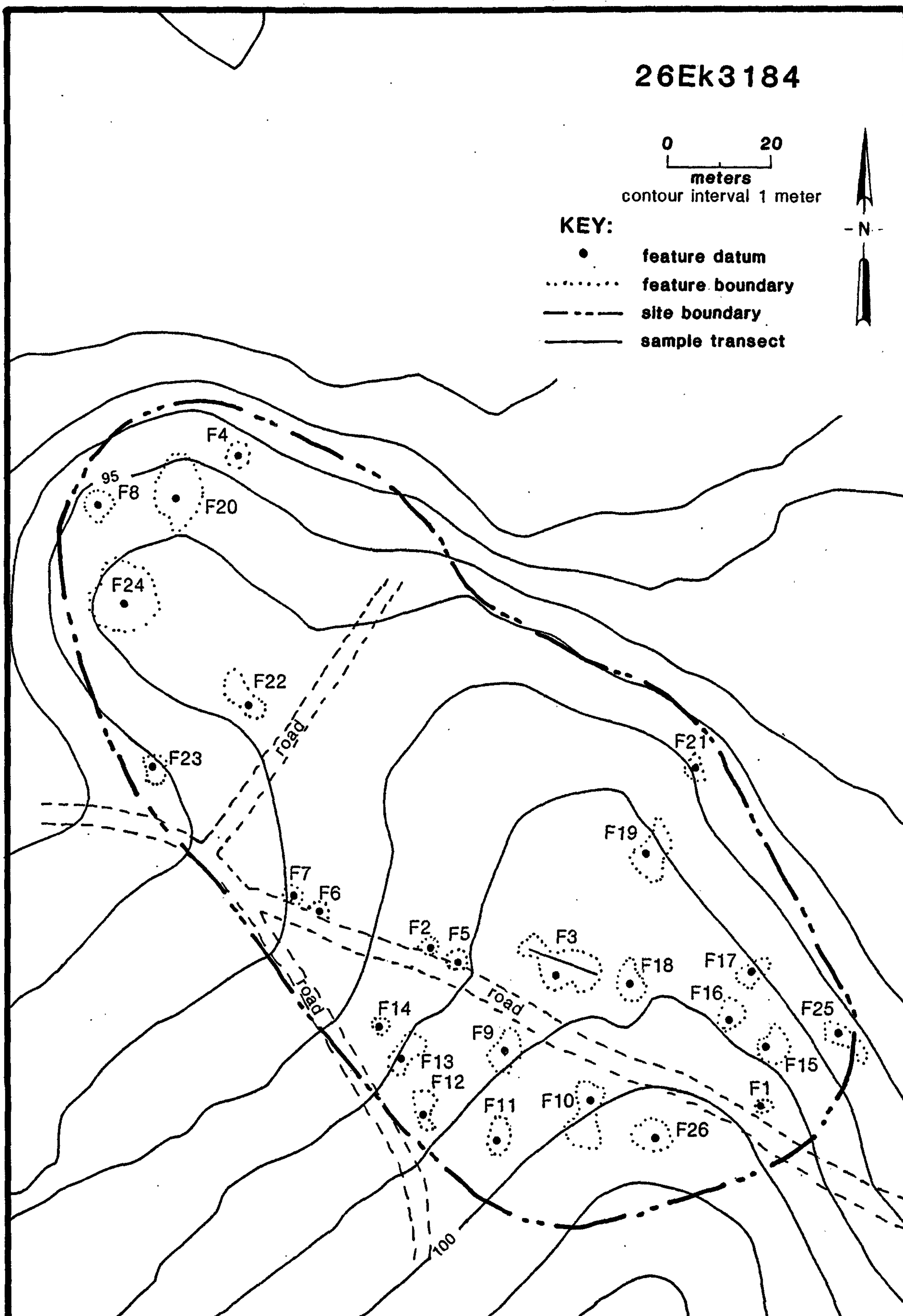

26Ek3184
0
20
meters
contour interval 1 meter
N
KEY:
feature datum
feature boundary
site boundary
sample transect
95
100
road
road
road
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F15
F16
F17
F18
F19
F20
F21
F22
F23
F24
F25
F26

Table 111. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Site 26Ek3184.

Feature Number	Type	Total Area (sq m)	ARTIFACT CLASSES: Reduction HM	OP	CR	QB	SB	PB	IB	Points PT	FG	Processing SC	PG	MP	OT	AB	Other SP	Total
1*	Biface Cluster/Cache	0.4	-	-	-	14	2	-	-	-	-	-	-	-	-	-	-	16
2*	Core and Biface Reduction	2	-	-	-	-	-	-	-	-	-	3	-	1	-	-	-	4
3*	Biface Reduction	160	-	1	-	9	-	1	-	1	1	7	-	-	-	1	-	21
4	Biface Reduction	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
5	Biface Reduction	15	-	-	-	4	-	-	-	-	-	2	-	-	-	-	-	6
6	Biface Reduction	2	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
7	Biface Reduction	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
8*	Biface Reduction	64	1	-	4	29	1	1	1	-	-	2	1	2	-	-	1	43
9	Biface Reduction	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
10	Biface Reduction	148	-	-	-	8	2	-	-	-	-	-	1	-	-	-	-	11
11	Core and Biface Reduction	16	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
12	Biface Reduction	22	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
13	Biface Reduction	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
14	Biface Reduction	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
15	Core and Biface Reduction	86	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
16	Biface Reduction	23	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	4
17	Biface Reduction	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
18	Biface Reduction	50	-	-	-	1	1	-	1	-	-	1	-	-	1	-	-	5
19	Core and Biface Reduction	39	-	-	-	3	1	-	-	-	-	1	-	-	-	-	-	5
20	Core and Biface Reduction	156	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
21	Biface Reduction	22	-	-	-	2	-	-	-	-	-	1	-	-	-	-	-	3
22	Biface Reduction	57	-	-	-	4	1	-	-	-	-	-	-	-	-	-	-	5
23	Biface Reduction	63	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
24	Core and Biface Reduction	177	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	2
Extra-Feature Context		N/A	-	-	1	4	2	-	-	-	-	1	1	-	-	-	-	9

* Sample Feature

Key to Artifact Classes

Reduction Tools and Artifacts
HM = Hammerstones
OP = Other Percussion Tools
CR = Cores
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces
PB = Preform Trajectory Bifaces
IB = Indeterminate Biface Fragments

Projectile Points
PT = Classifiable Points
FG = Unclassifiable Fragments

Maintenance/Processing
SC = Scrapers and Spokeshaves
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
OT = Indeterminate Flake Tool
AB = Abraders
SP =

to the site surface (<2 cm deep) and the feature lies immediately adjacent to the main dirt road through the project area, we remain somewhat skeptical about the origin of the feature. The concentration may indeed represent a discard pile, but its anomalous composition and context suggest that while it may represent a stockpile of rejects destined for redirection into smaller biface forms, it could as well be the discarded spoils of a pothunter.

Table 112. Debitage from Sample Feature Collections, Large Reduction Complexes, Holeplug Ridge.

SURFACE COLLECTIONS

Site Number	Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
26Ek3184	1	0.4	2	4.5	7	77.7	2.30	-	-	-	2	22.3	9
	2	2	4	577.8	1988	86.0	4.42	322	13.9	4.40	1	0.1	2311
	3	160	2	559.0	1096	98.0	1.92	16	1.4	6.10	6	0.5	1118
	8	64	1	408.0	374	91.7	3.13	34	8.3	2.48	-	-	408
				[664.0]	[656]	[98.8]	[0.05]	[7]	[1.0]	[0.90]	[1]	[0.2]	[664]
				(1072.0)	(1030)	(96.1)	(1.17)	(41)	(3.8)	(2.00)	(1)	(0.1)	(1072)
26Ek3190	1	31	28	236.0	4690	71.0	1.34	1851	28.0	2.32	68	1.0	6609
	2	9	12	269.0	2997	92.9	1.48	218	6.7	3.61	9	0.3	3224
26Ek3192	1	19	24	306.0	7068	96.2	1.39	255	3.5	2.46	24	0.3	7347
	2	400	5	671.0	3171	94.5	1.16	162	4.8	2.24	21	0.6	3354

SUBSURFACE COLLECTIONS

Site Number	Fea. No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
26Ek3184	1	1 / D	10	0.10	2	100.0	0.35	-	-	-	-	-	2
	8	1 / A	20	0.15	918	95.3	1.00	45	4.7	10.10	-	-	963
26Ek3190	1	1 / D	20	0.10	1125	89.9	0.36	120	9.5	1.10	6	0.5	1251
26Ek3192	1	*	40	3.40	9021	98.5	1.63	12	0.1	0.40	130	1.4	9163
	2	1 / D	20	0.10	458	95.0	0.48	24	5.0	0.69	-	-	482
	2	2 / A	80	0.80	3792	98.9	1.49	24	0.6	4.05	17	0.5	3833

Key to Excavation Unit Type
A = 1 by 1 m, 1/8 in. screen
D = 50 cm by 1 m, 1/8 in. screen

Key to Mesh Size Retrievals
n = 1/4 in.
[n] = 1/8 in.
(n) = 1/8 in. + 1/4 in. combined

* Excavation Unit No. 1 = Type D
Nos. 5, 6, 7, 8, 9, 11, 12, 13 = Type A

Feature 2 was selected for sampling as a typical reduction station. Its surface boundaries were extremely discrete and our 4 m^2 shovel scrape apparently removed all material lying in primary deposition, since no flakes were found below the scraped surface save in a zone of apparent rodent disturbance. The debitage assemblage consists of 1988 opalite waste flakes and 322 pieces of shatter (Table 112).

Debitage density is relatively high and uniform throughout the concentration, averaging 497/m^2 for flakes and ca. 81/m^2 for shatter. Average size of both are the same (4.4 gm). While the small size and discrete clustering of the debris suggested a single reduction event, the debitage exhibits several color varieties indicating reduction of multiple blanks (although not necessarily material from multiple sources). The feature lacks formed reduction artifacts, although the moderately large debitage and relatively low incidence of shatter suggests, perhaps, creation of the feature through processing cores and/or reduction of flake blanks into early stage quarry bifaces. The four flake tools recovered with the debitage are not obviously related to reduction activities. However, such items typically augment reduction features in the project area.

Feature 3 provided the opportunity to test a much larger reduction station with several discrete concentrations. Our 8 discontinuous sample units returned 1139 cultural items, heterogeneously distributed across the feature. Figure 84 depicts surface of the feature configuration and the placement of sample units. Table 113 presents the debitage recovered per unit.

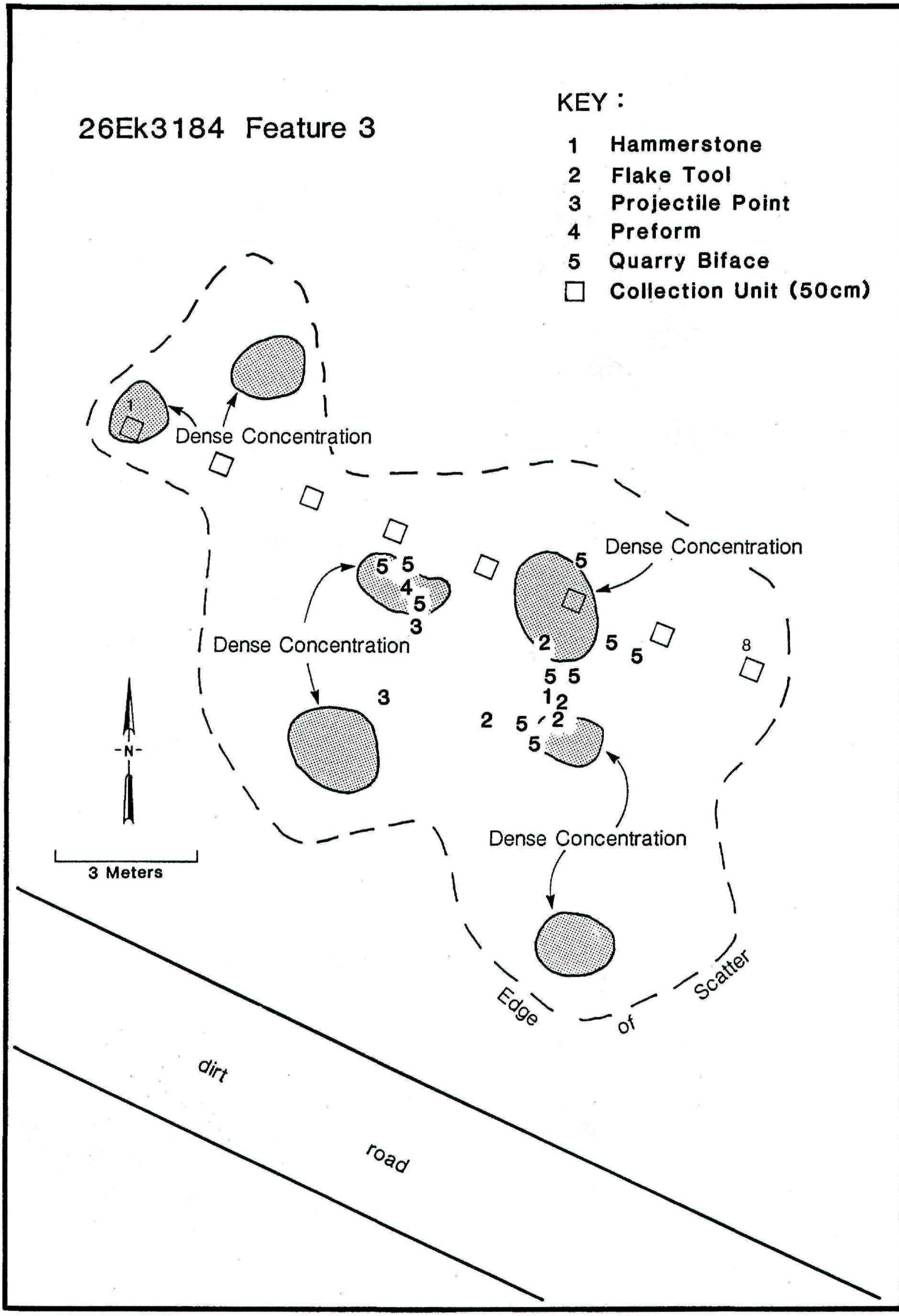
Table 113. Debitage from Sample Feature 3, Site 26Ek3184.

SURFACE COLLECTIONS

	OPALITE DEBITAGE						OTHER DEBITAGE		
Unit	Flakes			Shatter					
Number	(n)	(%)	(Av Wt)	(n)	(%)	(Av Wt)	(n)	(%)	Total
1	226	96.9	5.5	7	3.1	12.58	-	-	233
2	21	90.9	1.30	-	-	-	1	9.1	22
3	20	100.0	0.95	-	-	-	-	-	20
4	146	96.1	1.06	2	1.3	0.30	4	2.6	152
5	343	98.6	1.04	5	1.4	1.40	-	-	348
6	156	98.1	0.70	2	1.3	0.80	1	0.6	159
7	177	100.0	0.96	-	-	-	-	-	177
8	7	100.0	0.97	-	-	-	-	-	7
Total	1096	98.1	1.91	16	1.4	6.08	6	0.5	1118

Figure 84. Plan of Feature 3, 26Ek3184.

Figure 84. Plan of Feature 3, 26Ek3184.


26Ek3184 Feature 3
KEY :
1 Hammerstone
2 Flake Tool
3 Projectile Point
4 Preform
5 Quarry Biface
Collection Unit (50cm)
Dense Concentration
Dense Concentration
Dense Concentration
Dense Concentration
Dense Concentration
N
3 Meters
Edge of Scatter
dirt road

Comparison of Figure 84 and Table 113 discloses that the extent of the feature is not necessarily predicted by the occurrence of surface material. In fact, debitage recovery is highest in Unit 5 which falls outside all surface concentrations. These data suggest the possibility that the feature is a single large scatter exposed here and there at the surface. Unit 8 appears clearly to be peripheral to the feature.

The large average size of flakes (5.5 gm) and shatter 12.6 gm) in Unit 1 suggest earlier stage reduction compared to the smaller debitage recovered from the other units along the baseline.

Additionally, the feature yielded a variety of formed artifacts, but all were recovered from non-sample surface contexts. These include nine quarry bifaces (3 of Stage 2, 3 of Stage 3, 2 of Stage 4, and 1 whose reduction stage could not be determined), as well as several scrapers, a Cottonwood Series projectile point, and a shaft abrader (cf. Table 111).

Feature 8 was similar to other reduction stations, with two distinct opalite debitage concentrations of moderate density. However, it was distinguished by a small (1 m by 20 cm) surface cluster of quarry bifaces, cores, and other formed artifacts. On the possibility that this represented a cache or discrete workshop area, we superimposed a 1 m by 1 m shovel skim unit on the artifact concentration, subsequently excavating to a depth of 20 cm.

All formed artifacts occurred on the surface or within the upper 10 cm of the deposit (Table 111). A total of 19 quarry bifaces was revealed within the artifact cluster: 9 were recovered from the surface of the concentration and 11 from the 2-10 cm of the excavation. Reduction stages are divided between Stage 2 and Stage 3.

Surface skimming and excavation also recovered 2035 pieces of debitage (1949 waste flakes and 86 pieces of shatter); all except 2 obsidian flakes are opalite (Table 112).

Use of 1/8" mesh screen inflated debitage yields and greatly diminishes apparent average size of waste flakes. This renders raw results uncomparable to other samples recovered with 1/4" mesh. However, comparable data are provided by size grading waste flakes in the laboratory. Items in the 1/8" fraction of our sample are by far the most abundant, accounting for some 60% (n=1180) of debitage recovered but only 3% (65.2 gm) by weight. However, the 1/4" fraction contains amounts and sizes of debitage within ranges of 1/4" samples recovered elsewhere in the project area, reflecting early and intermediate stages of reduction also apparent in bifaces from the feature (Table 112).

26Ek3190

Site 26Ek3190 occupies the knoll top immediately to the east of 26Ek3184 and is separated from the Outcrop Quarry of 26Ek3191 by a shallow intermittent drainage (Figure 85). Like its neighbor to the west, the site contains opalite exposures but none of these evidence use; the 11 cultural features of the site relate almost entirely to toolstone reduction (Table 114).

Table 114. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Reduction Complex Site 26Ek3190.

			ARTIFACT CLASSES													
Feature		Area	Reduction					Points		Processing						
Number	Type	(sq m)	CR	QB	SB	PB	IB	PT	FG	SC	KN	PG	MP	GS	Total
* 1	Biface Reduction/ Residential	31	3	15	7	-	5	1	3	14	3	2	1	-	54
* 2	Biface Reduction	9	-	9	2	-	1	-	-	2	-	1	-	-	15
3	Biface Reduction	4	-	-	-	-	-	-	-	-	-	-	-	-	0
4	Biface Reduction	60	-	5	-	-	-	-	-	-	-	-	-	-	5
5	Biface Reduction	19	-	1	1	-	-	-	-	1	-	-	-	1	4
6	Biface Reduction	69	-	4	-	-	-	-	-	1	-	-	-	-	5
7	Biface Reduction	14	-	2	-	1	-	-	-	-	-	-	-	-	3
8	Biface Reduction	12	-	-	-	-	-	1	-	-	-	-	-	-	1
9	Core Reduction	2	-	-	-	-	-	-	-	-	-	-	-	-	0
10	Biface Reduction	50	-	-	-	-	-	-	1	-	-	-	-	-	1
11	Core Reduction	43	-	1	-	-	-	-	-	-	-	-	-	-	1
-	Extra-Feature	N/A	11	1	-	-	-	-	-	1	-	-	-	-	14

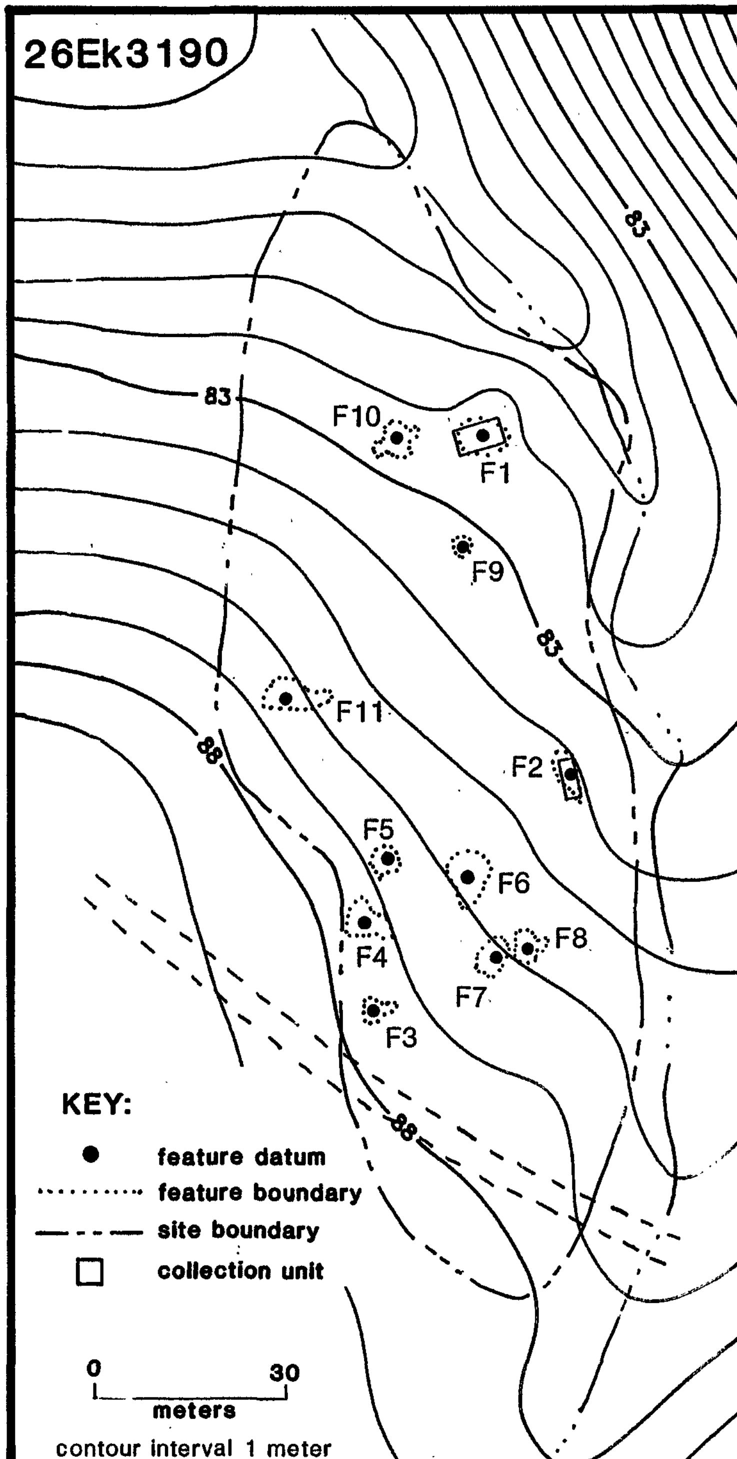
* Sample Feature

Key to Artifact Classes

Reduction Tools and Artifacts	Maintenance/Processing	Projectile Points
CR = cores	SC = Scrapers and Spokeshaves	PT = Classifiable Points
QB = Quarry Trajectory Bifaces	KN = Knives	FG = Unclassifiable Fragments
SB = Small Trajectory Bifaces	PG = Perforators and Gravers	
PB = Preform Trajectory Bifaces	MP = Multipurpose Flake Tools	
IB = Indeterminate Biface Fragments	GS = Groundstone	

Feature 1 was manifest on the surface by a moderate density scatter of opalite debitage. It was selected for sampling due to the presence of numerous tools and the non-opalite lithic waste materials (obsidian, jasper, and basalt) on its surface. The entire horizontal extent of the feature was removed with 28 1 m by 1 m shovel skim units. Where surface density was highest, the deposits were probed by excavation of a 1 m by 0.5 m unit to a depth of 20 cm.

Figure 85. Site map, 26Ek3190.



26Ek3190
83
83
83
88
88
F10
F1
F9
F11
F2
F5
F6
F4
F8
F7
F3
KEY:
feature datum
feature boundary
site boundary
collection unit
0
30
meters
contour interval 1 meter

The test recovered a large assemblage of formed tools in a wide variety of types (Table 114); all recovered from the surface (< 0-2 cm). While artifacts directly related to opalite processing predominate (n=30), maintenance and subsistence tools occur in nearly equal numbers; together, they comprise some 44% of the assemblage. Among these are a Desert Side-notched projectile point and several unidentifiable fragments, as well as numerous scrapers, knives, perforators, and other flake tools. The abundance of formed artifacts from this feature suggest the possibility of uses beyond those directed at toolstone reduction, i.e., as a hunting camp or other special task site.

The reduction assemblage, on the other hand, offers evidence of toolstone-oriented behaviors characteristic of the project area as a whole. The 15 quarry bifaces (13 Stage 2 and 2 are Stage 3), the cores, and the average size and relative abundance of opalite waste flakes and shatter (Table 112) suggest reduction tasks focused on processing or conversion of flake blanks into into quarry bifaces.

Small bifaces are noteworthy for their abundance (n=7). Such implements, presumably en route to terminal forms such as knives, or possibly dart points, are nowhere more abundant in any of the features sampled within Holeplug Ridge. At Features 1 and 2 at 26Ek3192, both of which contain "domestic" artifacts as well, small bifaces occur in similar quantities. The presence of small bifaces suggests the production of maintenance/subsistence tools intended for immediate use, rather than (as presumed of quarry bifaces) the production of portable "toolstone packages" intended for further processing and creation of tools elsewhere.

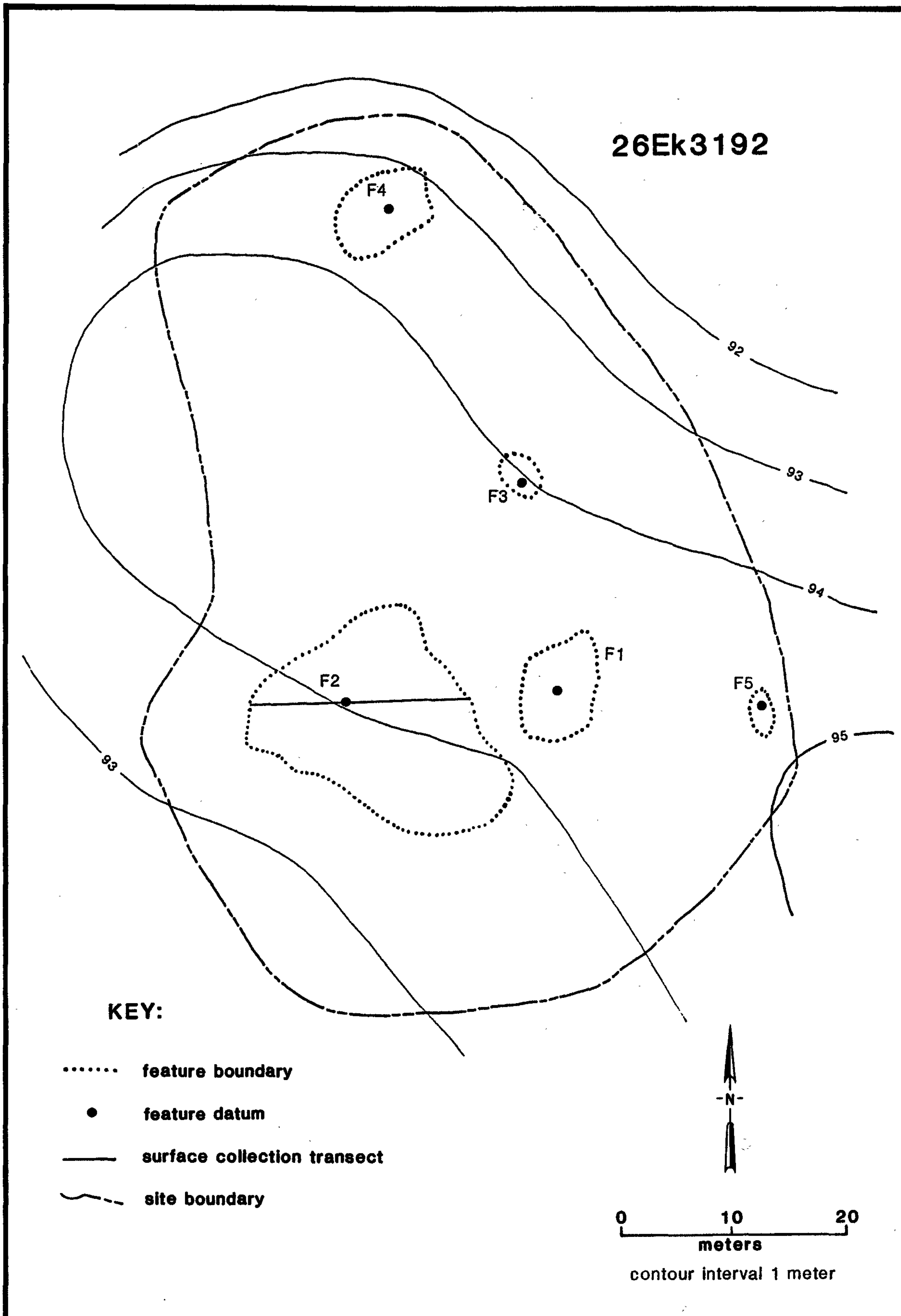
Feature 2 was tested as a more typical representative of the reduction stations at the site. Manifested by two moderate to high density flake concentrations and an intervening more diffuse scatter, it lacks the artifact diversity of Feature 1. Twelve 1 x 1's collected its entire surface expression.

Although including some non-reduction related tools (cf. Table 114), and lithic debris other than opalite (Table 112), the 5 Stage 2 and 2 Stage 3 quarry bifaces and the character of the debitage in Feature 2 suggest that it functioned principally as an early-stage reduction station.

26Ek3192

Site 26Ek3192 lies just off crest of the prominent knoll rising abruptly above Undine Gorge at the northern margin of the Holeplug study area (Figure 82 and 86). It is flanked on the east and west by outcrop quarries 26Ek3193 and -3191. The depositional context of 26Ek3192 contrasts strongly with that of both the neighboring sites and throughout USX-East as a whole.

Figure 86. Site map, 26Ek3192.


26Ek3192
F4
F3
F1
F2
F5
92
93
94
95
93
KEY:
feature boundary
feature datum
surface collection transect
site boundary
N
0
10
20
meters
contour interval 1 meter

The upper few cm of deposits are loess, overlying colluvial surfaces exposed at most locations in the project area. The area occupied by the site is smooth and flat, with no erosion or colluvial redeposition so prevalent elsewhere. Thus, aeolian accumulation appears to have buried and sealed essentially intact cultural features.

Five cultural features were recorded on the surface of 26Ek3192. Features 3-5, based on inventory-level examinations, are typical reduction stations of the kinds observed elsewhere (Table 115). Features 1 and 2 also include reduction station attributes in addition to large and diverse artifact assemblages. These characteristics led us to choose these as sample features.

The occurrence of these two large, complex and functionally distinct features at site 26Ek3192 invited special scrutiny during testing. Owing in part to the magnitude of our sampling there, and as well to artifact abundance and density in these two Sample Features, artifact collections are the largest of all sites tested. Some 35,130 cultural items were recovered from the site, and of these, 308 consist of bifaces and tools (cf. Table 115).

Feature 1

Feature 1 was marked on the surface by a scatter of opalite debitage and a cluster of 6 opalite Quarry Bifaces that we suspected was a biface cache. Initial shovel skimming of the feature recovered materials of uncommon abundance and diversity. Our initial 24 m^2 of shovel skimming encompassed virtually all of the visible surface scatter and produced 37 quarry bifaces and 19 sherds of pottery in addition to abundant debitage. A 1 m by 50 cm excavation unit (Unit 1) was centered on the surface biface cluster (Figure 87) and excavated to a depth of 20 cm, uncovering 35 additional bifaces. These close proximity and orientation suggested they had been placed in a basin-shaped depression about 50 cm in diameter and 20 cm deep. No evidence of a pit could be detected during excavation, but a slightly dark stain can be seen in a slide of the feature shot through a polarizing filter. Several hundred small opalite waste flakes occupied the matrix immediately surrounding the cache.

Where shovel skimming revealed an abundance of pottery sherds and burned opalite flakes, excavation Unit 3 was opened to check for the presence of a hearth. Neither a hearth, nor any additional pottery, was discovered, but the unit yielded over 700 small (avg. wt. 0.16 gm) flakes, many of them burned.

Subsequent to excavation of these two initial units, we opened a much larger area around Feature 1, entailing the excavation of an additional 11 m^2 (units 11-15) to depths of

Table 115. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Reduction Complex Site 26Ek3192.

Feature Number	Type	Total Area (sq m)	Reduction: HM	CR	AS	QB	SB	PB	IB	Points: PT	FG	Processing: SC	PG	MP	OT	GS	Other: CE	IC	Total
1*	Biface Cache/Residential/ Reduction	19	1	8	1	90	3	1	11	1	1	44	4	4	1	1	39	-	213
2*	Biface Reduction/Residential	396	2	7	1	23	8	1	5	5	7	15	-	1	2	1	1	1	80
3	Biface Reduction	12	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
4	Biface Reduction	64	-	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-	4
5	Biface Reduction	8	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	3
Extra-Feature		N/A	-	-	-	5	-	-	-	-	-	2	-	-	-	-	-	-	7

* Sample Feature

Key to Artifact Classes

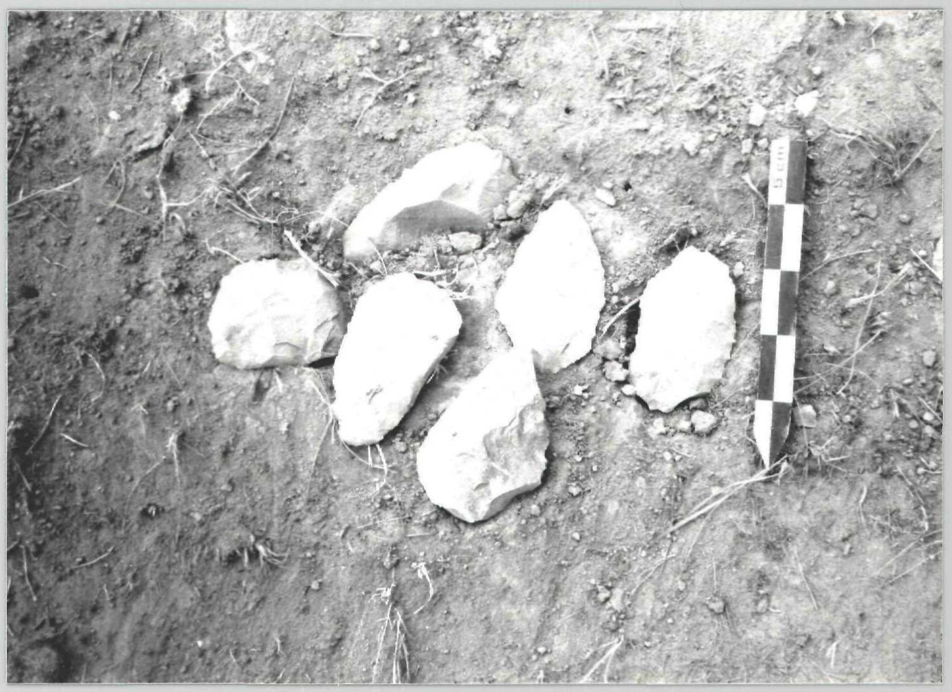
<u>Reduction Tools and Artifacts</u>
HM = Hammerstones
CR = Cores
AS = Assayed Stones
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces
PB = Preform Trajectory Bifaces
IB = Indeterminate Biface Fragments

<u>Projectile Points</u>
PT = Classifiable Points
FG = Unclassifiable Fragments

Other
CE = Cerammic Sherds
IC = Incised cylinder

<u>Maintenance/Processing</u>
SC = Scrapers and Spokeshaves
PG = Perforators and Gravers
MP = Multipurpose Flake Tools
OT = Indeterminate Flake Tool
GS = Groundstone

Figure 87. Biface cache at 2 cm below surface (a) and 10 cm below surface (b), site 26Ek3192.



a.

b.

between 20 and 40 cm (Figure 88, inset). By the close of operations, Feature 1 yielded 213 items including 90 quarry bifaces (41 of which constituted the cache), 39 Shoshone Brownware sherds, scores of flake tools (including a pair of end scrapers and 4 perforators), a projectile point, and a mano (Table 115). Opalite debitage was correspondingly abundant and included small amounts of obsidian and jasper as well (Table 112).

What appears to be a buried cultural feature was encountered by our broad subsurface exposure. Between 20 to 30 cm below surface (at an average depth of 26 cm), 9 contiguous excavation units centered on the biface cache (Unit 1) displayed a scatter of large flakes, hammerstones, unmodified opalite cobbles, and a few cores and biface fragments (Figure 88). This zone has the appearance of a workshop surface although analysis is pending. We note that the surface apparently underlay the lowest extent of the biface cache.

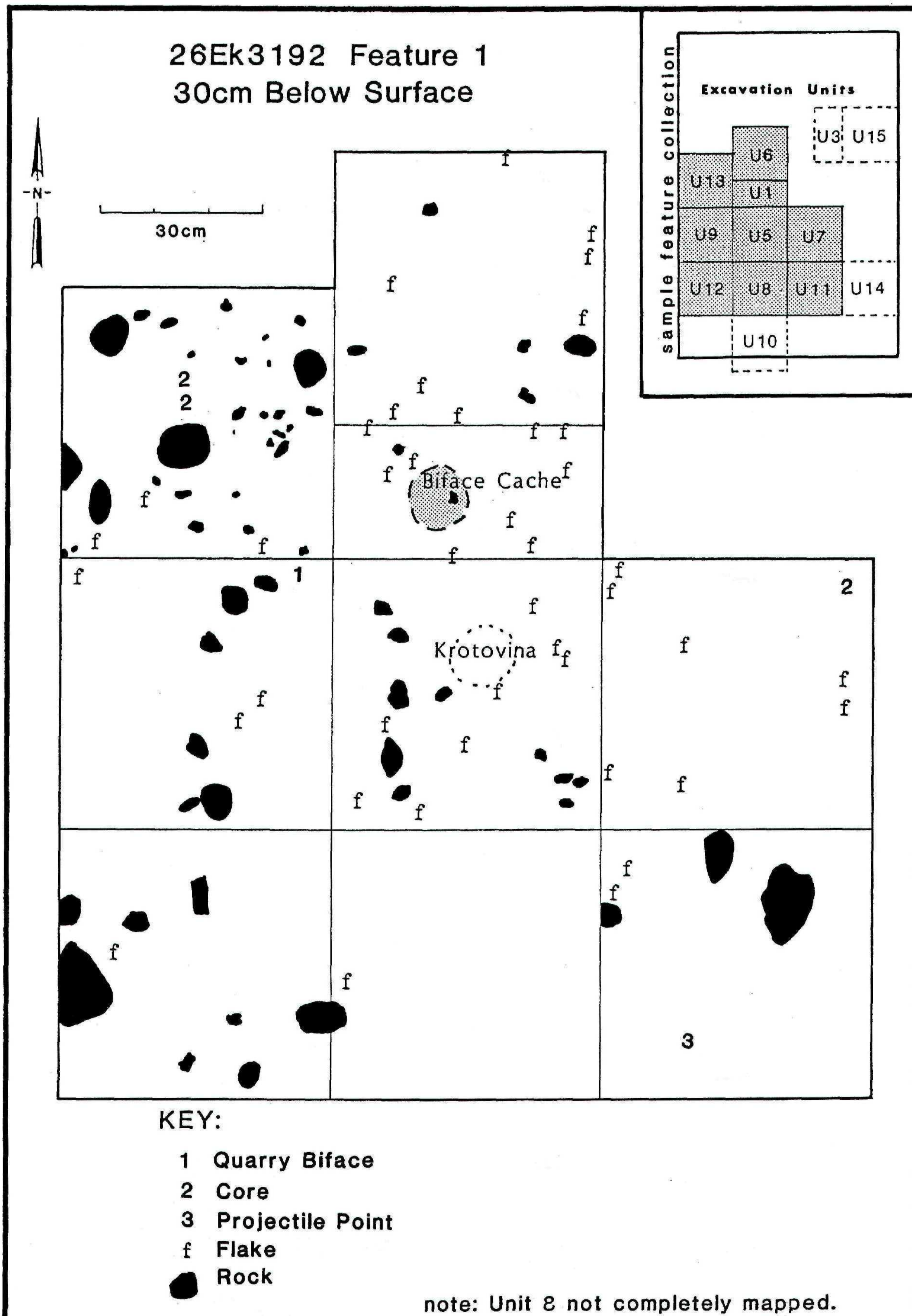
It would appear, overall, that Feature 1 functioned as a biface reduction station. Quarry bifaces recovered from the feature in its entirety (i.e., including the cache) suggest early to intermediate reduction: of the classifiable specimens, 50% are Stage 3, 35% are Stage 2, and ca. 7% were Stage 4. Within the cache itself were 30 (73%) Stage 3 bifaces, 10 (24%) Stage 2, and a single (2.4%) Stage 1 form (see Chapter 3, this volume, for detailed presentation of quarry biface cache data). The relative frequency and average size of opalite debitage fit biface reduction. The recovery rates for opalite shatter are lower in Feature 1 than usually found at other sites with similar assemblages of quarry bifaces.

Dating this feature rests on the evidence provided by pottery and projectile points. Shoshone Brownware (all of which was recovered in the upper 2 cm of the deposit) probably post-dates A.D. 1300 (Madsen 1977). The single projectile point recovered was a Humboldt Series specimen in brown, heat-treated opalite. Although Humboldt Series points are thought to be unreliable time-markers (Thomas 1980), this specimen could mark visitation of the site between ca. 3000 B.C. and A.D. 700. It was recovered from the 20 to 30 cm level of Unit 11 and is perhaps coeval with the buried surface partially exposed in that level.

Feature 2

Located some 20 m to the west of Feature 1, Feature 2 comprises two dense lithic concentrations against a a more diffuse lithic scatter. In addition to the dominant opalite debris, obsidian, basalt, and various chert debitage were present within the scatters. Inventory of the feature surface revealed numerous quarry bifaces, cores, modified flakes, one

Figure 88. Plan of Feature 1 at 20 to 30 cm below surface, site 26Ek3192.


26Ek3192 Feature 1
30cm Below Surface
-N-
30cm
sample feature collection
Excavation Units
U3
U15
U6
U13
U1
U9
U5
U7
U12
U8
U11
U14
U10
Biface Cache
Krotovina
1
2
2
2
3
KEY:
1 Quarry Biface
2 Core
3 Projectile Point
f Flake
Rock
note: Unit 8 not completely mapped.

sherd of Shoshone Brownware, and an incised stone cylinder. The assemblage also included 2 steep-edged, high-domed unifacial scrapers and a basalt Stemmed Series projectile point base. (Several additional, but equivocal, basalt fragments appeared to represent another stemmed point specimen.) Since the scrapers and the projectile point resemble forms characteristic of the pre-Archaic period, Feature 2 was selected for sampling.

A discontinuous transect of 20 shovel scrape collection units was intended to document variability in density of debitage in addition to sampling the larger and denser of the surface two concentrations (Figure 89). The recovery rates of these units is summarized in Table 116.

Table 116. Debitage from Sample Feature 2, Site 26Ek3192.

SURFACE COLLECTIONS

	OPALITE DEBITAGE						OTHER DEBITAGE		
Unit	Flakes			Shatter					
Number	(n)	(%)	(Av Wt)	(n)	(%)	(Av Wt)	(n)	(%)	Total
1	13	100.0	1.38	-	-	-	-	-	13
2	14	93.3	1.08	1	6.7	2.50	-	-	15
3	14	100.0	0.51	-	-	-	-	-	14
4	48	85.7	1.35	6	10.7	3.90	2	3.6	56
5	69	82.1	1.35	8	9.5	2.58	7	8.3	84
6	32	91.4	1.05	-	-	-	3	8.6	35
7	53	86.9	0.84	5	8.2	2.94	3	4.9	61
8	20	80.0	0.42	3	12.0	1.06	2	8.0	25
9	28	100.0	1.10	-	-	-	-	-	28
10	63	92.6	0.98	4	5.9	1.00	1	1.5	68
11	182	94.8	1.13	10	5.2	1.77	-	-	192
12	326	93.7	2.79	22	6.3	1.58	-	-	348
13	677	96.1	1.21	26	3.7	2.83	1	0.2	704
14	213	99.5	1.57	1	0.5	10.60	-	-	214
15	303	96.8	0.76	10	3.2	2.31	-	-	313
16	212	98.1	0.88	4	1.9	5.20	-	-	216
17	110	100.0	1.14	-	-	-	-	-	110
18	79	87.8	0.85	10	11.1	3.57	1	0.1	90
19	19	86.4	0.75	3	13.6	2.13	-	-	22
20	32	71.1	0.89	13	28.9	1.20	-	-	45

Comparison of Table 116 with Figure 89 suggests that the subsurface component of the larger of the 2 surface scatters closely approximates its surface configuration (cf. units 19-18). The average size of debitage tends to be greater within the concentration.

Two excavation units explored the subsurface where debitage was most dense within the concentration. Excavation Unit 1 (1 m by 50 cm) was taken to a depth of 20 cm, terminated when the incidence of cultural material fell off sharply and the fine silt of the uppermost stratum became increasingly burdened with clay.

Excavation Unit 4 (1 m by 1 m) encompassed surface sample Unit 15, and was dug to a depth of 80 cm below surface; Figure 90 depicts the stratigraphic profile of its East wall.

At Excavation Unit 4, an upper silty, root-laden zone is underlain by 20 to 35 cm of clayey silt that has seen massive rodent disturbance. Sloping sharply downward to the south (from 25 to 62 cm below surface) is friable, silty clay, underlain on the north by a weathered opalite bedrock and on the south by a massive clay.

The upper 10 cm level yielded opalite flakes, a mano, a Desert side-notched projectile point, 4 non-diagnostic projectile point fragments, 7 obsidian flakes, quarry biface fragments, and several small bifaces (including one of obsidian). Subsequent levels yielded diminishing numbers of flakes and other artifacts. Below 50 cm, virtually all cultural materials were recovered from krotovina; a Cottonwood Triangular projectile point was found in such a context between 60 and 70 cm. In the deepest level excavated (70-80 cm) only krotovina was excavated, for a return of one quarry biface fragment and ca 30 waste flakes.

The abundant and diverse artifacts of Feature 2 suggests multiple activities, not all related to reduction of toolstone. The quarry biface assemblage occurring at the feature appear similar to that of adjacent Feature 1. Of the 23 bifaces from Feature 2, 12 (52%) are Stage 3, 6 (26%) are Stage 2 and the remaining 5 are of indeterminate stage. The diversity of the assemblage suggests that, like Feature 1 at 26Ek3198, Feature 1 at 26Ek3190 and Feature 1 at 26Ek3185, and others, it may have served at times as a hunter's temporary camp. The possibility of great antiquity was not confirmed in subsurface deposits. However, the accumulation of loess may have obscured older remains. The apparent depth of deposits merits further exploration.

Small Reduction Complexes

Raven's (1988) survey of USX-East recorded five sites classified as Small Reduction Complexes: 26Ek3172, -3173, -3185, -3188, and -3189. Sites of this type occur only within the Holeplug Ridge portion of the project area. Compared to Large Reduction Complexes, Small Reduction Complexes contain lower numbers of features and fewer formed artifacts within features. However, the relative proportions of artifact classes are essentially the same at both types of site (Table 108).

Figure 89. Plan of Feature 2, site 26Ek3192.

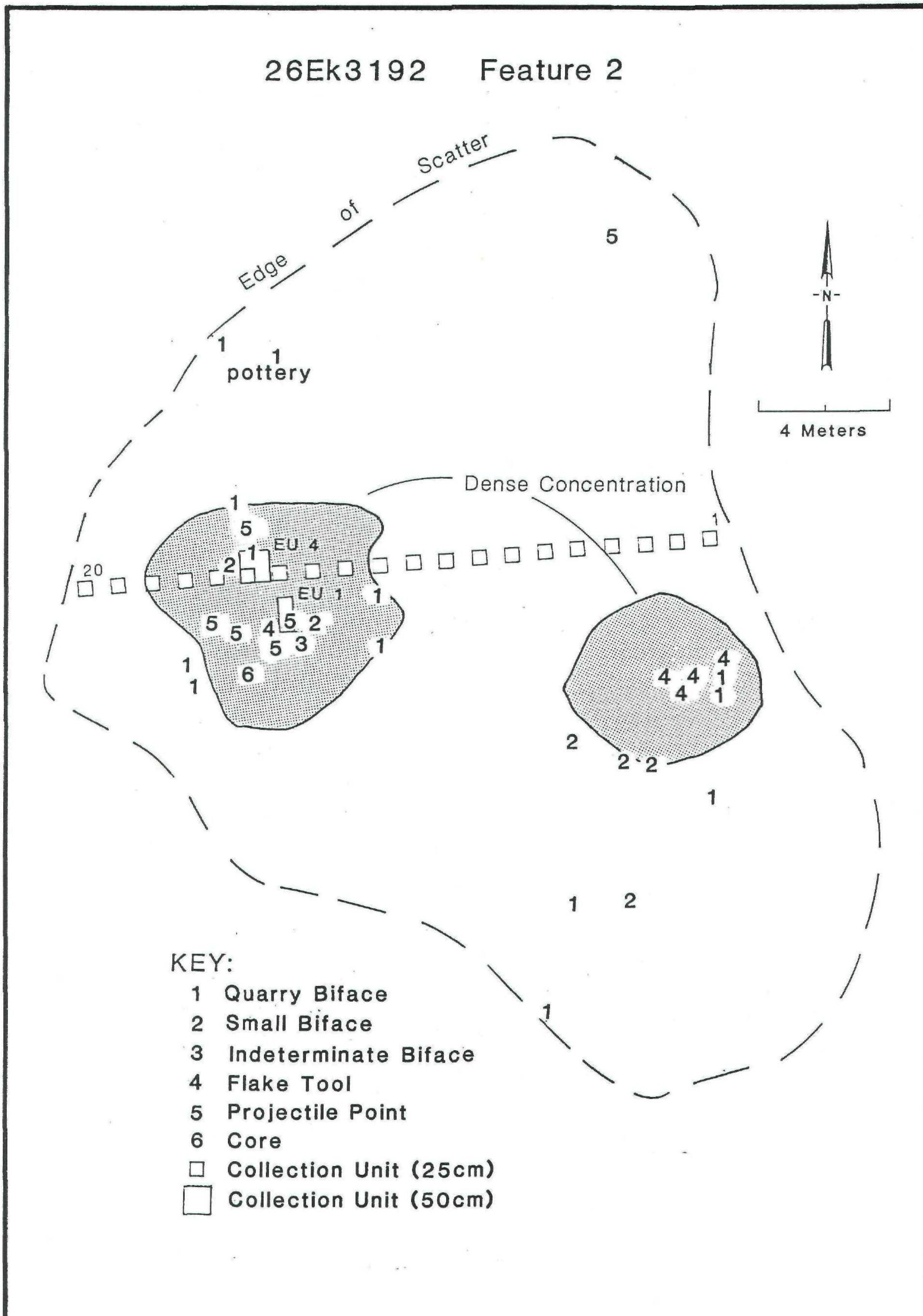
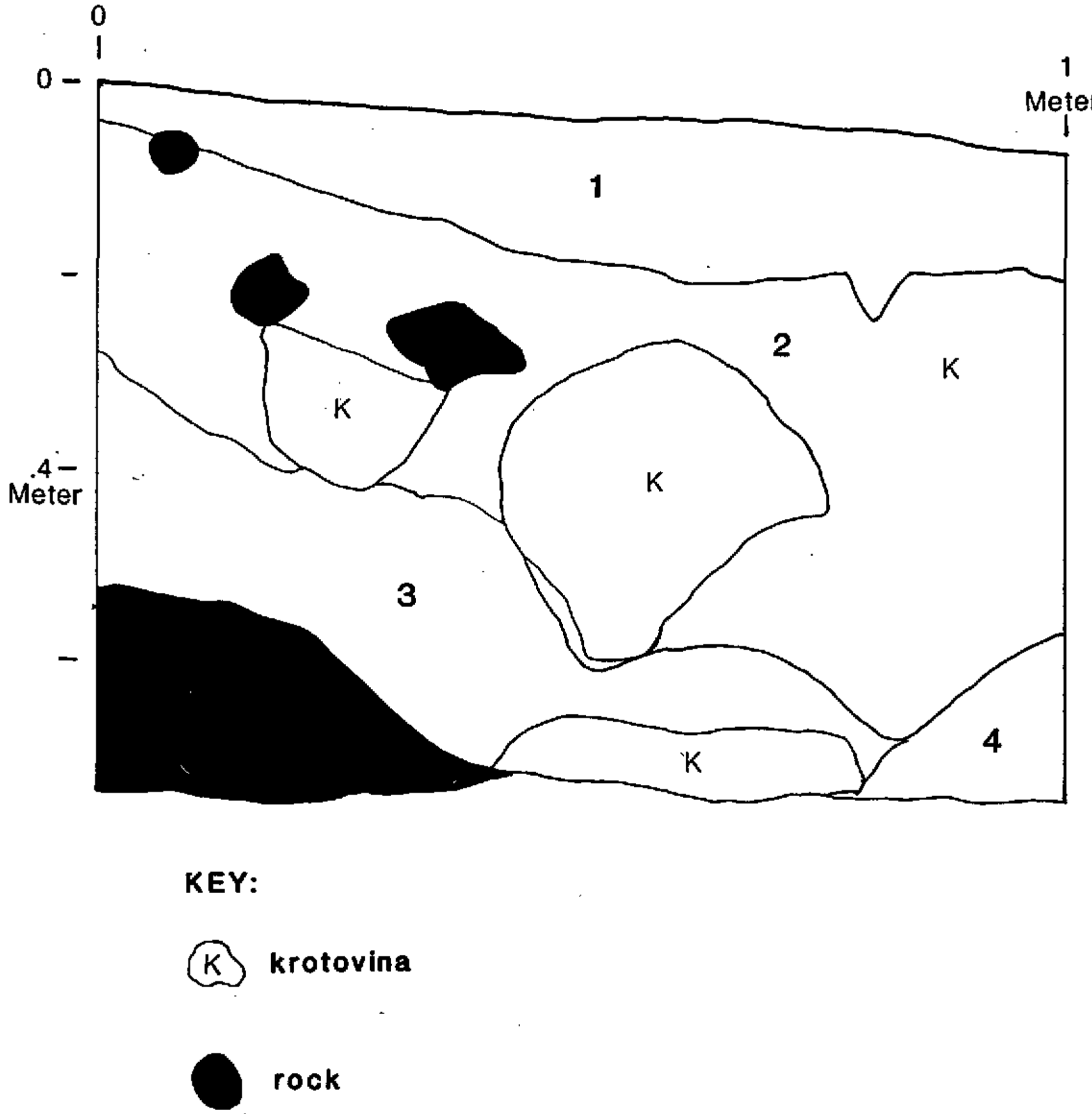

26Ek3192 Feature 2
Edge of Scatter
Dense Concentration
pottery
EU 4
EU 1
20
-N-
4 Meters
KEY:
1 Quarry Biface
2 Small Biface
3 Indeterminate Biface
4 Flake Tool
5 Projectile Point
6 Core
Collection Unit (25cm)
Collection Unit (50cm)

Figure 90. 26Ek3192 east wall profile, Feature 2, excavation Unit 4.

1. Loose loam with organics (root zone), 10YR 5/3.
2. Loose loam with light clay, 10YR 6/3.
3. Friable silty clay, 10YR 6/4.
4. Massive plastic clay, 10YR 4/3.

26Ek3192

EAST WALL, UNIT 4, FEATURE 2



Small Reduction Complexes are located at the geographical extremes of the Holeplug area. Two, 26Ek3172 and -3173 occupy relatively flat areas on the crest of Ramadan Ridge in the southwestern quarter of the project area and the remaining three, 26Ek3185, - 3188, and -3189, are positioned immediately upslope from the Large Reduction Complexes and Outcrop Quarries near the northern terminus of Holeplug Ridge (Figure 82).

Recall that 26Ek3188 and -3189 were not tested by "Sample Feature" techniques; our characterization of these two sites relies on information garnered from surface inspections during inventory procedures. The formed artifact assemblages obtained from each of the Small Reduction Complexes are summarized by Table 117, and debitage recoveries are presented in Table 118.

26Ek3172

Site 26Ek3172 is the largest of the Small Reduction Complexes, and, of those, the most depauperate in formed artifacts. Only Feature 4 contained a formed artifact (a small biface) on its surface. The additional four quarry bifaces and one more small biface recovered from the site were all retrieved from extra-feature contexts (see Table 117).

Feature 1, marked on the surface by a close-set pair of small concentrations of opalite debitage, were selected as our "Sample Feature" because of the presence of a single obsidian flake on the surface. Our block of 8 1 m by 1 m shovel skim units collected the entire visible surface extent. Artifacts obtained by the exercise - exclusively lithic debitage - are summarized in Table 118.

In the absence of formed reduction products at Feature 1, attributes of the debitage assemblage suggest that toolstone production tasks were performed at the feature, much like those expressed by reduction features elsewhere. The average individual sizes of flakes and shatter, ca 1.5 gm for both, is relatively small, suggesting the processing of intermediate stage reduction artifacts. The low incidence of shatter and absence of cores implies perhaps, that raw materials arrived at the Feature in the form of Stage 2 quarry bifaces. The four quarry bifaces collected from non-feature contexts seem to suggest this for the site as a whole, in that of those of identifiable reduction stage, 2 are Stage 2 forms and 1 is a Stage 4.

Table 117. Description of Artifact Classes Recovered from Feature and Extra-Feature Contexts at Small Reduction Complexes, Holeplug Ridge.

Site Number	Feature Number	Type	Total Area (sq m)	ARTIFACT CLASSES: Reduction HM	SS	CR	QB	SB	PB	IB	Points PT	FG	Processing SC	KN	MP	OT	GS	Total
26Ek3172	1*	Biface Reduction	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	2	Biface Reduction	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	3	Biface Reduction	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	4	Biface Reduction	8	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
	5	Biface Reduction	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	6	Biface Reduction	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	Extra-Feature		N/A	-	-	-	4	1	-	-	-	-	-	-	-	-	-	5
26Ek3173	1*	Biface Reduction	25	-	-	-	6	2	-	-	-	2	3	-	-	-	-	13
	2	Biface Reduction	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	3	Biface Reduction	60	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
	4	Biface Reduction	24	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
	Extra-Feature		N/A	-	-	-	1	-	-	1	-	-	1	-	-	-	-	3
26Ek3185	1*	Biface Reduction	16	1	1	1	6	1	3	-	3	2	7	1	1	0	1	27
	2	Core and Biface Reduction	14	-	-	1	2	-	-	-	-	-	-	-	-	-	-	3
	3	Biface Reduction	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	4	Biface Reduction	13	1	-	-	1	-	-	-	-	-	-	-	-	-	-	2
	5	Core and Biface Reduction	26	-	-	-	4	-	-	-	-	-	-	-	-	-	-	4
	6	Biface Reduction	12	-	-	-	1	1	1	-	-	-	1	-	-	-	-	4
	7	Core and Biface Reduction	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	Extra-Feature		N/A	-	-	-	4	2	-	-	-	-	1	-	1	-	-	8
26Ek3188	1	Biface Reduction	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
26Ek3189	1	Core Reduction	19	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
	2	Biface Reduction	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	3	Biface Reduction	9	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
	4	Biface Reduction	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	Extra-Feature		N/A	-	-	-	1	-	1	-	-	-	-	-	-	1	-	3

* Sample Feature

Key to Artifact Classes

<u>Reduction Tools and Artifacts</u>
HM = Hammerstones
SS = Scratched Stones
CR = Cores
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces
PB = Preform Trajectory Bifaces
IB = Indeterminate Biface Fragments

<u>Maintenance/Processing</u>
SC = Scrapers and Spokeshaves
MP = Multipurpose Flake Tools
OT = Indeterminate Flake Tool
GS = Groundstone

<u>Projectile Points</u>
PT = Classifiable Points
FG = Unclassifiable Fragments

Table 118. Debitage from Sample Feature Collections, Small Reduction Complexes, Holeplug Ridge.

SURFACE COLLECTIONS

Site Number	Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
26Ek3172	1	6	8	162	1250	96.2	1.57	40	3.1	1.54	9	0.7	1299
26Ek3173	1	25	40	66	2396	90.8	2.25	238	9.0	2.76	5	0.2	2639
26Ek3185	1	16	20	95	1833	96.3	1.6	67	3.5	.98	4	0.2	1904

SUBSURFACE COLLECTIONS

Site Number	Fea. No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
26Ek3173	1	1 / D	20	0.075	1456	93.6	2.26	96	6.2	4.21	1	0.2	1553
26Ek3185	1	1 / D	10	0.05	279	97.8	0.50	5	1.7	1.34	1	0.5	285

Key to Excavation Unit Type
A = 1 by 1 m, 1/8 in. screen
D = 50 cm by 1 m, 1/8 in. screen

26Ek3173

Located slightly higher on Ramadan Ridge, 26Ek3173 contains four reduction features. All of these are somewhat larger than those at 26Ek3172, but with one exception, are similarly depauperate in formed artifacts. However, Feature 1 contained several quarry bifaces and a pair of projectile point fragments. For this reason it was chosen for sampling. Our 40 1 m by 1 m shovel skim units collected the entire feature, consisting of a moderate density lithic scatter with dense central concentration of debris. The resulting debitage retrievals are summed by Table 118.

Overall, units averaged 60 flakes. However, adjoining units 26 and 29, on the concentration of debris in the center of the feature, yielded densities of 263/m^2 and 363/m^2, respectively. Flake densities of units that fell beyond the confines of the scatter visible on the surface (units 32-40) provided correspondingly low flake yields (averaging 18/m^2). The feature, thus proved to have been spatially discrete and was recovered in its entirety.

A 1 m by 0.5 m excavation unit was placed where debitage densities were highest, in surface collection units 26 and 29. The upper level of the deposit (2-8 cm) returned some 1400 pieces of lithic debitage, including 1 waste flake of obsidian. Level 2, excavated in only one-half of the unit, returned only 80 pieces of opalite debitage.

Although the surface assemblage of Feature 1 included minor evidence for tasks other than toolstone processing (the projectile point fragments and 3 scrapers) its use seems related overwhelmingly to opalite reduction. Reduction stages displayed by the quarry biface collection (2 Stage 2, 3 Stage 3, and a Stage 4), as well as the debitage assemblage, suggest that Feature 1 was created from by-products of intermediate reduction. Pieces of shatter are relatively rare and are outnumbered by opalite flakes on the order of 10:1. This, coupled with the absence of cores, suggests that, like Feature 1 at 26Ek3172, opalite raw materials arrived at Feature 1 in an already reduced state, presumably as Stage 1 quarry biface flake blanks or Stage 2 quarry bifaces.

26Ek3185

Site 26Ek3185 lies just off the crest of Holeplug Ridge, immediately to the south of, and slightly higher than the Large Reduction Complex 26Ek3184. Seven reduction features, consisting of accumulations of opalite processing debris, occur at the site. Our "Sample Feature" Feature 1, is accompanied as well by an array of reduction artifacts, as well as a variety of maintenance and subsistence tools represented by three projectile points (1 Cottonwood Triangular; 2 Desert Side-notched), point preforms, a mano, and numerous flake tools of various kinds (Table 117). Our block of 20 shovel skim units were centered on the single dense concentration of opalite debris at the feature. Subsequent testing added only a few flake tools and quarry bifaces to the assemblage.

Activities not strictly directed at toolstone processing occurred at the feature, given the abundance and variety of maintenance/subsistence tools it contains. Like similar features nearby (e.g., Feature 1 at 26Ek3190, Feature 1 at 26Ek3191, and Feature 2 at 26Ek3192), the assemblage of Feature 1 here probably represents a hunter's temporary camp, or an overnight stop by people engaged otherwise in the procurement of opalite. The diagnostic projectile points in the feature suggest post-A.D. 1300 occupation.

While considering the age of Feature 1 we note that, like Feature 2 at 26Ek3192 and in several locations with 26Ek3184 and -3190 close by, its tool assemblage includes several (n=4) domed, steep-edged, unifacial end-scrapers reminiscent of pre-Archaic tools throughout the Great Basin. Although the utility of such items specimens as time-markers has not been demonstrated, their presence may indicate earlier use of the site than is implied by the the other temporally diagnostic artifacts recovered.

26Ek3188 and 26Ek3189

Sites 26Ek3188 and -3189 are two Small Reduction Complexes tested only by an inventory of surfaces contexts. These sites occupy the ridge slopes immediately across a shallow drainage to the east of 26Ek3185 (Figure 82). They contain between 1 and 4 reduction features, respectively, composed of moderate to high density accumulations of opalite debitage. The single large feature composing 26Ek3188 lacks formed artifacts; the formed artifact assemblage at 26Ek3189 is depauperate as well (Table 117). A Stage 2 quarry biface and one core were observed at Features 1 and 3 respectively, and an additional Stage 2 quarry biface and one projectile point preform were retrieved from extra-feature contexts.

Compared to those of other Small Reduction Complexes, the features at these two sites are similar with their low numbers of formed artifacts and abundant toolstone processing debris.

Reduction Stations

All the Reduction Stations recorded at USX-East occur within the Holeplug Ridge area, with the exception of site 26Ek3178 which lies isolated far to the east within the Undine Gorge component. By definition, Reduction Stations are manifest by no more than two cultural features, and these are typically accumulations of opalite toolstone processing debris. Most of these sites appear to be the functional equivalent of Reduction Features within larger sites in the project area. Most of these sites are found on microtopographic flats throughout the central mid-slopes of Holeplug Ridge. Site 26Ek3174 occupies the highest bench on Ramadan Ridge (Figure 82).

Of the eight Reduction Stations tested, only three, 26Ek3179, -3181, and 3183 were addressed by Sample Feature procedures; the remainder are known only from surface inventory. Formed artifact recoveries are summarized by Table 119 and debitage from Sample Features appears in Table 120.

Table 119. Description of Artifact Classes Recovered from Reduction Stations, Holeplug Ridge.

Site Number	Feature Number	Type	Total Area (sq m)	ARTIFACT CLASSES Reduction CR	QB	SB	IB	Processing SC	MP	GS	Other CE	Total
26Ek3174	1	Biface Reduction	82	-	-	-	-	-	-	-	-	0
	2	Core Reduction	102	-	1	-	-	-	-	-	1	2
26Ek3175	1	Core and Biface Reduction	85	-	1	-	-	-	-	-	-	1
26Ek3179	1*	Core and Biface Reduction	6	1	1	2	1	3	-	-	-	8
	2	Biface Reduction	2	-	-	-	-	-	-	-	-	0
26Ek3180	1	Biface Reduction	12	-	1	-	-	-	-	-	-	1
26Ek3181	1*	Biface Reduction	19	-	9	-	1	6	1	1	2	20
26Ek3183	1*	Biface Reduction	8	-	4	-	-	-	-	-	-	4
26Ek3186	1	Unspecified Reduction	55	-	-	-	-	-	-	-	-	0
	2	Biface Reduction	19	-	1	-	-	-	-	-	-	1
26Ek3187	1	Unspecified Reduction	49	-	-	-	-	-	-	-	-	0

* Sample Feature

Key to Artifact Classes

Reduction Tools and Artifacts
CR = Cores
QB = Quarry Trajectory Bifaces
SB = Small Trajectory Bifaces
IB = Indeterminate Biface Fragments

Maintenance/Processing
SC = Scraper
MP = Multipurpose Flake Tools
GS = Groundstone

Other
CE = Ceramic Sherds

26Ek3179

Site 26Ek3179 is located just downslope and to the west of Large Reduction Complex 26Ek3194 and contains two reduction features. The larger of these, Feature 1, was selected as our sample feature. Feature 1 was a comprised of several small, moderate density concentrations of opalite debitage within a surrounding light density lithic scatter. A core, one quarry biface (Stage 3), and one small biface were visible on the surface of the scatter during initial inspection.

Shovel skimming 13 1 x 1 m units encompassed the entire surface extent of the feature, but added only one small biface, an unidentified biface fragment, and 3 flake scrapers to the formed artifact assemblage (Table 119). The remainder of the spoils consisted of opalite debitage and a single jasper waste flake (Table 120).

Table 120. Debitage from Sample Feature Collections, Reduction Stations, Holeplug Ridge.

SURFACE COLLECTIONS

Site Number	Fea No.	Total Area (sq m)	Skim Area (sq m)	Mean Density (sq m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
26Ek3179	1	6	13	100	1218	93.7	1.16	81	6.2	1.79	1	0.1	1300
26Ek3181	1	19	24	107	2356	91.8	2.12	190	7.4	1.01	21	0.8	2567
26Ek3183	1	8	15	148	2169	97.8	1.13	43	1.9	1.03	6	0.3	2218

SUBSURFACE COLLECTIONS

Site Number	Fea. No.	Unit No./Type	Depth (cm BS)	Volume (cu m)	OPALITE DEBITAGE Flakes (n)	(%)	(Av Wt)	Shatter (n)	(%)	(Av Wt)	OTHER DEBITAGE (n)	(%)	Total
26Ek3181	1	1 / D	10	0.05	1194	96.4	1.06	30	2.4	0.71	15	1.2	1239

Key to Excavation Unit Type
A = 1 by 1 m, 1/8 in. screen
D = 50 cm by 1 m, 1/8 in. screen

The test suggests that the surface expression of the feature only partially predicts the abundance of flakes just below the surface. Overall, units returned a mean density of waste flakes of ca 93/m^2. Where units coincided with surface concentrations, flake densities were higher (e.g., Unit 4, 162/m^2; Unit 9, 294/m^2). However, Unit 10, adjacent to a surface concentration and displaying only a light scatter on its pre-skimmed surface, yielded some 283 waste flakes. The concentrations thus appear to represent high density clusters of debris within an otherwise moderate density scatter that is immediately below the ground surface. The horizontal limits of this slightly buried deposit do seem to be fairly well predicted by the light density surface scatter surrounding the concentrations. Units 1, 6, and 12 placed tangential to, but outside, the visible perimeter of light lithic scatter posted returns of only 17, 13, and 23 waste flakes respectively.

The average size of opalite waste flakes and shatter is relatively small, ca 1.2 gm and 1.8 gm respectively. Coupled with the low incidence of shatter (flake to shatter ration = 15:1) this suggests that raw materials processed at the feature likely arrived as well-prepared cores and/or Stage 1 blanks.

26Ek3181

Site 26Ek3181 occupies the central mid-slope of Holeplug Ridge (Figure 82). It consists of one reduction feature defined by a single concentration of opalite debris and a peripheral lower density lithic scatter. Within the concentration and a radius of ca. 1 m around it, were 3 quarry bifaces, two scrapers, a mano, and an obsidian waste flake. Like the assemblages encountered at numerous other reduction features in the vicinity, these suggest maintenance/subsistence activities. Our 24 contiguous 1 m^2 shovel skim units collected the whole surface expression of the site, yielding 3 additional quarry bifaces, the remainder of the flake tools (Table 119) and a quantity of opalite debitage (Table 120).

Recovery rates for opalite waste flakes reveal that the visible surface concentration is surrounded by a somewhat larger area of dense debitage immediately below the surface. The concentration, occupying the highest point on the slope, is probably the source of materials found in areas outside and downslope.

The mean density of waste flakes recovered from the feature as a whole was ca $98/m^2$. Where debitage was densest on the surface (i.e., in portions of units 18 and 21) flakes were retrieved at a rate of $307/m^2$ and $327/m^2$. Contiguous units 20 and 23, upslope and outside the concentration, contained dense accumulations of flakes as well, ca $383/m^2$ and $199/m^2$, respectively. All additional areas sampled yielded far fewer cultural materials; diminishing recovery rates appear to correspond to site slope. The 6 units that sampled the upslope half of the feature, in or adjacent to the concentration, provided on average some 142 waste flakes per m^2, while the 6 grid units placed over the downslope half of the feature contained debris only approximately one-third as dense, ca 55 m^2. While this heterogeneous distribution of debitage suggests that the areal extent of the feature may be the result of colluvial redeposition, these forces do not appear to have size-sorted the debris to any great extent. Average individual sizes of waste flakes range widely across the feature, from as large as 4 gm in Unit 23 to as small as 0.6 gm in Unit 17, both within the upslope contexts of the scatter; the average flake weight over the entire feature is ca. 2 gm per item. Its upslope and downslope halves, however, yield flakes of essentially equivalent average sizes, ca 1.8 gm.

Our 1 m by 0.5 m excavation unit sampled shovel-skimmed deposits, debitage returns were highest in surface collection Unit 20. By the time we reached clay soil at a depth of 10 cm, all cultural material had apparently been collected. The exercise contributed 3 more quarry bifaces to the formed artifact assemblage; several jasper waste flakes, and a predictably large quantity of opalite debitage (Table 120). In addition, a recently burned sage stump contributed abundant charcoal and red oxidized soil to the deposit.

The formed reduction artifacts recovered included 9 opalite quarry bifaces, 1 Stage 4, 4 Stage 2, and 4 Stage 3. As at other sites somewhat far removed from source locations, the high incidence of waste flakes to shatter (ca 10:1) suggest raw material was brought to 26Ek3181 in a preprocessed state, presumably as initially reduced cores and/or Stage 1 forms.

26Ek3183

Located ca 50 m to the east and slightly downslope from 26Ek3181, 26Ek3183 is likewise defined by a single cultural feature, composed of four moderate density concentrations of opalite debitage and a peripheral light density lithic scatter (Figure 82). The site/feature is distinctive for its complete lack of formed artifacts other than those directly related to opalite processing. Fifteen contiguous shovel skim units collected entire surface extent of the feature and retrieved 4 quarry bifaces: one example each of Stages 2-4, plus an unidentified specimen (Table 119). Almost all of the debitage is opalite save for 4 small obsidian waste flakes and two of jasper (Table 120).

The distribution of debitage recovered in collection units suggest that the concentrations of debris visible on the surface accurately map the occurrence of debitage below the surface. For the most part, concentrations are spatially discrete; flake density in three units coinciding with concentrations ranged between (447/m^2 and 172/m^2); mean flake densities in surrounding units were about 140 m^2. The fourth concentration contains about 150 flakes/m^2.

Opalite shatter is exceedingly rare at the site. It is outnumbered by waste flakes 50 to 1 and consists of small individual pieces, averaging ca 1 gm each. This, combined with the formed reduction artifact collection, implies that toolstone processors were unwilling to transport raw materials laden with waste fractions very far from a source and suggesting that "toolstone packages" arrived at site in already reduced forms.

The site seems to have functioned as an opalite reduction workshop where Stage 2 quarry biface forms were processed through Stage 4 secondary thinning. Presence of the four very small (ca 0.1 gm each) obsidian waste flakes likely reveal an episode of tool maintenance as well.

The five remaining Reduction Stations (26Ek3174, -3175, -3180, -3186, and -3187) would appear to have served a similar range of functions as those sampled and described previously. Our opting not to sample these sites was due largely to the fact that they did seem to represent remains identical to those encompassed by Reduction Stations already tested.

Summary

The nineteen sites within the Holeplug Ridge study area are almost entirely the consequence of toolstone reduction. Primary sources of opalite are virtually absent from the area, and where they do occur within the precincts of Holeplug sites (in 26Ek3191 and -3193) they appear to be of low toolstone quality and evidence use that appears to have been expedient and episodic. Nowhere within the subarea did toolstone sources inspire the excavation of quarry pits or other intensive means of extraction. Instead, the archaeological record of Holeplug Ridge seems to derive largely from the processing of lithic raw materials that were liberated from bedrock and rendered into portable forms at other sources located nearby.

Tests revealed two of the Holeplug sites to be particularly informative laboratories at which to address several of the research domains pertinent to the Tosawihi Quarries and the immediate vicinity (Elston 1988; Chapter 1, this volume). Site 26Ek3184 offers the project area's largest suite of reduction stations; based on test actions, many of these features are relatively spatially discrete to suggest that their contents and configuration remains comparatively little altered by post-depositional processes. Additional mapping and excavation of select features would go far toward defining the range of variation in reduction stations reflecting on group size, the conduct of ancillary activities, and the place of the site's workshops in local reduction trajectories. Such efforts likewise would contribute to modeling the timing, duration, and frequency of visits, thus clarifying the energetic expenditure at the area's principal workshop complex.

At 26Ek3192, the assemblage diversity characteristic of Feature 1 and 2 suggest that they should be particularly informative of the range of variation in site function. The cache at Feature 1 (like that encountered at 26Ek3095 at USX-West) carries important implications for understanding the "package size" and perceived units of transportability in which Tosawihi opalite was exploited. Too, the staging of reduction strategies is well studied at Feature 1, where, in its later component, a particular stage appears to be isolated from episodes of preliminary manufacture and transport. Site formation processes likely to be revealed at the feature include the preparation of heat-treating hearths, the reduction of Stage 2 to Stage 3 bifaces, and the storage of pieces for future reduction or transport. The apparent earlier component at Feature 1 is also likely to have important implications for analysis of site structure, since numerous tools and by-products appear to rest on an intact loess-buried surface. Feature 2 will provide important chronological data on early use of the project area if it proves possible to isolate an assemblage associated with Early Archaic artifacts.

Part VI. Conclusions

Chapter 18: SUMMARY AND CONCLUSIONS

by Michael P. Drews, Robert G. Elston, Melinda Leach, Christopher Raven, and Dave N. Schmitt

Of 214 prehistoric archaeological sites discovered during survey of the North Access Corridor, and the USX-West and USX-East project areas, 65 (30%) were tested as reported in the present volume. In order to address the significance of the sites, and to assess mitigation needs, substantial quantities of data were gathered. Their analysis focused on the ability of any particular site to address particular research goals defined for Tosawihi Quarries (Elston 1988 and this volume). Our findings are summarized here under five topical headings: Paleoenvironments and Chronology; Site Function, Assemblage Composition and Diversity; Site Structure and Formation Processes; Organization of Lithic Procurement; and Implications for Data Recovery.

Paleoenvironments and Chronology

Paleoenvironmental data appear not well preserved in the shallow, open sites so far investigated at Tosawihi Quarries. Pollen weathers badly in unprotected eolian, colluvial and alluvial sediments, and most sites in the study areas lack any kind of plant macrofossil preservation. Stratigraphy is also problematic in most of the shallow deposits of open sites at Tosawihi Quarries. Eolian silts and colluvium usually have been churned by slope movement and bioturbation. Nevertheless, natural stratigraphy is present in alluvial terrace deposits of site 26Ek3092 (USX-West) and sites 26Ek3251 and 26Ek3237 (North Access Road). Of course, deposits filling quarry pits are very well stratified, but such sediments are nearly all cultural in origin and have little to do with paleoenvironments. Faunal remains recovered from stratified alluvial deposits (cf. site 26Ek3092) may well provide the best opportunity for the study of paleoenvironments in the Tosawihi vicinity. For instance, bison scapluae recovered from quarry pits at 26Ek3208 and 26Ek3200, as well as possible bison bones at site 26Ek3092, help document the distribution of a poorly known species in the western Great Basin (Elston and Budy 1990).

The absence of Mazama tephra (ca 6,900 years B.P.) in most tested sites is chronologically limiting and possibly suggestive of paleoenvironmental change. Mazama tephra or volcanic ash is present in alluvial sediments of Ivanhoe Creek, Willow Creek, and Antelope Creek, below 5600 feet in elevation, but to date, unassociated with cultural remains. The ash has not been observed in alluvial, eolian, or cultural sediments in the upland environment of Tosawihi Quarries. Here, shallow eolian/colluvial sediments, sometimes containing cultural remains, rest on bedrock or unconformably on a strong paleosol of at least Pleistocene age. This suggests the possibility of past environmental conditions in which early Holocene deposits containing Mazama tephra were washed off slopes and flushed out of drainages in the Tosawihi uplands, possibly during increased summer precipitation of the mid-Holocene (cf. Davis 1983; Katzer 1990). Nevertheless, it seems unlikely that all tephra would be washed away, and probably means that we have not yet looked in the right places for it. If Mazama ash eventually turns up at Tosawihi Quarries, it will provide an invaluable time-stratigraphic marker for the calibration of both paleoenvironmental and cultural events.

The cultural chronology of the Upper Humboldt region outlined in Chapter 1 (see Figure 4) was constructed from radiocarbon dates and temporally sensitive artifact types such as projectile points and pottery. So far, radiocarbon dates are few from Tosawihi Quarries, although the discovery of charcoal in quarry pits offers opportunity to date closely sequences of quarrying events and differences in quarrying intensity at various sources and areas as discussed below. In addition, obsidian artifacts are fairly common in sites adjacent Tosawihi Quarries, offering opportunity for dating through the obsidian hydration method (cf. Hughes 1984). For the time being, with the exception of Clovis, virtually the full range of time-diagnostic Great Basin projectile points and pottery has been observed in and adjacent Tosawihi Quarries.

Great Basin Stemmed Series points at Tosawihi suggests that pre-Archaic people began to visit the quarries and vicinity during the Dry Gulch Phase of 8,000 years ago, and possibly earlier. Rusco (1982:34) reports a GBSS point fragment made of opalite from the Rossi Mine area about 15 km to the southeast, but all the Great Basin Stemmed Series points that we have collected from Tosawihi Quarries are made of obsidian, basalt, or other volcanic rocks. These points usually are found as isolates or in questionable association with surface lithic scatters, such as at site 26Ek3107. While these Great Basin Stemmed points may be broken and worn out tools discarded during retooling, they could also represent hunting losses. There is presently no direct evidence confirming that the earliest visitors to Tosawihi Quarries actually quarried toolstone there or stayed long enough to generate camp site debris typical of Archaic sites. The lack of evidence for early quarrying and residential use of Tosawihi Quarries, however, could just as well be due to geological and biological processes which (as discussed in more detail below) render progressively older cultural deposits less visible.

What kinds of cultural variation through time did testing reveal at Tosawihi? In the absence of many radiocarbon dates and without detailed qualitative and quantitative analyses beyond the scope of the test phase, we see as yet very little evidence for temporal change in reduction technology or toolstone extraction techniques. What is apparent, however, are changes in the frequency of various time sensitive projectile points. Arranging the frequencies of point series in chronological order suggests variation in frequency of point loss or discard through time. Further calculating and plotting the cumulative frequencies of point series arranged in chronological order produces a characteristic "curve" for each site or group of sites. The question of what these curves actually mean in terms of functional, technological, or spatial behavior of people is begged for the time being. Nevertheless, for heuristic purposes, one may advance the hypothesis that the loss/discard rate is roughly the same from place to place and time to time. Differing rates between areas or time periods then signal the possibility of functional, technological, or spatial variability, which can be investigated further.

Frequencies of various projectile point series by project area are given in Table 121. Humboldt and Large Side-notched points are not included in these data since their chronological ranges are so great. The samples for the USX-West and USX-East areas are roughly similar in size as well as in shape of their frequency distributions; the North Access sample is less than half as large, but its frequency distribution seems to be different from the other two.

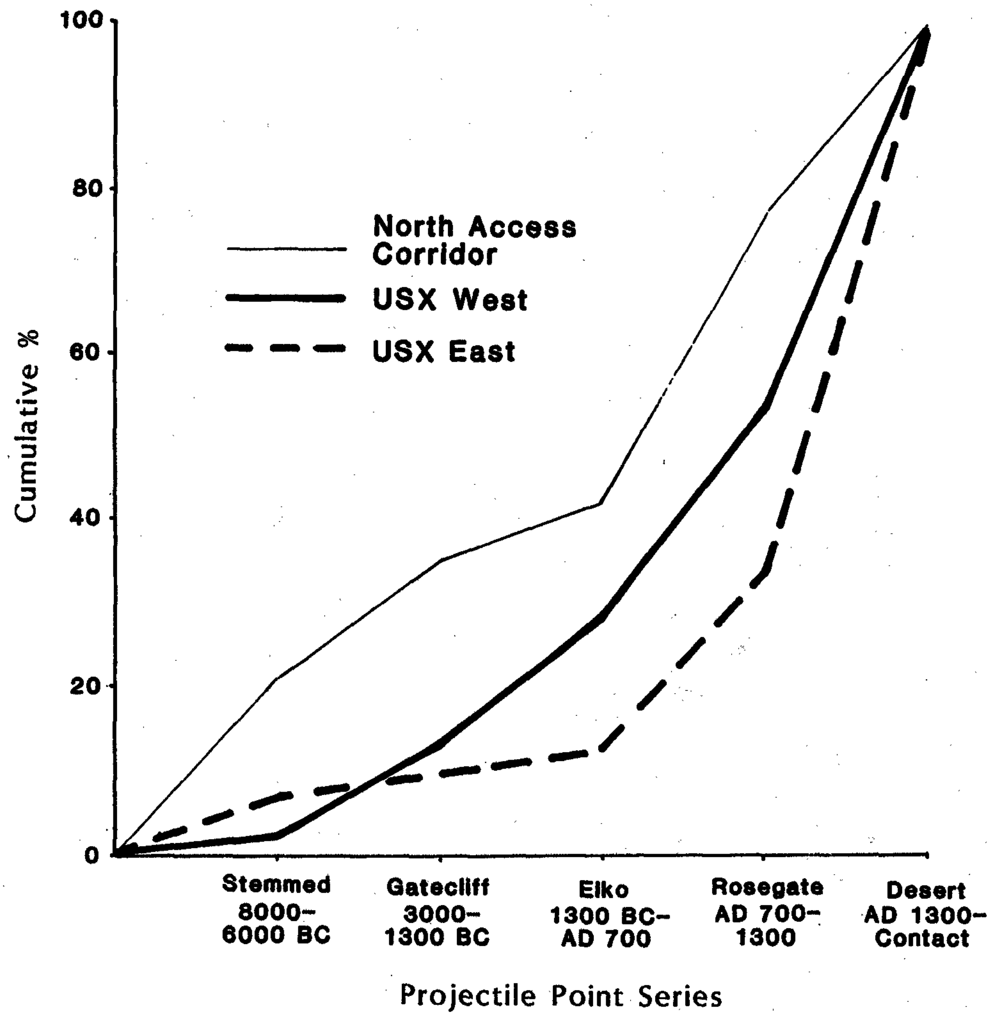
Table 121. Frequency of Projectile Point Series by Study Area.

	West		East		North	
Series	N	f	N	f	N	f
Desert	16	.44	25	.61	3	.21
Rosegate	9	.25	8	.20	5	.36
Elko	6	.16	1	.02	1	.07
Gatecliff	4	.11	4	.10	2	.14
Stemmed	1	.03	3	.07	3	.21
Total	36		41		14	

Figure 91 plots cumulative frequencies of projectile point series by study area, using data from Table 121. The resulting "temporal curves" allow graphic comparisons among the three areas.

The North Access sites (specifically 26Ek3237) have the highest frequencies of Great Basin Stemmed Series and Gatecliff Series points, resulting in a steep, convex curve on the left side of the graph. The low frequency of Elko Series points causes a "flat" place in the middle of the curve, followed by another steep climb with high frequencies of Rosegate Series and Desert Series points. Because of relatively low frequencies of

Figure 91. Cumulative frequencies of projectile points by geographic area.


100
80
60
40
20
0
Cumulative %
North Access Corridor
USX West
USX East
Stemmed 8000–6000 BC
Gatecliff 3000–1300 BC
Elko 1300 BC–AD 700
Rosegate AD 700–1300
Desert AD 1300–Contact
Projectile Point Series

early point series, the curves for cumulative frequency distributions in USX-West and USX-East are both relatively flat on the left side of the graph, but increase in steepness toward the right, due to sharp increases in frequencies of Rosegate and Desert Series points. The East and West differ mainly in frequencies of Elko Series points which are much more abundant in USX-West.

Thomas (1988) has observed that cumulative ogives sometimes suggest similarities or differences between frequency distributions that are not statistically significant. Differences between pairs of cumulative frequency distributions can be assessed using the Kolmogorov-Smirnov (KS) two-sample test (Blalock 1979), wherein the frequency distributions are considered distinct only if observed differences in cumulative frequencies exceed a predetermined critical value.

Using the KS test, a number of questions can be asked of the data. The greatest differences (Figure 91) appear to be between the North Access curve and the curves for USX-West and USX-East. Is this supported by The KS test? As shown in Table 122, there appears to be no difference between the North Access area and the pooled frequencies of the USX-East and West areas at the 0.05 level of significance. All frequency distributions and the curves they describe could have been drawn from the same population.

Table 122. Maximum Observed and Critical Values for North Access Versus Pooled East and West Frequencies (0.05 significance level).

	n1 Sample Size	n2 Sample Size	Critical Value	Maximum Observed Value
USX-West + USX-East/North Access	75	14	.396	.346

Are the differences between frequency distributions of study area pairs then significantly different from each other? Table 123 shows that the frequency distributions of USX-East and North Access sites are significantly different, but that the null hypothesis cannot be rejected for curves comparing USX-West/USX-East and USX-West/North Access. That is, the curves for those areas could both have been drawn from the same population.

While Figure 91 suggests an early high frequency in point loss in North Access sites compared to sites adjacent the Tosawihi Quarries, that is true only when contrasted with sites of USX-East.

Table 123. Maximum Observed and Critical Values Between Geographic Profiles (0.05 significance level).

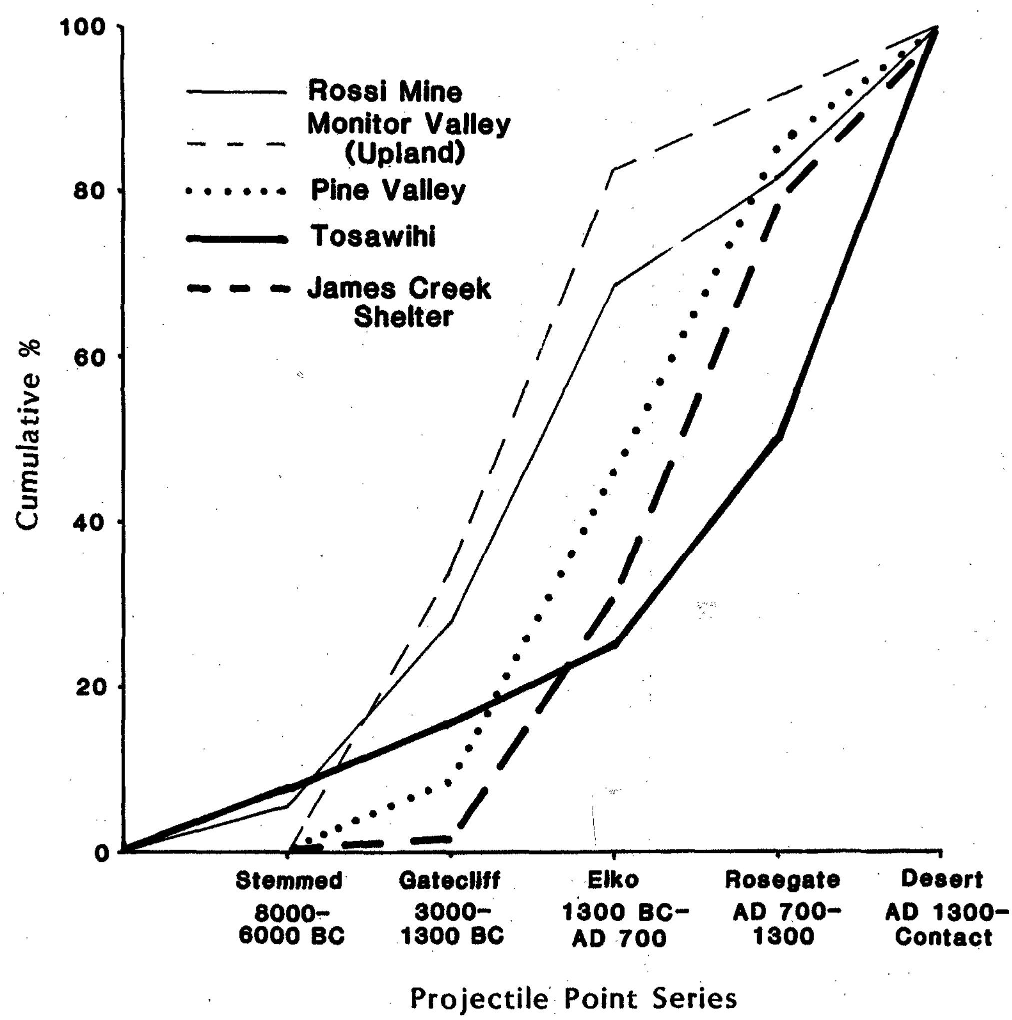
	n1 Sample Size	n2 Sample Size	Critical Value	Maximum Observed Value
USX West/USX East	37	38	.314	.199
USX West/North Access	37	14	.426	.245
USX East/North Access	38	14	.425	.444

We tentatively conclude a similar history of projectile point loss and discard in all three areas from 8000 B.P. to Historic Contact, with a sharp increase during the Late Archaic (Maggie Creek and Eagle Rock phases). For now, the differences we observe graphically between areas are not statistically significant at the 0.05 level. Does this mean that the differences are not real or are not interesting in an archaeological sense? Perhaps, but whether or not they could signify important trends in the data is obscured by the small sample size for the North Access area and by the limited numbers of Great Basin Stemmed, Gatecliff, and Elko points; several cells contain only one item. Discovery of one or two additional points of any of the earlier point series easily could alter the results of the KS test.

However differences in early rates of point loss between areas eventually play out, there is no doubt that in the Late Archaic Maggie Creek (Rosegate Series) and Eagle Rock (Desert Series) phases, projectile point frequencies in all three areas increase rapidly. In USX-East, for instance, 65% of the points are Desert Series and over 80% of the points post-date the Elko Series. Do these trends signal increased rates of point loss/discard with the introduction of the bow and arrow? Or did increases in the abundance of other resources, such as bison, attract more people to the area?

Broad changes in technology, resource availability, or population, however, ought to be reflected regionally. Are the trends in the Tosawihi data mirrored elsewhere in the Great Basin? In Figure 92, projectile point frequency distribution from all three Tosawihi project areas combined are compared to projectile point frequencies from other upland sites and localities in the central Great Basin. The Tosawihi Quarries curve is distinctly different. Figure 92 shows that curves for upland sites all contain an upward trend, but this occurs during the Middle Archaic when Elko points are in use. The frequencies for Late Archaic Rosegate points are high in the upland assemblage but the frequencies of late prehistoric Desert Series fall off. At Tosawihi, major increases in point frequencies occur throughout the Late Archaic.

Figure 92. Cumulative frequencies of various upland site and Tosawihi projectile points.



100
80
60
40
20
0
Cumulative %
Rossi Mine
Monitor Valley (Upland)
Pine Valley
Tosawihi
James Creek Shelter
Stemmed 8000–6000 BC
Gatecliff 3000–1300 BC
Elko 1300 BC–AD 700
Rosegate AD 700–1300
Desert AD 1300–Contact
Projectile Point Series

When compared to the upland curves with the KS test, the Tosawihi Quarries distribution is distinctly different (Table 124); critical values are exceeded in all cases.

Table 124. Maximum Observed and Critical Values Between Tosawihi and Upland Profiles (0.05 significance level).

	n1 Sample Size	n2 Sample Size	Critical Value	Maximum Observed Value
Tosawihi/Pine Valley	89	80	.210	.356
Tosawihi/James Creek	89	78	.211	.288
Tosawihi/Rossi Mine	89	38	.264	.322
Tosawihi/Monitor Upland	89	62	.225	.425

This suggests that something different happened at Tosawihi Quarries than at other upland areas of central Nevada. We strongly suspect that these projectile point frequency changes are somehow linked to increased intensity in the exploitation of Tosawihi opalite. Why this increase occurred and how it could have been sustained are topics of upcoming research, as discussed below.

Site Function, Assemblage Composition and Diversity

Although numerous sites represent on or near-surface manifestations which may contain palimpsest accumulations (e.g., overlapping accumulations of artifacts deposited during different occupations; see especially Thomas 1988:380-382), the presence of domestic equipment, fabricating tools, and weaponry clearly attests to subsistence activities performed in support of forays for toolstone procurement. Even so, the proximity to sources of toolstone heavily influences the content of site assemblages. Table 125 shows numbers of quarry and maintenance tools and percentage of quarry tools by area and subarea. Within each area, subareas are arrayed by increasing distance to toolstone source (please refer to subarea maps throughout this report), and the reader will notice that the proportion of quarry-related tools decreases as expected in each case.

For instance, with the presence of numerous on-site opalitic cobble and outcrop sources along Undine Gorge, artifact assemblages from sites there reflect activities largely, but not exclusively, directed toward the acquisition of toolstone. Prehistoric occupants employed diverse extraction techniques including pit excavation, outcrop reduction, cobble deposit assay, and bedrock excavation. Seventy percent of Undine Gorge sites contain at least one lithic source and the proportion of quarrying to non-quarrying tools is 73%. Exclusion of campsite 26Ek3198, with its abundant hunting, fabricating, and processing equipment, increases the proportion of quarrying tools in Undine Gorge sites to 83%.

Table 125. Quarry and Maintenance Tools by Subarea.

	Quarry	Maint.	Total	% Quarry
NORTH ROAD				
Ivanhoe Creek	76	104	180	42
Perron Canyon	15	95	110	14
USX-WEST				
Rodent Valley	112	27	139	81
Basalt Canyon	94	77	171	55
Bitterroot Ridge	771	649	1420	54
USX-EAST				
Undine Gorge	315	115	432	73
Ramadan Ridge	124	85	209	59
Holeplug	369	266	635	58

A similar proportion of quarrying tools (81%) is found in several large and diffuse reduction complexes of Rodent Valley, located between the western boundary of the Tosawihi Quarries on the north and the Red Hill quarries to the south. Some Rodent Valley assemblages contain non-quarrying artifacts (e.g., scrapers), but cores and quarry bifaces dominate. On Red Hill, in addition to several minimally exploited outcrop quarries, are other high quality outcrops with substantial quarry pit features and massive accumulations of quarry debris (most notably 26Ek3085/3208 and 26Ek3084). These deeply stratified deposits of quarrying waste indicate an extraordinary expenditure of effort. The sites do not appear in Table 125 because their documentation emphasized stratigraphic recordation rather than artifact collection.

At the subarea level, then, the proportion of quarry tools decreases with distance to major toolstone source, but at the site level it varies as a function of the number, size, and type of sources present, as well as with the degree of "residentiality", or signs of short-term domestic use of the area in the form of maintenance and food-processing assemblages. For instance, both Ramadan Ridge sites (26Ek3170 and 26Ek3171), where the proportions of quarry tools are only 57% and 64% respectively, contain one or two open quarry pits; these are relatively small, discrete features. The residential character of these sites also serves to inflate the proportion of non-quarry tools, as it does in site 26Ek3198 along Undine Gorge where the proportion of quarry tools is only 48%

In portions of USX-East lacking toolstone sources, we find only low-intensity reduction stations containing products of transported and reduced quarry bifaces and cores. The proportion of quarrying tools in sites along Hole Plug Ridge is 58%. Only two Hole Plug sites (26Ek3191 and 26Ek3193) have lithic sources, both diffuse outcrop quarries with minimal signs of exploitation. This suggests that the topography and ecology of Hole Plug Ridge may have offered opportunities more suited to the reduction of partially reduced bifaces transported from the Undine Gorge sources and possibly, as well, the procurement and processing of non-lithic resources. This almost certainly is the case for the Basalt Canyon and Bitterroot Ridge areas, with 55% and 54% quarry tools respectively. Both are adjacent bitterroot patches and riparian resources, well removed from toolstone sources. Both areas reflect later stage toolstone reduction and short term occupational use indicated by assemblages with abundant small bifaces, projectile points, scrapers, perforators, and ground stone. This is particularly evident at Bitterroot Ridge sites 26Ek3160 and 26Ek3116 where the proportion of quarrying tools is only 42% and 32%, respectively. Perhaps these larger scatters indicate a strategy in which hunting and plant preparation were embedded in toolstone procurement and processing forays.

The North Access Road offers the best opportunity to examine the relationship between increasing transport costs with distance from the Quarries and technological decision making. The distance from major toolstone sources to sites located in the North Access Road is greatest, and these sites contain the fewest quarrying artifacts. This is most evident in the Perron Canyon subarea which includes site 26Ek3251 on Willow Creek (the site most distant from known toolstone sources), where small and preform bifaces abound and quarry bifaces are scarce. In fact, quarry tools account for only 8% of the assemblage from this site. The numerous flake tools, groundstone fragments, and other non-quarrying artifacts attests to the residential character of the site.

Although assemblage content appears to be related closely to distance from toolstone source, assemblage diversity (numbers of tool classes) may be related to differences in the use of sites. Figure 93 is a semi-log plot of the number of artifacts (log transformed) against the number of classes of artifacts (untransformed), intended for preliminary data exploration. The well known correlation (Jones, Grayson and Beck 1983; Thomas 1983b) between assemblage size and diversity (numbers of classes) is quite strong, with r = 0.94.

Nevertheless, the plotted data also suggest a fair amount of structure. For clarity, the points in the plots have been enlarged to circles and filled with different patterns, each representing a functionally different type of site. Note that the array of sites appears to form three groups along the regression line. Reduction stations, reduction complexes, and shelters have similar distributions and are present in both the lower and middle groups, supporting the hypothesis that most small Tosawihi rockshelters were used more as lithic reduction stations than as residential bases. None of the sites deemed "residential" in the graph is associated with quarrying, and each contains between 8% and 66% quarry tools; all are in the middle and upper groups. Sites 26Ek3160, 26Ek3271, and 26Ek3095 comprise the uppermost group.

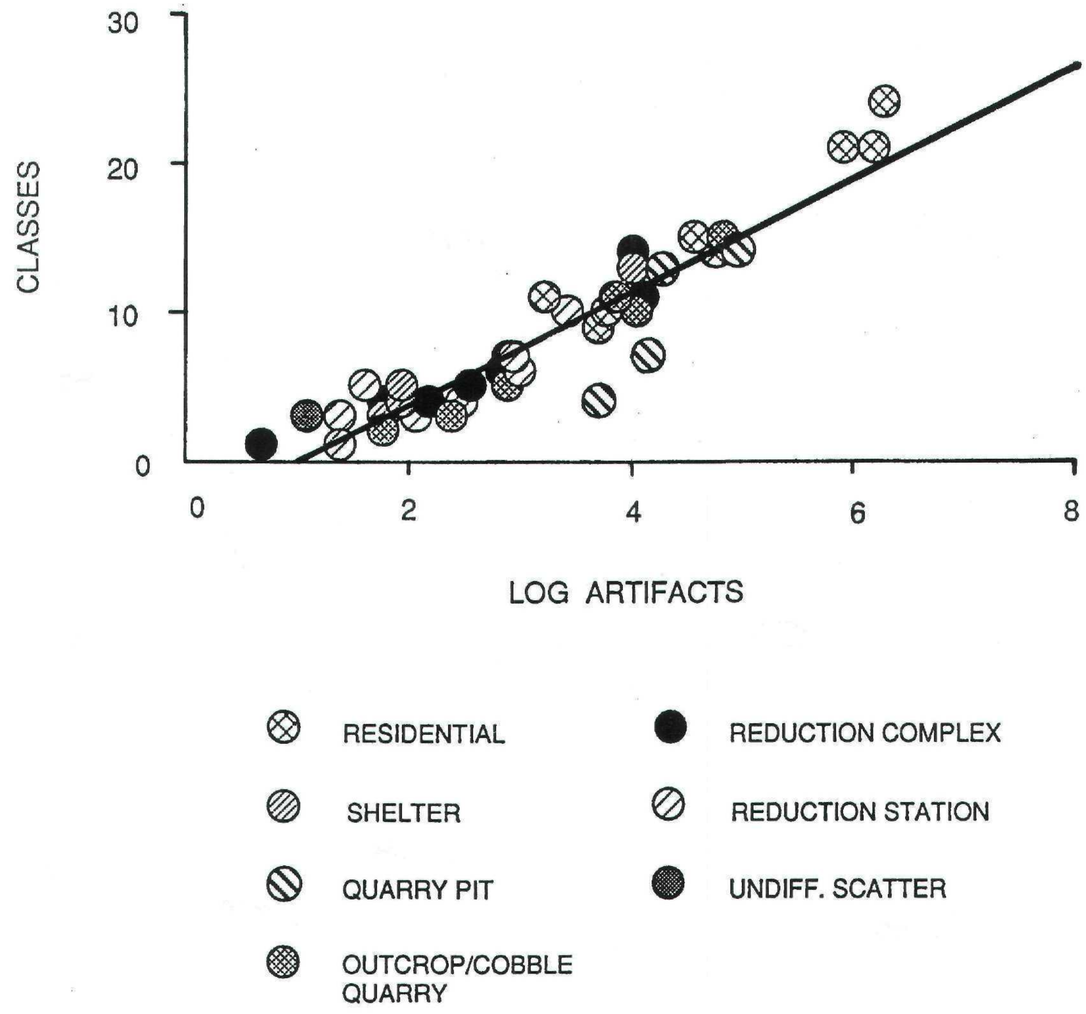
Quarry pit sites are exclusive to the middle group, except that two sites (26Ek3195 and 26Ek3197) fall substantially below the regression line. This supports the hypothesis that quarry pit assemblages are likely to contain a more limited range of artifact types than assemblages from other site types. The two quarry pit sites falling on the regression line are 26Ek3170 and 26Ek3171, both with strong "residential" components, as previously discussed.

All this suggests that, with additional data, further analysis of assemblage composition and diversity will aid substantially the interpretation of archaeological variability at Tosawihi Quarries. The structure of these relationships can be investigated through site-by-site comparative studies of fall-off rates in numbers, size, and reduction stage of quarry tools and debitage, while controlling for changes in other variables such as type of toolstone source, intensity of toolstone exploitation, and use of non-toolstone resources. For instance, multiple opalite sources are accompanied by numerous reduction localities exhibiting early stage toolstone processing in USX-East. Because of the diversity of lithic material extraction techniques and the staged reduction of transported quarry blanks, this area promises to add important information to our study of tool procurement and processing strategies. Further, with additional data recovery an assessment of how variation in toolstone quantity and quality across the project area affected prehistoric behavior and, hence, site character will be possible.

In USX-West, we have documented the most functionally diverse suite of localities in the entire project area. The western sites can contribute significantly to an understanding of toolstone reduction strategies on the periphery of the Tosawihi Quarries. The large residential complexes, such as the stratified buried site in Basalt Canyon (26EK3092), representing a series of repeatedly occupied short-term campsites, are significant for their complex internal structure and what they reveal about organization of the groups using the quarries (eg. group size and gender constituency, subsistence activities, seasonality of site use, and duration of stay).

Although many sites have a strongly residential character, early stage reduction dominates many of the discrete features in each, suggesting western sites may have been important staging

Figure 93. Numbers of artifacts (log transformed) versus numbers of artifact classes.



30
20
10
0
CLASSES
0
2
4
6
8
LOG ARTIFACTS
RESIDENTIAL
REDUCTION COMPLEX
SHELTER
REDUCTION STATION
QUARRY PIT
UNDIFF. SCATTER
OUTCROP/COBBLE QUARRY

areas for the prehistoric quarriers as they left the primary toolstone procurement localities. Evaluation of the intensive exploitation of the Red Hill quarries offers an excellent opportunity for reconstructing time-allocation and energy expenditure in concert with experimental quarrying studies now underway.

It may be possible to identify how subsistence and technological strategies interdigitated: did intensive toolstone quarrying represent a singular activity that involved an entire residential group, or rather logistically organized, task-specific groups? Did toolstone distribution and regional demand condition toolstone procurement to be a directly targeted task, or one embedded in food-getting activities?

North Access sites show some variability among reduction loci in the stage of bifaces being produced, indicating there may have been a difference in the function of particular sites along a toolstone processing trajectory. Further study of North Access sites will allow examination of the role of short-term residential sites as temporary field camps along a logical transport corridor to and from the Tosawihi Quarries.

With additional data recovery, and refined chronological studies, it will be possible to evaluate long-term change in the use of the Tosawihi environs, to assess temporal variability in site function, and to examine shifts in the structure of the subsistence/economic system.

Site Structure and Formation Processes

Much of the field effort of the Tosawihi testing program was spent extracting information on the spatial distributions of components of the archaeological record. We were interested on the one hand in the spatial organization of behavior, and in the degree to which that organization is reflected in patterns observed archaeologically. On the other hand, we wished to assess with specific reference to Tosawihi sites the degree to which natural processes (e.g., slope movement, eolian and alluvial deposition, and bioturbation) may have affected the behavioral "readability" of distributions. Accordingly, site structure and site formation processes were identified as research issues meriting special consideration, and our testing was designed to evaluate the quality of data on each. Three structural patterns predominate at Tosawihi, reflecting the principle functional classes identified by analysis of assemblage compositions.

Quarry Features are characterized by generally dense concentrations of primary debitage and shatter, focused either along linear surface exposures of opalite outcrops or on subsurface point sources of opalite bedrock.

In the case of the former, quarrying materials tend to accumulate as talus slopes along the base of bedrock faces. Such deposits sometimes cover hundreds of square meters. Often, significant deposition is found coincident with the most favorable expanses of high quality toolstone. The dimensions of outcrop quarry features are governed largely by the extent of the workable face, while the density and depth of their associated debitage deposits is a function of the relative accessibility of quality toolstone in the exposed bedrock.

Prehistoric quarry pits were excavated at the base of outcrops as well as in open surfaces with no outcrops. At quarry pits, site structure is a function of the removal of overburden, primary extraction of raw toolstone, and natural processes of deposition. Because non-toolstone material (soil and bedrock) must be removed before opalite quarrying can begin, such features tend to be more restricted in area (average area = 109 m^2) than at outcrop quarries. Quarry pits are roughly circular in plan (although some are elongate or trench-like), and ringed by berms composed of both overburden backfill and discarded opalite quarrying debris. Their depth is governed by the distance from surface of exploitable bedrock, varying from less than .5 m (e.g., Feature 1 at 26Ek3171) to nearly 3 m (at 26Ek3208).

Quarry pit deposits invariably are well stratified. Moreover, the accumulation of sharp, angular quarry debris and mineral soil in quarry pits appears to be a poor substrate for living creatures with the result that such deposits evidence little or no bioturbation.

The removal of overburden and waste rock, extraction of opalite toolstone, toolstone assay and processing, and natural accumulation of sediments all produce characteristic deposits. These deposits also tend to occur in characteristic positions in and around quarry pits. The simplest quarry pit results from a single episode of excavation to bedrock, toolstone extraction, and abandonment. A model of the life of a simple quarry pit follows:

1. Remove soil overburden to bedrock with a digging stick, and place it outside the pit on the down-slope side in contact with the unmodified ground surface. Overburden deposits have similar texture and clasts to undisturbed soil adjacent to the pit (usually loams), but differ in color and structure because of mixing during removal and redeposition. Overburden is often the basal deposit in the berm around the pit.

2. With hammerstones, wedges, and levers, remove non-toolstone bedrock to expose and/or isolate opalite toolstone. This creates at least two

kinds of deposit. "Hash" is probably a byproduct of removal of non-toolstone bedrock through battering, and is comprised of fine angular opalite fragments, pulverized tuff, silt and/or clay. In the simple pit, hash characteristically is found in thin lenses resting directly on bedrock in pit bottoms. Waste rock removal also produces layers of coarse rubble comprised of pebble to cobble sized angular chunks of tuff and opalite with opalite flakes. These layers often contain broken hammerstones and hammerstone spalls. In the simple case, coarse rubble is piled around the edges of the pit and forms most of the deposits in the berm.

3. With hammerstones, wedges, levers, and possibly fire, extract the now isolated toolstone. This may produce a coarse deposit such as the one just described (also with hammerstones and spalls), but it contains more opalite than tuff. These deposits also tend to be deposited on the berm. Charcoal deposits and burned stones in the pit fill may signal small fires set to crack and separate isolated masses of toolstone.

4. With hammerstones, process the extracted toolstone; create large flake blanks and perform initial biface reduction. These activities produce layers composed mostly of flake debitage (much of which is large) that may also contain bifaces and cores. Hammerstones and spalls are also present, but much smaller in size than those described above. These deposits occur within pits and on pit berms; in the simple case, these are the last cultural deposits created before abandonment.

5. Abandon the pit. Natural processes (slopewash, frost heaving) cause the inner slopes of the pit walls and berm to contribute material that accumulates in the pit bottom. Vertical size sorting may occur as fine material settles among larger objects. If left undisturbed, eolian accumulation of fine sediment and organic material may fill the pit bottom and begin to form a humic horizon.

This simple model remains unobserved in the field. All the quarry pits that we have examined demonstrate multiple episodes of quarrying and abandonment in the same pit or in adjacent pits. Old quarry pits are filled with overburden and waste from new pits. Multiple quarrying episodes in pits on open surfaces tend to move uphill; those at the base of bedrock outcrops tend to move into the bedrock exposure, and probably laterally along the outcrop as well. But because the deposits generated during different phases of quarrying are so distinct, it should be possible to separate discrete episodes in complex quarry pit fills.

Reduction Features consist of moderately dense scatters of secondary debitage, biface thinning flakes, cores, and bifaces, generally limited in horizontal extent (average area = 41 m^2) and confined vertically to a thin film seldom exceeding a few cm in depth. For obvious reasons, reduction features are most visible in areas away from quarries and their associated accumulations of debris. Most reduction features appear to be products of single event reduction episodes involving no more than two or three actors, since the distribution of debitage tends, where not modified by post-depositional processes, to concentrate in one to three loci within the scatter, from which a rapid fall-off in density occurs. Whether these multiple nuclei represent contemporaneous episodes (i.e., a three member reduction party) or are palimpsests of spatially coincident reuse awaits data recovery and the close monitoring of distributions by reduction stage and material type.

Residential Localities, by virtue of the greater diversity of activities performed at them, of the greater population densities and durations of habitation that they sustain, and of their tendency to accumulate palimpsest assemblages, tend to be much less structurally lucid than single event or single activity features. Apparently lacking facilities such as houses, storage pits, or many visible external hearths to articulate space within their boundaries, such sites often exhibit relatively amorphous scatters of multifunctional artifacts and debitage (e.g., 26Ek3092, 26Ek3170, 26Ek3171, and 26Ek3251), against which background only the most recently formed features are distinguishable. More rarely, such as at 26Ek3095, relatively discrete multifunctional features punctuate a landscape dominated by fairly barren inter-feature space, suggesting that such places are products of a smaller residential group size, shorter duration of habitation, or less frequent revisits.

The occurrence of these distinctive structural patterns, of course, is not mutually exclusive at Tosawihi, nor do they often occur as isolated instances of their class. More commonly, in fact, clusters of functionally related features form complexes that, until chronological controls can be imposed, ambiguously reflect either concentrated activity loci or long scenarios of revisitation; the 27 reduction features at 26Ek3184 comprise a case in point, and their implications for understanding the organization of work are affected profoundly by which interpretation is favored. Likewise, subsurface quarrying features occur often in coalescent clusters that reflect prolonged exploitation, although not necessarily during the same season, of the same toolstone source.

More complex, because it blurs structural distinctions, is the frequent coincidence of separate classes of feature. Quarrying features, for instance, are almost always accompanied by reduction stations nearby, and most often actually are intruded by them. As described above, early stage biface manufacture frequently takes place on and about the berms of quarry pits, and the interior depression receives much of the discard. Too, all residential localities are characterized by at least a few reduction stations, and some (e.g., 26Ek3170 and 26Ek3171) subsume quarrying features within their boundaries. Structural analysis in these cases will require the meticulous teasing apart of the products of functionally distinct episodes of deposition.

Additional to behavioral patterning, observable site structure is a function of various natural processes that have contributed to, obscured, or deformed original patterns. At Tosawihi we have noted all these effects; reading of original (behavioral) patterns.

Some of these processes were touched upon previously in the quarry pit model. Because abandoned quarry pits function somewhat as catchment basins, these processes actually clarify some aspects of behavior. Slope wash and eolian material accumulating during episodes of non-use delimits stratigraphic units that otherwise would be more difficult to isolate. Such delineation helps to emphasize structural differences between quarry pits (e.g., the deep pits at 26Ek3208, products of progressive working against a vertical face, from Feature 7 at 26Ek3171, the product of horizontal advance across a bedrock floor, with many episodes of backfilling). Importantly, such intercalation underscores that many quarrying features have resulted from several reiterative episodes, sometimes widely separated in time, rather than from single, sustained efforts.

Doubtless many prehistoric features in open sites and alluvial situations have been obscured by soil accumulation. We have noted in the USX East area, particularly, that eolian deposition has covered numerous reduction features with a film often no more than 2 cm thick. Since such features are rendered invisible to surface examination, structural analysis must rely in part on subsurface control.

Deformation is largely a product of slope movement and bioturbation. At Tosawihi, such processes most notably have affected reduction stations which tend, because they consist of patterned but very shallow scatters, to diffuse through time. On slopes, they undergo a general down slope migration, probably with measurable size sorting, until eventually they disappear as discrete entities. Similar dispersal, although less directional, is produced by burrowing rodents and the passage of livestock; the former may entail vertical displacement as well.

To the degree that behavior can be inferred from site structure, and structure from observed distributions, the spatial dimension of Tosawihi archaeology will repay overt measures of data recovery to understand it. Both behavioral and depositional models will have to be invoked.

The Organization of Lithic Procurement

Binford (1979, 1985a, 1985b; Binford and Stone 1985) maintains that toolstone procurement by hunter-gatherers is always "embedded" in other activities, occupies slack time, or is pursued when primary target resources fail to materialize. However, Gould (Gould 1980, 1985; Gould and Saggers 1985) counters that hunter-gatherers may make forays targeted specially at toolstone, when demand is high because of critical task requirements, or religious or trade incentives.

Tosawihi Quarries provides an excellent test ground for evaluation of these two competing models. As we have seen, Tosawihi Quarries is in a hinterland, not an easy place to be for any length of time in most seasons and over 40 km from the nearest known ethnographic winter base camp. Quarry pit excavation and toolstone processing must have been difficult and time consuming, and yet were carried out there on a scale unprecedented elsewhere in the Great Basin. Hundreds, perhaps several thousand, of quarry pits occur as individual features or in groups.

We doubt that this level of activity could be accomplished through a purely "embedded" strategy of exploitation, by people dallying a few hours on their way through the area. Extraction and processing (including heat treatment) could easily occupy several days. Steward (1941:337) quotes a Reese River Shoshone informant that flint was "put under the ashes for 5 nights". By definition (Binford 1980), the establishment of an overnight camp away from the residential base is logistical behavior.

Nevertheless, the question is not whether specialist task groups were employed who did nothing but extract and process toolstone, but how people could afford to spend several days at the quarries since food and water appear to have been limited there. Obviously, even though lithic resources were targeted at the quarries, visiting them was probably more advantageous at certain times of the year than at others.

Metcalfe (personal communication) suggests that people are more likely to move to lithic resources during times when the variance between different food resource return rates is low enough that the added lithic utility makes the lithic source more attractive than other places. This could be seasonal; food resource return rates are leveled during the winter, but the climate mitigates against spending too much time at Tosawihi then. Moreover, we have seen no archaeological evidence shelters or food storage that would support winter occupation at Tosawihi. Spring and early summer seem to be the most productive times at Tosawihi, and resource return rates are leveled by general abundance at that time; that is, there is abundance everywhere. Too, differential food resource return rates are created on an irregular basis, such as when the quarry vicinity hosts a herd of antelope or bison.

In any case, the presence of biface caches suggest that sometimes more toolstone was produced than could be transported. If conditions sufficient to support task groups at the quarries occurred infrequently and/or at irregular intervals, the biface caches could be part of a deliberate strategy to maximize production while it was possible to do so, and store the surplus to be retrieved on short term, "embedded" trips over the next months or possibly years.

The definitive answer to the question of how toolstone procurement was organized at Tosawihi Quarries lies in the analysis of a variety of problem areas discussed throughout this report and summarized here. These include elucidating the technology of extraction, processing, and manufacturing; estimating time and effort required for extraction and processing; and estimating the size of groups visiting the Quarries and the duration of their stay.

Implications For Data Recovery

The intent of the testing program was to identify those sites that retain data relevant to a suite of research issues, and to delineate those problem areas in which additional work would be rewarded. To this end we have invoked multiple strategies of testing and data evaluation, aware that in few cases could we expect to answer fully the questions posed by our research issues, but that in all cases we should be able to sort productive from non-productive lines of inquiry. Additional to the data reported here, then, the testing program has yielded two important kinds of information, one substantive and one methodological, affecting the structure and strategy of subsequent data recovery. On the one hand, the testing results allow us to categorize the subject sites in terms of their potential contribution to various of the identified research issues, and to isolate those at which problem-driven data recovery seems appropriate. In all, eight sites in the USX-East area (26Ek3170, 26Ek26Ek3171, 26Ek3184, 26Ek3192, 26Ek3195, 26Ek3198, 26Ek3200, and 26Ek3204), seven in USX-West (26Ek3084, 26Ek 3085, 26Ek3092, 26Ek3095, 26Ek3160, 26Ek3165, and 26Ek3208), and two in the North Access Corridor (26Ek3237 and

26Ek3251) promise to return data bearing importantly on the strategies and economics of toolstone procurement at Tosawihi (cf. Chapter 2). As well, most of these appear to be informative of site structure, function, assemblage composition, and site formation processes; a few (especially 26Ek3092, 26Ek3198, 26Ek3237, and 26Ek3251) are likely to contribute to understanding local subsistence patterns and cultural chronology. Accordingly, data recovery plans have been prepared to guide further investigation of the 17 sites identified above, with special emphasis given the extraction of data directly relevant to the research issues they are most likely to inform (IMR 1988).

On the other hand, we have gained from testing some useful methodological insights about how to reliably and efficiently get data from sites at Tosawihi. The strategy of scraping and screening a 2 cm veneer from the surface of reduction features, for example, yielded data nicely compatible with ethnographic models of small scale spatial behavior (Binford 1978, 1980). Horizontal controls of 1 m^2 allow both intra- and inter-feature comparisons, while limited test excavations placed within scraped features suggest that visible reduction stations at Tosawihi consist largely of surface or near-surface phenomena. Too, the use of 1/8 in. mesh for the recovery of a sample of such features (with the rest screened through 1/4 in. mesh) allows control for the relative frequency of small debitage without inflating overall recovery rates as would occur were 1/8 in. mesh used throughout.

The use of backhoes proved an effective and efficient method for exposing the internal structure of complex quarrying features. We believe that quick access to stratigraphic cross-sections, drawn in detail and further characterized by the collection of material samples, can return data sufficiently robust that the loss incurred by coarse-grained extraction techniques is outweighed substantially. Since quarry features (especially pits and their associated berms) tend to be composed of densely packed blocks of unconsolidated cultural material, the recovery of relevant data through hand excavation rapidly accumulates enormous costs in field and laboratory time not repaid by analytical benefits.

In sum, efficient data recovery at Tosawihi should exploit proven successes while minimizing fruitless, irrelevant, or redundant lines of inquiry. Attention should focus only on those sites demonstrated by testing to hold data pertinent to the research questions identified in Chapter 2, and should employ techniques (such as the shovel-skimming of reduction features and the mechanical dissection of backhoe trenches) that confront cleanly and directly the data needs posed by those questions.

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