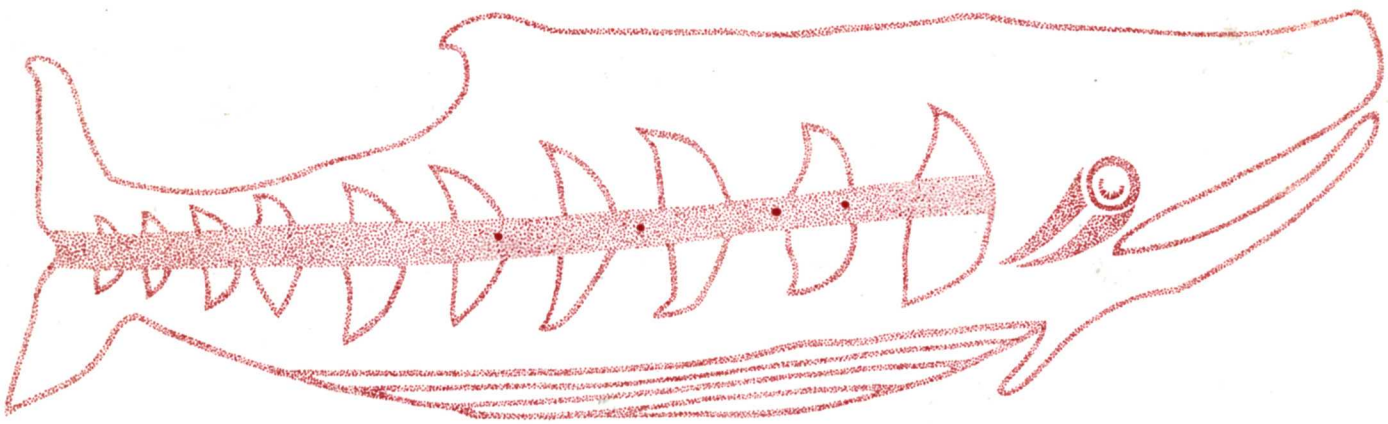
OZETTE ARCHAEOLOGICAL PROJECT RESEARCH REPORTS

VOLUME I

HOUSE STRUCTURE AND FLOOR MIDDEN

edited by

Stephan R. Samuels



WSU Department of Anthropology Reports of Investigations 63
National Park Service, Pacific Northwest Regional Office

Continued from inside back cover . . .

54 1977 Adams, William H., *Silcott, Washington: Ethnoarchaeology of a Rural American Community*. $7.00.

55 1978 Bodley, John H., *Preliminary Ethnobotany of the Peruvian Amazon*. $5.00.

56 1979 Bodley, John H., and Foley C. Benson, *Cultural Ecology of Amazonian Palms*. $5.00.

57 1979 Brown, Christopher L., and Carl E. Gustafson, *A Key to Postcranial Skeletal Remains of Cattle/Bison, Elk and Horse* (reprinted 1990) $13.00.

58 1980 Croes, Dale R., and Eric Blinman, editors, *Hoko River: A 2500 Year old Fishing Camp on the Northwest Coast of North America*. (Out of Print; $35.40 xerox).

59 1981 Flenniken, J. Jeffery, *Replicative Systems Analysis: A Model Applied to the Vein Quartz Artifacts from the Hoko River Site*. $8.00.

60 1983 Knudson, Ruthann, *Organizational Variability in Late Paleo-Indian Assemblages*. $12.00.

61 1989 Kohler, Timothy A., editor, *Bandelier Archaeological Excavation Project: Research Design and Summer 1988 Sampling*. $13.25.

62 1990 Kohler, Timothy A., editor, *Bandelier Archaeological Excavation Project: Summer 1989 Excavations at Burnt Mesa Pueblo*. $14.75

63 1991 Samuels, Stephan R., editor, *Ozette Archaeological Project Research Reports I: House Structure and Floor Midden*. $19.50. (Copublished with the National Park Service, Pacific Northwest Regional Office, Seattle.)

Reports can be ordered from the Department of Anthropology, Washington State University, Pullman, WA 99164-4910. Please add $1.00/volume for shipping and handling. Washington State residents add applicable sales tax.

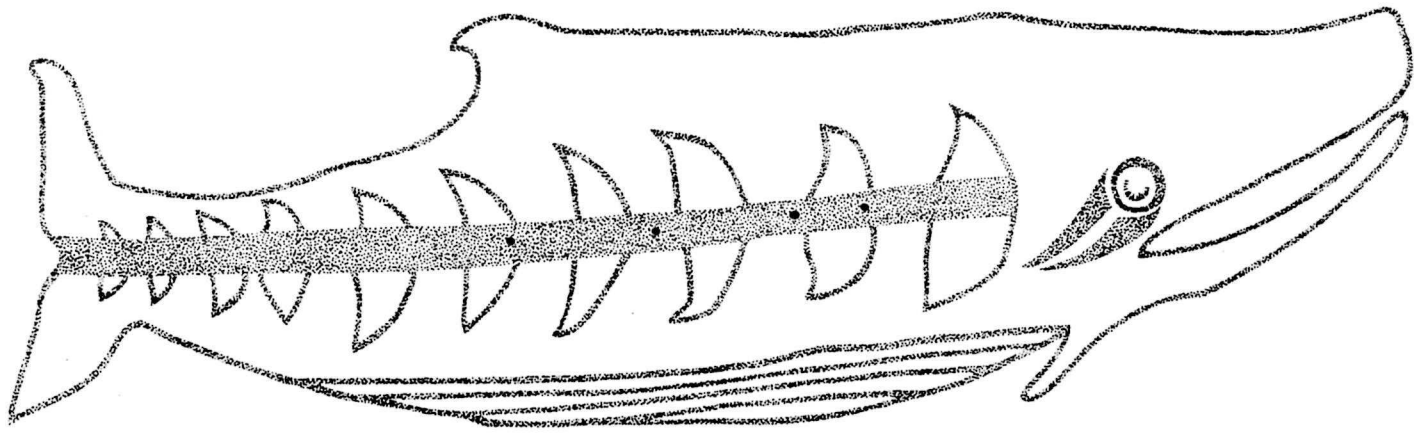
OZETTE ARCHAEOLOGICAL PROJECT RESEARCH REPORTS

VOLUME I

HOUSE STRUCTURE AND FLOOR MIDDEN

edited by

Stephan R. Samuels



WSU Department of Anthropology Reports of Investigations 63
National Park Service, Pacific Northwest Regional Office

Complete bibliographic format for WSU Reports of Investigations 63:

Samuels, Stephan R. (editor)
1991 *Ozette Archaeological Project Research Reports, Volume I, House Structure and Floor Midden.* Reports of Investigations 63. Department of Anthropology, Washington State University, Pullman, and National Park Service, Pacific Northwest Regional Office, Seattle.

Cover illustration is of a whale, taken from a carved panel (29/IV/21) recovered from House 1.
Drawing by Stephan R. Samuels.

ISSN 1059-4000

This report is printed on acid-free paper.
Price: $19.50

Reports of Investigations is an occasional series published by the Department of Anthropology, Washington State University, to disseminate information resulting from research undertaken by students, staff, and faculty associated with the department. Timothy A. Kohler, General Editor.

Preface and Acknowledgments

Literally hundreds of people have contributed to the Ozette Archaeological Project since initial excavations were begun in 1966. The numerous dissertations, theses, and project reports produced during the excavation and analyses acknowledge the contributions of many individuals and organizations. It is not possible to cite all contributions here, but mention must be made of some, without which this project could not have been undertaken.

Foremost among the individuals responsible for the Ozette Archaeological Project is its principal investigator, Dr. Richard D. Daugherty. His work at Ozette has spanned over 40 years. It is through his guidance that the studies represented by reports in these volumes were undertaken and completed. He consistently provided thoughtful criticism, intellectual stimulation and insightful comment. His care, patience and good humor in editing the many project reports and special studies have been greatly appreciated by all Ozette Project analysts. His determination to complete excavation and analysis always kept the project on track, even with difficult environmental and fiscal conditions.

The people of the Makah Tribe deserve thanks for their enthusiasm and cooperation during the many years. Their hospitality and support gave relevance to these analyses. In particular, thanks to the staff of the Makah Cultural and Research Center for use of their equipment and facilities.

Among the Ozette Project staff, mention should be made of the untiring work of the field directors. During the many years of excavation, several field directors kept the excavations proceeding while maintaining consistency in field methods, so it could all be put back together during analysis; these include Paul Gleeson, Jeff Mauger, Dave Huelsbeck, and Gary Wessen.

For over ten years, summer at Ozette was marked by a field school, full of eager young people learning archaeology, who unselfishly contributed their effort and talents. During each winter, the crew was reduced to a "hard core" who continued excavation in the normally inclement weather or huddled indoors, where thousands of bone and shell debris awaited analysis. Thanks to all those staff and volunteers who persevered through the trying conditions.

The scope and quantity of data recovery from this site was a result of many years of excavation and analysis. Thanks to all the people who spent countless hours processing the materials and paperwork at the Neah Bay laboratory. Various personnel at Washington State University, particularly in the Department of Anthropology, Washington Archaeological Research Center and Laboratory of Anthropology and History, all deserve many thanks for clearing the logistical hurdles inherent in work at such a distant and remote locale, and for their assistance in production of the many reports. The drafting for this volume was done by Jeff Mauger and Steve Samuels, and the Makah orthography was contributed by Steve Gill and Maria Parker Pascua.

The funding for this multi-faceted project was made possible with federal grants from Interagency Archaeological Services—National Park Service. Particular mention must be made of Garland Gordon, chief of IAS—San Francisco, who began the relationship between IAS and the Ozette Archaeological Project, and Bennie Keel, Departmental Consulting Archaeologist, who attempted to maintain federal funding during difficult fiscal times. Thanks to Jim Thomson, National Park Service, Pacific Northwest Regional office, and Tim Kohler, Department of Anthropology, Washington State University, this publication series will provide for a wider distribution of Ozette analyses than was previously possible.

This volume details analyses of the house structural features and the floor middens of excavated structures, and the exterior midden adjacent to these structures. Future volumes in this series will present results from subsistence studies of marine, intertidal, and terrestrial faunal remains, and studies of plant utilization and woodworking technology.

Table of Contents

Preface and Acknowledgments iii

Part I
INTRODUCTION TO THE OZETTE ARCHAEOLOGICAL PROJECT
by
Stephan R. Samuels and Richard D. Daugherty

Part I 1
Ozette Village 3
Archaeological Overview 3
Introduction to the Ozette Site Excavations 4
History of Ozette Archaeological Excavations 11
History of Ozette Analysis 24

Part II
SHED-ROOF HOUSES AT OZETTE
AND IN A REGIONAL PERSPECTIVE
By
Jeffrey E. Mauger

Part II 29
Abstract 31

1. INTRODUCTION 31

2. SETTING 33
Introduction 33
Economy 33
Settlements 34
Makah House Architecture 40
Summary 48

3. METHODOLOGY 49
Introduction 49
Stratigraphy 49
Beach Sand 49
Unit VII 50
Unit VI 50
Unit V (including temp. V through temp. VII) 50
Unit IV 51
Unit III 51
Unit II 51
Unit I 51
Sources of Incomplete Recovery 52
Excavation 52
Field Documentation 53

Laboratory Procedures 53
Analysis 53
Documentary Sources 55

4. OZETTE ARCHITECTURAL ELEMENTS 57
Introduction 57
Structural Elements 57
Planks 58
Logging 59
Plank Splitting 59
Dressing 61
Morphological Classes 61
Split Planks 62
Dressed Planks 63
Bilaterally Lipped Planks 64
Cross-Grain Planks 65
Unilaterally Lipped Planks 66
Functional Classes 67
Wall Planks 70
Roof Planks 71
Benches 72
Plank Repair 74
Posts 75
Rafter-Support Posts 76
Manufacture 78
Comparative Data 82
Other Posts 83
Rafter Beams 84
Poles and Stakes 86
Functional Classes 89
Fish-Drying Racks 89
Wall Poles 89
Rafter Poles 90
Wall Buttresses 90
Withes 91
Roof Weights 92
Post Linings 92
Whalebones 93
Summary 93

5. OZETTE STRUCTURAL FEATURES 97
Ozette Village Pattern 97
Historic Makah Village Patterns 97
Ozette House Construction 98
Construction Sequence 98
Roof System 99
Rafter-Support Posts 101
Rafter Beams 102
Rafter Poles 102

Roof Planks . . . 102
Roof Weights . . . 103
Wall System . . . 103
Wall Poles . . . 105
Wall Planks . . . 106
Corners . . . 106
Windows . . . 106
Wall Chinking . . . 106
Entrances . . . 107
Benches . . . 108
Carved Panels . . . 110
Decoration . . . 112
Accessory Features . . . 113
Partitions . . . 113
Floors . . . 115
Storage . . . 115
Fish-Drying Frames . . . 117
Drainage Features . . . 117
South Whalebone Feature . . . 118
East Whalebone Feature . . . 118
Retaining Walls . . . 119
Interior Drainage Features . . . 120
Repair and Maintenance . . . 122
Summary . . . 126

6. SHED-ROOF HOUSES IN THE PACIFIC NORTHWEST . . . 127
Introduction . . . 127
Northwest Coast House Types . . . 127
Northern House Type . . . 127
Chinook-Oregon Coast House Type . . . 127
Lower Klamath House Type . . . 128
Wakashan House Type . . . 129
Shed-Roof House Type . . . 129
The West Coast of Vancouver Island . . . 131
Nootka Sound . . . 131
Clayoquot Sound . . . 134
Barclay Sound . . . 135
Northwest Washington . . . 137
The Strait of Juan de Fuca . . . 138
Klallam . . . 138
Chemakum . . . 139
Songish . . . 139
Twana . . . 140
Puget Sound . . . 140
Strait of Georgia . . . 143
Fraser River . . . 145
Discussion . . . 145

7. INTERGROUP COMPARISONS . . . 149

Introduction 149
Village Layout 149
House Site Selection and Preparation 149
Manufacture 150
Logging 150
Plank Splitting 151
Dressing 152
Repair 154
Construction Sequence 154
House Size 154
Walls 155
Construction 155
Wall Poles 155
Wall Chinking 156
Corners 156
Wall Mats 157
Entrances and Doors 157
Windbreaks 158
Windows 158
Decoration 159
Roof Systems 159
Rafter-Support Posts 159
Rafter Beams 160
Rafter Poles 160
Roof Planks 160
House Interior 162
Floor 162
Benches 163
Space Allocation and Partitions 164
Carved Planks 165
Storage 165
Accessory Structures 166
Fish-Drying Racks 166
Other Structures 166
Abandonment 166
Summary 167

8. SUMMARY AND CONCLUSIONS 169

Part III
PATTERNS IN OZETTE FLOOR MIDDENS:
REFLECTIONS OF SOCIAL UNITS
by
Stephan R. Samuels

Part III 175
Abstract 177

1. INTRODUCTION 177

Cultural Stratigraphy 179
Basal materials—Unit VIII 179
Prehistoric level—Unit VII 180
Clay deposits—Unit VI 180
Protohistoric level—Unit V 181
Early Unit V (temp. VII) 181
Middle Unit V (temp. VI) 184
Late Unit V (temp. V) 185
Clay slide—Unit IV 186
Historic levels—Unit I through Unit III 187
Protohistoric Midden 187

2. SPATIAL THEORY AND RESEARCH METHODS 195
Theoretical Considerations 195
Excavation Techniques 198
Computer Graphics Applications 199

3. FLOOR MIDDEN PARTITIONING 201
Architectural Summary 201
Ethnographic Reports of House Utilization 201
Archaeological Plan 203
Partitioning Interior Space 207

4. MIDDEN ELEMENT DENSITIES AND DISTRIBUTION PATTERNS 213
Definition of Midden Elements 213
Distribution Patterns and Nonrandomness Evaluations 214
Stationary Elements 215
Movable Elements 219
Conclusions 220
Cultural Deposition Process Evaluations 222
Postmolds and Stakes 224
Comparison of Density and Diameter Ranges 225
Creation Processes 226
Relationships to Occupation Length 228
Potential Movable Element Disturbances 232
Artifact Dislocation Testing 232
Artifact Curation Testing 240
Change Through Time in Artifact Deposition 240
Faunal Debris Densities and Distributions 248
Recovery Technique Corrections 248
Data Subset Definitions 249
Trampling and Housecleaning Testing 252
Indications of Status Distinctions 266
Summary and Conclusion 266

BIBLIOGRAPHY

References Cited 271

List of Figures

Figure — Page

1. Northwestern Olympic Peninsula map. 5

2. Area B70 at the Ozette archaeological site complex. Photograph taken from Tskawahyah Island, facing southeast. 6

3. View of the Bodeltah Islands. Photograph facing west, taken from beach in front of Ozette village. 7

4. Ozette archaeological site complex map. 8

5. Aerial view of the Ozette archaeological site complex, facing northeast. Ozette Island is in the foreground, with Tskawahyah Island and the main excavation areas in the midground. 9

6. Area B70 excavations, showing a Unit V whalebone feature *in situ*, in exterior midden. . 10

7. Makah village and camp location map. 12

8. Ozette archaeological site excavation area map. Contour interval is one meter. 13

9. Area A after brush clearing, prior to trench excavations. Photograph taken from Tskawahyah Island. 14

10. Area A during the 1966 trench excavation. Photograph facing east. 15

11. Beginning overburden removal in Area B70. Photograph facing north, in the area south of House 1. 16

12. Artifacts (including loom parts) and whale bones *in situ* at the base of Unit IV slide. Photograph facing south in the western part of the House 2 area. 17

13. Detail photograph showing basket *in situ* at the base of the Unit IV slide. 18

14. Photographs of Area B70, facing northwest, showing the eastern portion of House 1: A - Removal of Unit IV clay overburden using high-pressure hoses, exposing structural remains (note the rafter-support post in the foreground); B - the same general area, after removal of the Unit IV clay covering. 19

15. Use of low-pressure garden hoses: A - final removal of Unit IV overburden; B - water-screening *in situ* Unit V midden deposits. 20

16. Area B70 settling pond. Photograph facing north, with the excavation area to the right. 21

17. Area B70 general stratigraphic profile, showing relationships among Unit V house floors and exterior midden. 22

18. Area B70 - house structure outline maps, showing plan view relationships among floors. 23

19. Shed-roof houses on Tatoosh Island. 36

20. Drawing of Tatoosh Island from John Meares' voyage in 1786–87. 37

21. Shed-roof houses on Tatoosh Island with drying fish on racks. 38

22. Drawing of Deah village by George Gibbs. 41

23. House ruins at the Archawat village site (courtesy of the Washington State Historical Society). 43

24. Ozette village viewed from Tskawahyah Island (courtesy of the Washington State Historical Society). 44

25. Ozette village viewed from the south (courtesy of the Washington State Historical Society). 45

26. Interior of an historic Makah shed-roof house. (courtesy of the Washington State Historical Society). 46

27. Shed-roof house and house frame: a - rafter beam; b - rafter-support post; c - rafter pole. 47

28. Generalized stratigraphic profile of Area B70. 50

29. Distribution of Unit IV and Unit V structural remains in Area B70. 54

30. Segmented cylinders: A - longitudinal; B - diagonal; C - transverse; D - radial. 58

31. Planks displaying aligned dressing scars. 62

32. Planks displaying fluted dressing scars. 63

33. Bilaterally lipped plank cross-sections: A - troughed; B - guttered; C - fluted. 66

34. Cross-grain plank derived from a canoe side: A - gunwale; B - gunwale ties; C - thwart ties. 68

35. Unilaterally lipped plank cross-sections: A - single lip; B - single front; C - double-lip front. 69

36. Roof construction technique cross-sections: A - bilaterally lipped planks for both the upper and lower courses; B - plain planks for the upper course and bilaterally lipped planks for the lower course. 71

37. Planks mended by sewing with withe ties. 75

38. Plank mending techniques: A - securing by friction; B - securing by whipping; C - securing with pegs; D - tightening with a splint; E - tightening by whipping with a separate withe. 76

39. Mending ties tightened with a splint. 77

40. Rafter-support posts *in situ* in the north part of the House 1 east wall. 78

41. Rafter-support post: A - nomenclature; B - measurement locations (NW - notch width, ND - notch depth, W1 - width near top of post, W2 - width near bottom of post, T - thickness, L - total length). 79

42. House 1 posts and post stubs. 81

43. House 2 posts and post stubs. 82

44. Rafter-support post cross-sections: A - Ozette; B - Archawat. 83

45. Rafter-support post stub with square hole cut near one end. 84

46. Ranges in width and thickness of rafter-support posts to one standard deviation. 86

47. Photograph of round and rafter-support post stubs in the southeast corner of House 1. . 87

48. Distribution of pole stubs and stakes in House 1. 89

49. Distribution of pole stubs and stakes in House 2. 90

50. Distribution of poles in House 1. 91

51. Distribution of poles in House 2. 92

52. Scattergram of pole lengths and diameters. 93

53. Distribution of rocks in House 1. 94

54. Distribution of rocks in House 2. 95

55. House 2 northwestern corner rafter-support post pit in cross-section, showing rock lining. 96

56. House 1 ground leveling map. 99

57. Roof-support system components. 100

58. House 1 *in situ* wall remnants: A - South wall (at left), from southeast corner facing west; B - north wall, from north of House 1 facing south. 104

59. Withe-slung wall construction. 105

60. Detail photograph of House 1 south wall, showing wall planks *in situ.* 107

61. Distribution of benches in House 1. 109

62. Benches in the southeast portion of House 1. 110

63. Distribution of benches in House 2. 111

64. Detail photograph of a bench front, showing opercula inlay. 113

65. Informally decorated planks. 114

66. Photograph of the upper level of the south whalebone feature, facing north. The south wall of House 1 is just beyond the whalebones, with the southeast corner at the right. 119

67. Photograph of the east whalebone feature, facing east. 120

68. House 1 baseboards and lower wall boards. 121

69. House 2 baseboards and lower wall boards. 122

70. House 1 drainage features. 123

71. House 2 drainage features. 124

72. Photograph of baseboards along the east wall of House 1. 125

73. Major Northwest Coast native groups. 128

74. Wakashan house and house frame. For clarity many of the rafter poles are not illustrated. 129

75. Locations of native groups in the shed-roof house area. 130

76. Barclay Sound house frame as interpreted from the account of Gilbert Sproat (1868:40–43). 136

77. Shed-roof house frame variations: A - single-unit structure; B - multiple-unit structure; C - multiple-unit structure with tie-beam construction. 146

78. Standing western red cedar with slab removed. The vertical distance from the lower (base) to the upper cut is about three meters. 152

79. Methods of laying roof planks in cross-section: A - Comox and West Saanitch using plank and lipped planks; B - Puget Sound area using shallowly and deeply lipped planks; C - hypothetical technique at Ozette using guttered and troughed planks. 161

80. Carved knot on an Ozette plank. 163

81. Wall elements in House 1, along the east wall. 170

82. Structural relationships in half of a gabled house. 171

83. Distribution of rafter-support post pits in a: A - Wakashan and; B - shed-roof house. . . 173

84. Sediment Ternary Diagram 180

85. Early Unit V feature map. 182

86. Middle Unit V feature map. 183

87. Late Unit V feature map. 184

88. Area B70 stratigraphy profile cross-section. 185

89. Photographs of House 1: A - south wall; B - pebble layer. 188

90. Photographs of hearth complexes: A - from House 2 with hearth fill excavated, showing ash at base; B - from House 1 showing pebble lining and charred wood. 189

91. House 2 mid-floor drainage trench facing west: A - with plank cover; B - with cover removed. C - portion of whalebone retaining wall between Houses 1 and 2. 190

92. Photograph of stratigraphy in Unit V exterior midden, just north of House 1. 192

93. Photograph of stratigraphy in House 1 floor midden. 193

94. Idealized ethnographic house plan. 203

95. House 1 archaeological feature plan map. 204

96. House 2 archaeological feature plan map. 205

97. House 5 archaeological feature plan map. 206

98. Houses 1 and 2 archaeological roof-beam location map. 207

99. House 1: A - area; B - zone partition maps. 209

100. House 2: A - area; B - zone partition maps. 210

101. House 5: A - area; B - zone partition maps. 211

102. House 1 postmold map. 216

103. House 1 stake map. 217

104. House 2 postmold map. 218

105. House 2 stake map. 219

106. House 5 postmold map. 220

107. House 5 stake map. 221

108. House 1 artifact map. 222

109. House 2 artifact map. 223

110. House 5 artifact map. 224

111. Postmold vs. stake density scatterplots by area in Houses 1, 2, and 5. 227

112. Histograms of stationary element diameters by house. 229

113. Ternary diagram of small- vs. large-diameter postmold/stakes by house. 230

114. Ternary diagrams of artifact density by area in Houses 1, 2, and 5. 234

115. Ternary diagrams for small-diameter postmold/stake density by area in Houses 1, 2, and 5. 235

116. Ternary diagrams for artifact and small-diameter postmold/stake density linkage lines by area in Houses 1, 2, and 5. 236

117. Artifact vs. small-diameter postmold/stake density scatterplots by area in Houses 1, 2, and 5. 239

118. House 1 whole tool and debris/fragment artifact density maps. 241

119. House 2 whole tool and debris/fragment artifact density maps. 242

120. House 5 whole tool and debris/fragment artifact density maps. 243

121. Ternary diagram for whole tool and fragment/debris densities in Houses 1, 2, and 5. . . . 244

122. House 1 artifact maps, divided by relative height. 246

123. House 2 artifact maps, divided by relative height. 247

124. Faunal debris density histogram. 251

125. House 1 density maps for small and large shells. 254

126. House 2 density maps for small and large shells. 255

127. House 5 density maps for small and large shells. 256

128. House 1 density maps for non-identifiable mammal bone and identifiable mammal bone. 257

129. House 2 density maps for non-identifiable mammal bone and identifiable mammal bone. 259

130. House 5 density maps for non-identifiable mammal bone and identifiable mammal bone. 260

131. House 1 and 2 density maps for identifiable fish bone. 261

132. House 1 density maps for artifacts and small-diameter postmold/stakes. 263

133. House 2 density maps for artifact and small-diameter postmold/stakes. 264

134. House 5 density maps for artifact and small-diameter postmold/stakes. 265

135. Pie charts of floor midden composition for Houses 1, 2, and 5. 267

List of Tables

Table Page

1. Winter Village Census by James Swan in the Early 1860s. 39
2. Metric Attributes of Split Planks (in Meters). 64
3. Metric Attributes of Dressed Planks (in Meters). 65
4. Metric Attributes of Bilaterally Lipped Planks (in Meters). 67
5. Metric Attributes of Unilaterally Lipped Planks (in Meters). 70
6. Metric Attributes of Benches (in Meters). 73
7. Metric Attributes of Protohistoric Ozette Rafter-Support Posts (in Meters). 80
8. Metric Attributes of Historic Ozette and Archawat Rafter-Support Posts (in Meters). . . 85
9. Metric Attributes of Posts Other Than Rafter-Support Posts (in Meters). 88
10. House and Rafter-Support Dimensions Reported for Old Man House. 142
11. Ethnographically Reported Plank Dimensions. 153
12. Postmold and Stake ANOVA Test Results by House. 215
13. Artifact ANOVA Test Results by House. 221
14. Relative Density of Stationary Elements by House. 225
15. Density of Stationary Elements by Area. 228
16. Small- vs. Large-Diameter Stationary Element Concentrations by House. 231
17. Density of Artifact and Small-Diameter Postmold/Stakes by Area in Houses 1, 2, and 5. 238
18. ANOVA Results for Vertical Subdivision of Artifact Counts into Relative Height Classes. 245
19. Excavation Statistics for Faunal Debris Recovery Techniques in Houses 1, 2, and 5. . . . 248
20. Mean Density of Faunal Debris Elements in Houses 1, 2, and 5. 249
21. Mean Water-Screened Densities for Faunal Debris Elements in Houses 1, 2, and 5. 250

Part I

INTRODUCTION TO THE OZETTE ARCHAEOLOGICAL PROJECT

By

Stephan R. Samuels and Richard D. Daugherty

Photograph of the Ozette archaeological site, with Area B70 in the center and the field camp to the right.

Ozette Village

This volume is the first of a series which makes generally available results of excavation and analyses at the unique Ozette Village archaeological site complex, where it has been possible to recover a virtually complete material culture record of daily life. This site has been compared to Pompeii, the most famous example of a catastrophic event that produced an unusually detailed look at ancient life. It is an apt comparison, for as at Pompeii the event which today allows us to obtain such a complete glimpse of an ancient time was a natural disaster for the community involved. At Ozette, however, it was not volcanic ejecta but the clay cap which was instrumental in preserving organic material, as well as destroying a portion of the village in which generations of families had made their homes.

The catastrophe at Ozette occurred in protohistoric times when a section of the hillside above Ozette village gave way, possibly as a response to tectonic activity, and the liquified clay roared downhill, displacing or crushing everything in its path. This part of the village was densely packed with longhouses—large multifamily dwellings—50 to 60 ft (15 to 18 m) long, 20 to 30 ft (6 to 9 m) wide, and 10 to 12 ft (3 to 4 m) high. The mudslide hit the village with so much force that the stout cedar posts which supported the roof superstructure were snapped off at ground level. When the slide was over, much of the roof structure and items stored high in the eaves of at least four houses had been carried onto the beach. Many of the longhouse walls, interior furnishings, material stored close to ground level, and the nearly intact middens covering the ground were covered by 6 to 10 ft (2 to 3 m) of cohesive, massive clay.

Archaeological excavations produced a rich information base for the analyses presented in these volumes because of several factors: their setting in the middle of a multiseason village; excellent preservation of organics in a cultural environment where wood and fiber comprise a very high proportion of all utilized raw materials; pumped water as an excavation tool; and the massive scale and complete documentation of the excavation effort. This introduction provides a synopsis of the Ozette site setting, a history of excavation and analytic efforts, and an introduction to the two studies which form the bulk of this first volume.

Archaeological Overview

The earliest archaeological work along the Pacific coast of Washington was conducted in the second decade of the twentieth century (Reagen 1917, 1928) with investigation of the distribution and contents of shell midden deposits. The first systematic survey by Richard D. Daugherty was not conducted until after the second World War (Daugherty 1948). Most systematic explorations of the Olympic Peninsula located sites adjacent to modern beaches, although some fortuitous evidence has been found of archaeological deposits associated with earlier (relic) beach features, along some river systems, and in adjacent densely forested areas (Wessen 1990). Including Ozette, only 15 of the over 110 sites recorded along the coast have been excavated sufficiently to characterize their deposits. Over 40 radiocarbon dates have been obtained from 14 of these excavated sites, and the dates all indicate occupation within the last 3000 years. However, the early and mid-Holocene land/sea relationships on the Olympic Peninsula are complex, and earlier archaeological sites may well be present on raised beaches associated with earlier sea-levels.

Most sites along the northern half of the Olympic Peninsula coastline are shell middens, as is Ozette, and all generally contain constituents similar to shell middens elsewhere along the Northwest Coast. Most recovered materials are residue from food processing and utilization, such as large quantities of invertebrate and mammalian remains and hearth clean-out deposits (ash and charcoal), but artifacts or structural features are not common. Typically, only low frequencies of

bone, shell, and pecked/ground stone artifacts are found within these shell middens. Chipped stone is uncommon.

Ethnographic information strongly suggests that the vast majority of artifacts produced by coastal peoples were fashioned of wood or wood fiber, at least in part. The absence of easily deteriorated wooden items in typical midden deposits leaves large gaps in the record of prehistoric technology. Two excavated sites on the northern Olympic Peninsula coastline stand in contrast to this pattern, the Hoko River wet site and the Ozette site (in Area B70). In both, local environmental conditions resulted in preservation of the normally deteriorated wooden materials, which has allowed a more complete view of prehistoric material remains and technologies. At Ozette, over 85% of the recovered artifacts were composed of perishable materials. The additional breadth and depth of cultural material obtained from preserved deposits is remarkable.

The Hoko River wet site contains objects deposited in a near-shore environment along the Hoko River. These objects, often broken and discarded items, were covered by continual shoreline deposition, and thereby preserved in water-saturated sands (Blinman 1980; Croes and Blinman 1980). Exposed by fluctuations in the river channel, these deposits contain tools associated with fishing and other subsistence activities, including many items of woven plant fiber (cordage, basketry, and matting), carved wood (fishhooks), and pecked/ground stone (ground slate knives, ground stone mauls, net weights, and abraders). A bipolar microlithic chipped stone industry has been identified from the deposits, with complete examples of composite tools. These consist of bipolar microliths (small sharp-edged, razorblade-like pieces of quartz) hafted into the end of wooden handles. These are believed to have been employed as fish filleting knives (Flenniken 1980). This area of the site has been dated to 2750 $\pm$ 90 (WSU 1443), and is the earliest known site on this part of the coast. Wood wedges were recovered, indicating a sophisticated woodworking technology, and evidence for structural remains at this marine and riverine fishing camp were found, but not in the near shore area with preserved deposits. The majority of artifacts are fishing tools or basketry. Comparison with Ozette examples of similar functions has shown strong continuity over at least 2500 years. Artifact manufacturing technologies appear to have changed little during this time, and even some forms are very similar, particularly among the basketry and cordage (Croes 1976).

Ozette clearly was a large multiseason community. The stratigraphic level in the portion of the Ozette site which was the focus of excavation is a protohistoric occupation, dating about 250–450 years ago. The preserved deposits contain abundant evidence of village structures, as well as preserved wooden and fiber artifacts. The presence of a virtually complete material record of village life makes Ozette unique as an archaeological site, and provided the impetus to mount the extensive, long term excavation project described below. The continuity in manufacturing technologies and artifact forms indicate that Ozette analyses cannot only provide a detailed view into protohistoric village life, but also can assist in understanding the nature of cultural material recovered from less well-preserved sites along the Northwest coast.

Introduction to the Ozette Site Excavations

Ozette was the southernmost of the five main villages of the Makah Indian tribe. The Makah are Nootkan speakers, closely related socially, as well as linguistically, to the Nitinaht of Vancouver Island. The name "Makah" actually is a Klallam term for these people which translates as 'generous and full' (as in food). The name they use when referring to themselves is [/**q^{w}idičč aʔa·tx̌**/]→ 'people by the seagulls and rocks'.

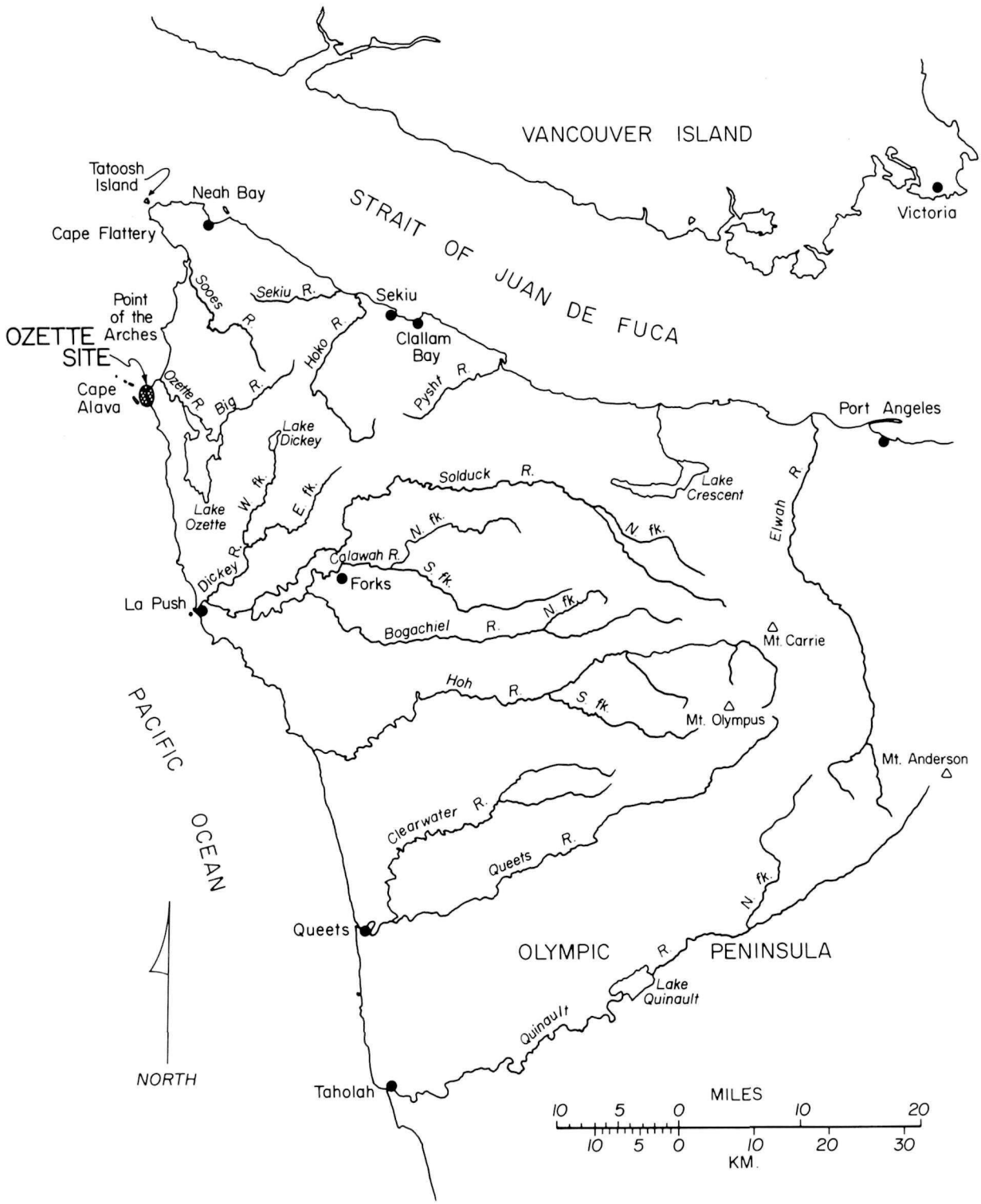


Figure 1. Northwestern Olympic Peninsula map.

The Ozette village site complex (45CA24) is located 14 miles (ca. 24 km) south of Cape Flattery on the northern Washington coast at Cape Alava (Figure 1). In prehistoric and early historic times this was perhaps the largest of the Makah villages.

Figure 2. Area B70 at the Ozette archaeological site complex. Photograph taken from Tskawahyah Island, facing southeast.

The Makah are the "Cape People" (Swan 1870:1), occupying the entire Cape Flattery area with villages along both the Strait of Juan de Fuca and the Pacific Ocean. In ethnographic times, their neighbors to the east along the Strait of Juan de Fuca were the Klallam (Coast Salish speakers), and to the south along the Pacific coast were the Quileute (Chemakuan speakers).

The lithology of the Cape Alava area is a complex association of tertiary sedimentary materials, predominantly marine conglomerates, siltstone, and sandstones (Weisenborn and Snavely 1968). This base is overlain by a thick mantle of Pleistocene glaciofluvial sediments consisting of unconsolidated gravels, sands, and clays. The area generally is considered to have been overridden last by ice during the Vashon stade of the Fraser glaciation (ca. 14,000 years ago). The land/sea relationships are complex because isostatic rebound, which changes land levels, interacts with the changing sea levels. However, it is clear the sea level was lower and the beach was farther westward when the ice first retreated than it is today, and erosion of the sea bank has produced an eastward migration of the beach.

Today, Cape Alava is marked by a low ridge more than 1 km long, extending to about 50 m above sea level. At the base of this ridge is a narrow bench, parallel to the beach, approximately 20 to 30 m at its widest and varying between 1 and 5 m in elevation above high tide (Figure 2). The main Ozette village was constructed on this bench. Shell midden deposits are exposed along the edge of the sea bank for nearly the entire length of the bench and near the northern end of the site are nearly 4 m thick.

Figure 3. View of the Bodeltah Islands. Photograph facing west, taken from beach in front of Ozette village.

In front of the site is a narrow gravelly beach, and a broad rocky shelf lies in front of the beach. This shelf, or wave-cut platform, is approximately 3 km at its widest and at low tide numerous rocks and tide pools are exposed (Figure 3). This area is very rich in intertidal resources which draw birds, fish, and mammals to feed. The nearby offshore islands of Ozette and the Bodeltahs, and the tidal island Tskawahyah (or Cannonball, as it is commonly called) are collectively referred to as Flattery Rocks. Shell midden deposits have been found on these islands, and together they and the mainland village site comprise the Ozette village site complex (Figure 4). The offshore islands also form a sheltering arc around the main village (Figure 5), protecting it from large ocean swells and waves and offering ideal conditions for launching and landing canoes in all but the heaviest storms.

Cape Alava has a mild, wet maritime climate. Almost all precipitation falls as rain, as the temperature seldom drops below freezing. Monthly temperature averages range from a January mean of 3.8° C to a July mean of 17.3° C (Phillips and Donaldson 1972). Most precipitation falls from late fall through spring, with 75% of the yearly total (180 cm to 250 cm) falling between October and March.

In prehistoric as well as historic times the Ozette economy was strongly oriented towards marine resources. Sea mammals were the focus of Ozette procurement activities. Northern fur seals (*Callorhinus ursinus*) provided a major part of the diet at Ozette. Migrating herds now come within a few miles of the beach and may have come closer in the past (Huelsbeck 1983b). Sea otters

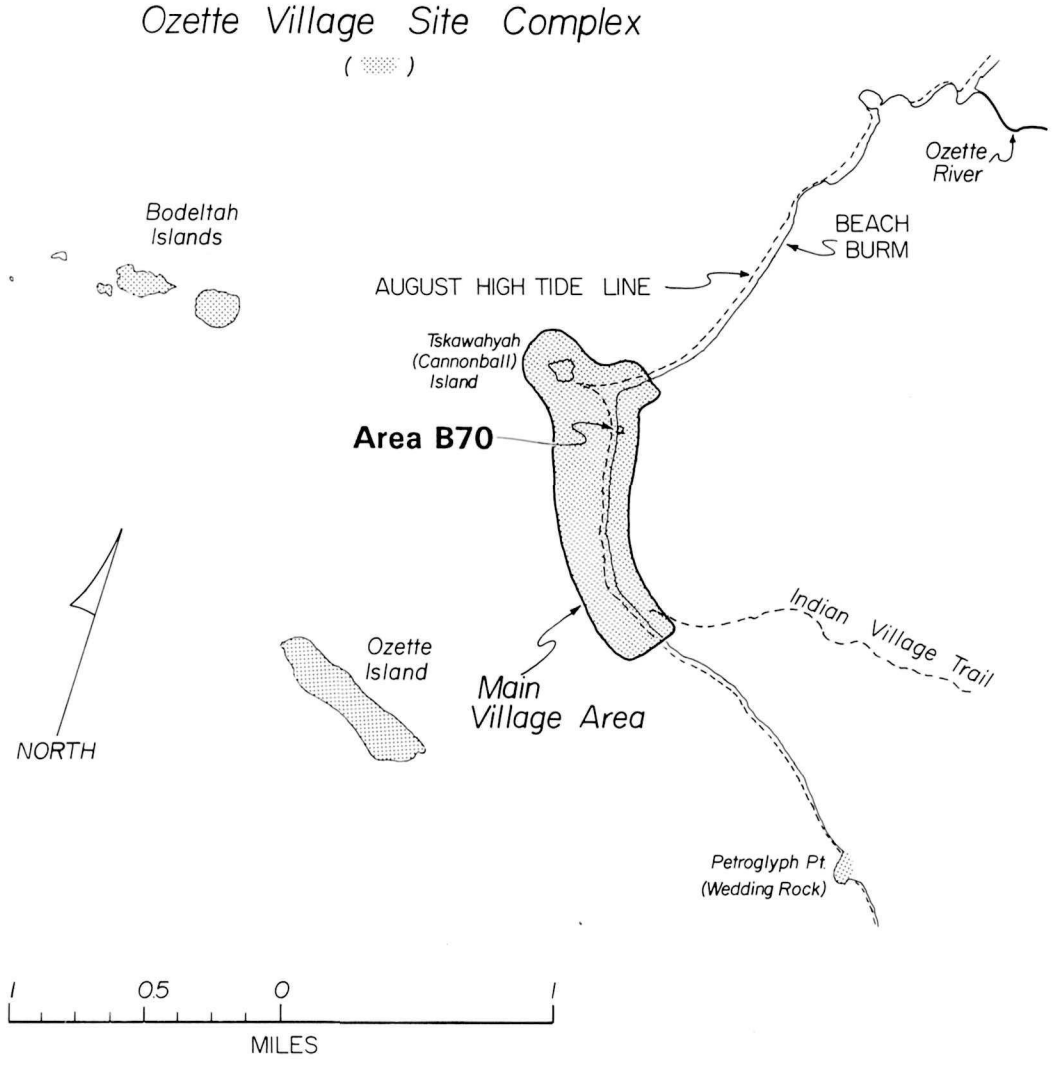


Figure 4. Ozette archaeological site complex map.

(*Enhydra lutris*), harbor seals (*Phoca vitulina*) and sea lions (*Eumetopias jubata* or *Zalophus californianus*) also were found in abundance around the offshore rocks and kelp beds. Many examples of sea mammal procurement and processing tools have been recovered from the Ozette deposits, as well as several hundred thousand bones from these animals (Huelsbeck 1983b).

Whales, particularly California grays (*Eschrichtius gibbosus*) and humpbacks (*Megaptera novaeangliae*), were harpooned from large canoes in the spring and early summer. The rich source of food at the edge of the wave-cut platform drew these large whales closer to shore here than elsewhere along their migration route, which greatly enhanced Ozette as a location for whale hunting. Almost 1,900 whale bones were recovered from the protohistoric cultural deposit, representing at least 67 individuals (Figure 6). Whaling clearly was the most important single subsistence activity at Ozette, accounting for over 75% of the total meat and oil represented by all faunal remains (Huelsbeck 1983c, 1988b, 1988c). Probably Ozette was the premiere whale and fur seal hunting locality along the entire west coast of North America south of the Aleutian Islands.

The waters just offshore from Ozette abound in bottom fish, such as rockfish (*Sebastes* spp.) and lingcod (*Ophiodon elongatus*). Seasonally, herring (*Clupea harengus pallasi*) spawn on the

Figure 5. Aerial view of the Ozette archaeological site complex, facing northeast. Ozette Island is in the foreground, with Tskawahyah Island and the main excavation areas in the midground.

beaches around the site. To the northwest of Tatoosh Island (see Figure 1) were excellent halibut (*Hippoglossus stenolepis*) banks. Halibut was a major food resource for the Ozette, and many Makah were known ethnographically to spend the summer camped at Tatoosh Island, obtaining and drying halibut for winter storage. Several species of salmonid (*Oncorhynchus* spp. and *Salmo* sp.) were available in Makah territory, including sockeye (*Oncorhynchus nerka*), which ran in the nearby Ozette River during the summer months and were available in Lake Ozette during the fall and early winter, and coho (*Oncorhynchus kisutch*), which were available in all rivers during the fall (Huelsbeck 1981b).

The coastal area was a major flyway for migrating ducks and geese, and the offshore islands were rookeries for the great variety of sea and shore birds that lived in the area year-round. Aside from their food value, birds were obtained by the Ozettes as a source for raw materials used in manufacturing, such as down, feathers and bones. Scoters (*Melanitta* spp.) may have been a source of down, with albatross (*Diomedea* spp.), pelicans (*Pelecanus occidentalis*), gulls (*Laris* spp.), and cormorants (*Phalacrocorax* spp.) used for bone tools and feathers. The fulmar (*Fulmarus glacialis*) may have been a winter food source (DePuydt 1983b).

Extensive shellfish beds were found in certain localities along the beaches, and mussels could be collected from the rocks exposed at low tide. The sample recovered from floor and exterior midden is very large, over 300,000 items, and shows a wide diversity in the Ozettes' use of invertebrate

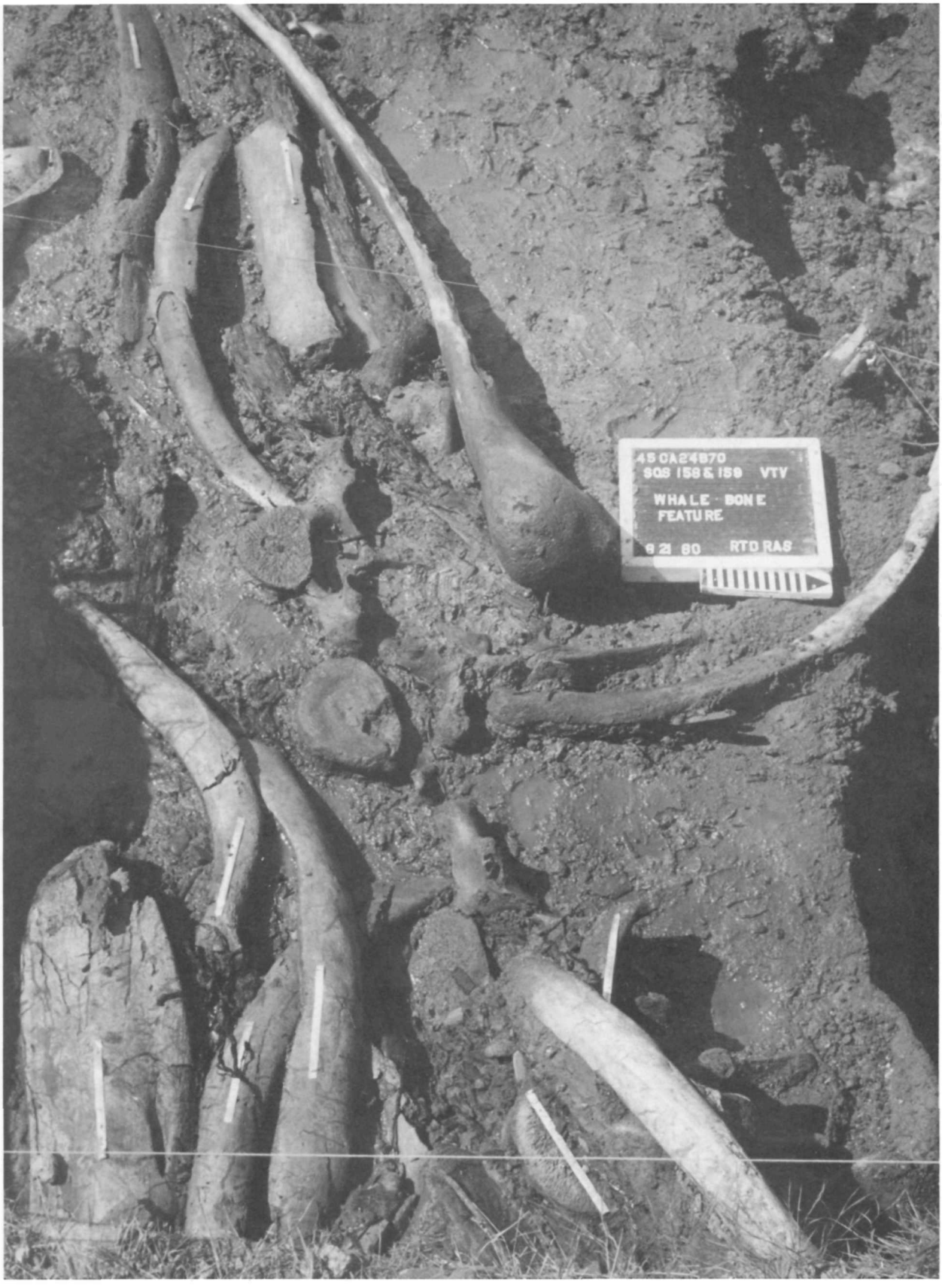


Figure 6. Area B70 excavations, showing a Unit V whalebone feature *in situ*, in exterior midden.

resources. Remains from 90 species have been identified from these archaeological deposits, including various bivalves, chitons, crabs and octopi (Wessen 1983).

Augmenting the diversity of maritime resources were those found in the forests behind the village, including land mammals and a wealth of vegetal foods. When compared to faunal evidence for sea mammal use, bones from land mammals make up a relatively small part of the collection (Gustafson 1968; Huelsbeck 1983b). Likewise, there were relatively few artifacts recovered that could have been used for hunting large land mammals such as deer (*Odocoileus hemionus*) and elk (*Cervis canadensis*).

Swanton (1969) lists five winter villages which are considered part of the Makah Indian Nation: Baada [/**biʔidʔa**/], Deah (or Neah) [/**di·ya**/], Waatch (or Wa-atch) [/**waʔaǰ̓**/], Tsues (or Tsoo-yes) [/**ċu·yas**/], and Ozette [/**ʔuse·ʔiṯ**/]. Three summer village areas also are known: Warmhouse (or Midway) [/**ƛaƛakišx̌uwis**/]→ 'standing rocks', Tatoosh [/**hu·pačakt**/] or [/**ča·di**/], and Archawat [/**haċa·ʔwa·t**/]→ 'big surf' (Figure 7). Ozette village was occupied for at least 2000 years, into the early part of the twentieth century. The major focus on maritime resources in the subsistence pattern seen during early historic times (see Swan 1870) also appears to have been true for as long as Ozette was occupied. Ozette was abandoned as a village only when the Makah were required by the U.S. Government (Bureau of Indian Affairs) to send their children to school. Since there was no school at Ozette, families faced the choice of sending their children away or moving with them. Most families moved with their children to the village of Neah Bay, which was formed by the amalgamation of Baada and Deah. Since about 1910, people from Ozette and their descendants have returned only occasionally for hunting, although the fishing station near the mouth of the Ozette River continues to be used on a regular basis.

History of Ozette Archaeological Excavations

Archaeological investigations at Ozette began in the winter of 1947 when Richard D. Daugherty visited the site while conducting an archaeological survey of the entire Pacific coast of Washington. He observed that Ozette was clearly the largest site and had the most impressive midden deposit seen along the coast. Daugherty spent seven months during 1948 and 1949 conducting ethnographic studies with the Hoh and Quileute along the Pacific coast south of Ozette. During this research, he became particularly interested in aboriginal sea mammal hunting along the northern Washington coast. When he again visited Ozette in 1961, he became convinced by the wealth of sea mammal bones in the midden that this site would be the place to investigate a culture in which sea mammal formed a major part of their economic and social life. During this period the Ozette site also was visited by Stallard and Denman (1955) who dug a small test excavation.

Major investigations at the site began when Daugherty, along with geologist Roald Fryxell and zoologist Carl Gustafson, conducted excavations during the summers of 1966 and 1967, with support from the National Science Foundation (Daugherty and Fryxell 1967). During the first season's work all areas of the site, including the offshore islands, were tested and evaluated. Excavations (Figure 8) included a 70-meter-long test trench dug in Area A (Figures 9 and 10). The oldest material dated, with an age of 2010 ± 190 (uncorrected) radiocarbon years (WSU 1123), was obtained from the base of deep midden deposits on top of Tskawahyah Island.

Excavations the following year (1967) focused on an area (designated Area B) where the remains of recent longhouses could be found decaying in the brush and forest duff. Most excavation was centered along the sea bank edge, where a large area was exposed. Nine of the 20 test pits excavated were dug to a depth at which perishable materials were found. Almost 200 perishable items were recovered, including matting, cordage, basketry, wedges, boxes, points, and bows. The only obvious features seen were hearths, and no evidence of houses was located. On the other hand, in the one test

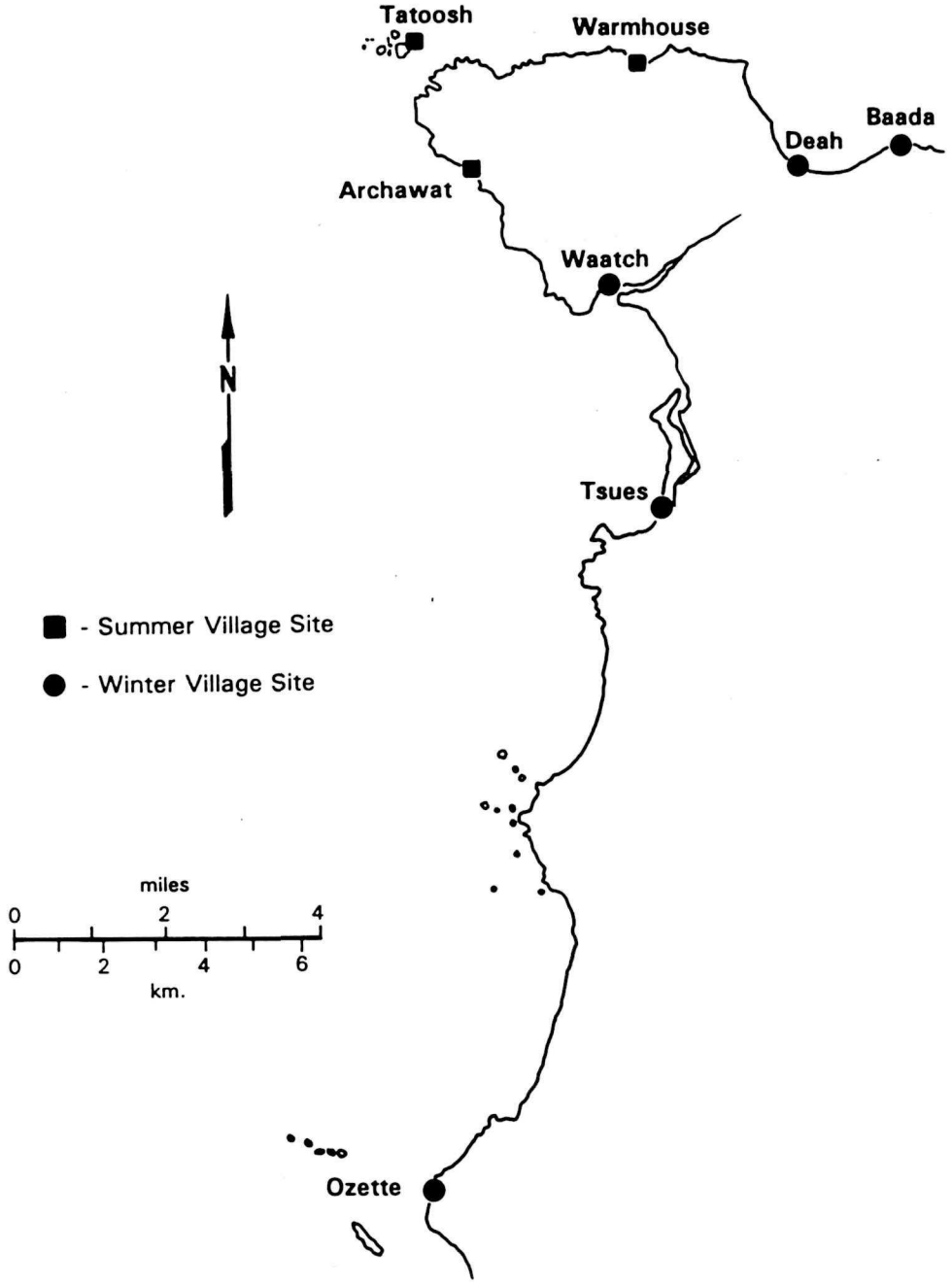


Figure 7. Makah village and camp location map.

pit located upslope (20 m inland), excavations revealed the preserved remains of a house corner, buried at a depth of 3 m in water-saturated deposits. A carved wooden sleeping bench, mats and baskets were observed, all in an excellent state of preservation (this buried house was later designated House 4). Because of the lateness of the season this discovery could not be pursued. The excavations in 1966 and 1967 utilized traditional archaeological excavation techniques (shovels, trowels, and wiskbrooms), which were found to be relatively ineffective in removing the cohesive clay while also excavating the delicate wood and fiber objects without damage.

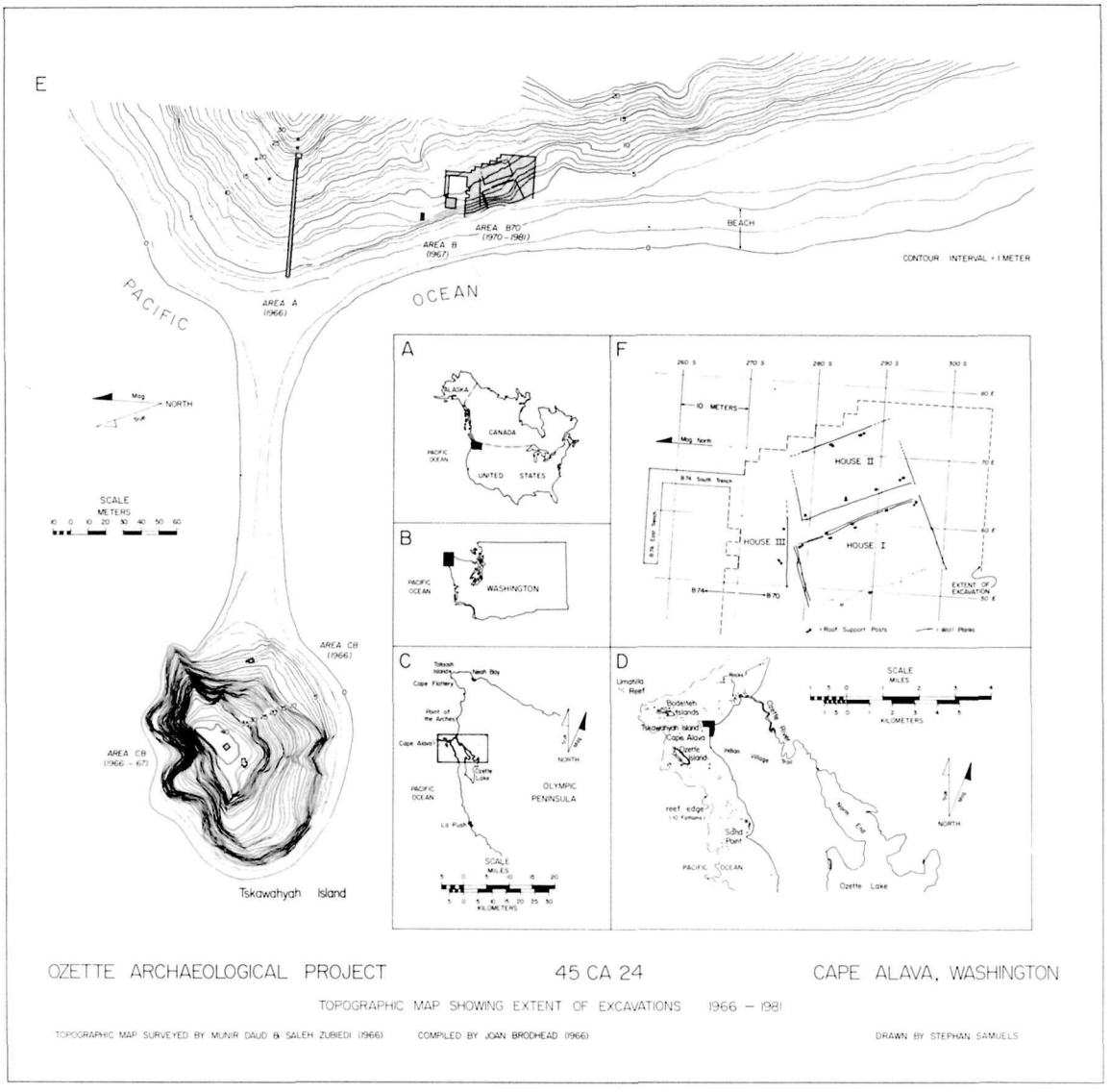


Figure 8. Ozette archaeological site excavation area map. Contour interval is one meter.

A severe storm in February 1970 brought waves crashing against the sea bank above the beach. The storm tides undercut the sea bank, causing slumps which exposed buried house planks, an inlaid box, a canoe paddle, wedges and other wooden artifacts. Daugherty was contacted by the Makah Tribal Council and asked to return to Ozette to evaluate the situation. Inspection indicated that a buried longhouse was being exposed by the wave action. It was clear the situation demanded immediate action. Funds were secured and a crew was in the field by April with the intent of stabilizing the sea bank. Once the potential importance of the site was clear, what began as a limited salvage excavation was soon expanded into a year-round archaeological project with fieldwork that continued until 1981.

Several major technical problems were encountered in the early days of excavation. Logistically, there was a problem with access to the site. A four-mile-long trail led through the rain forest from the end of the road at the north end of Lake Ozette. Fragile archaeological material could not easily be carried out nor could all supplies and machinery be carried in along this trail. The

Figure 9. Area A after brush clearing, prior to trench excavations. Photograph taken from Tskawahyah Island.

Helicopter Detachment at the United States Coast Guard Station at Port Angeles provided initial logistical support during the emergency salvage work in 1970, with helicopter transport for supplies and archaeological materials between the site and Neah Bay. Throughout the following years, supply runs undertaken by the U.S. Marine Corps Reserve Helicopter Detachment 770 stationed at Whidbey Island Naval Air Station played a major role in solving the problem of site access. For almost eleven years, helicopter support flights were made between the research laboratory in Neah Bay and Ozette, ferrying supplies into the site and archaeological materials out to Neah Bay.

Visitors began coming to the site almost as soon as excavation began. During the middle 1970s over 60,000 visitors per year were walking four miles each way to visit the ocean shore and to take a tour of the archaeological excavations. The trail through the rain forest from Lake Ozette to the Pacific shore began as a rough, muddy, slippery path in 1970. Through the perseverance of the rangers assigned to the Lake Ozette Ranger Station (National Park Service), this path was eventually developed into the wide boardwalk it is today, allowing more comfortable and safer access to the beach while retaining the natural character of the rain forest.

Other problems overcome in 1970 related directly to archaeological techniques of excavation and preservation. There was a massive amount of the sterile clay overburden covering the excavation area, 2 to 3 m thick (Figure 11). It was very cohesive in its water-soaked condition and was difficult to remove with shovels. Even where it could be removed with mechanical or physical shoveling, there was nowhere to pile the overburden that would not damage the environment. An additional consideration was that experience gained during 1966 and 1967 had shown the inadequacy of traditional tools for excavating these deposits with preserved organic materials. The interface between sterile clay and cultural material often was sharp, and just under the clay were extremely well-preserved but still fragile artifacts (Figures 12 and 13).

Figure 10. Area A during the 1966 trench excavation. Photograph facing east.

The solution devised to overcome these problems was to use hydraulic techniques rather than traditional excavation tools. A pumping system was developed during 1970 which used four positive gear pumps to deliver water to the site, either through a large diameter high pressure refueling hose or smaller diameter garden hoses (Gleeson and Grosso 1976). Each pump had the capacity to deliver 40 gallons of water per minute at up to 250 pounds per square inch (p.s.i.) pressure. Used in combination, flows of up to 120 gallons per minute at 200 p.s.i. were used to remove particularly cohesive clay overburden, although normally about 80 gallons per minute was a sufficiently strong flow to liquify the clay and wash it downslope (Figure 14A). This technique was used to remove all but the lowest few inches of the massive clay overburden (Figure 14B). Excavators then switched

Figure 11. Beginning overburden removal in Area B70. Photograph facing north, in the area south of House 1.

to low pressure garden hoses with adjustable nozzles for removal of the final clay covering and for excavation of all cultural deposits. These nozzles allowed control fine enough to preserve the most delicate fiber items while loosening them from the surrounding matrix (Figure 15).

During most of the year, the source for excavation water was a very large tide pool several hundred meters west of the site. With the onset of winter storms, two fresh water holding tanks were used as the water source since the tide pool water line could not be maintained during winter. Each year after the storms had abated the tide pool water line was reset, and an extensive shallow basin was constructed on the beach in front of the excavation area. Built of drift logs and lined with plastic it served as a settling pond for the muddy water runoff produced by the excavation process (Figure 16). Clay, silt, and sand were washed into the basin and clear water flowed from under the beach sand at the far end. The sediments thus accumulated were washed away by storm tides the following winter without endangering the marine life, and a new basin was constructed the following spring as the first step in preparation for the summer season, when most of the excavation was done.

The final major problem was stabilizing the recovered wood and fiber objects. Preserved in their anaerobic conditions because of the absence of destructive microbes, when wooden items were excavated and re-exposed to air decomposition began at an accelerated rate. For the majority of wood and fiber materials, stabilization was accomplished by complete immersion of the item in a 50% solution of Carbowax 1500 (polyethylene glycol, or PEG) and water, with Cytox 2013

Figure 12. Artifacts (including loom parts) and whale bones *in situ* at the base of Unit IV slide. Photograph facing south in the western part of the House 2 area.

added as a fungicide (Gleeson and Grosso 1976). This processing replaced the water within the cells of the wood with PEG, a flexible waxy substance which sealed the wood, preventing further decomposition. Depending on the sectional density of the wood, immersion was required for one to three months (see Gleeson and Grosso 1976 and Grosso 1975, 1976).

More that 90% of the wood and fiber materials, mostly softwoods, were stabilized using this process, including Sitka spruce (*Picea sitchensis*), western red cedar (*Thuja plicata*), and Pacific hemlock (*Tsuga heterophylla*). Hardwood artifacts, especially those soaked with oils, like food serving bowls or the some of the canoe paddle handles, were not successfully stabilized using this technique. The basic problem lay in the impermeability of hardwoods, which prevented Carbowax takeup into interior wood cells. Although many variations in procedure were attempted, most hardwood artifacts have not been stabilized, and so today remain immersed in the carbowax solution, which is preserving them until better stabilization methods can be developed.

Cataloguing and preliminary preservation of artifacts, structural and faunal remains were accomplished at the site. Further stabilization procedures and storage were done at the project facilities in Neah Bay. As excavation proceeded, thousands of artifacts, large structural pieces and whalebones began filling the Neah Bay facilities. During the years of excavation, many members of

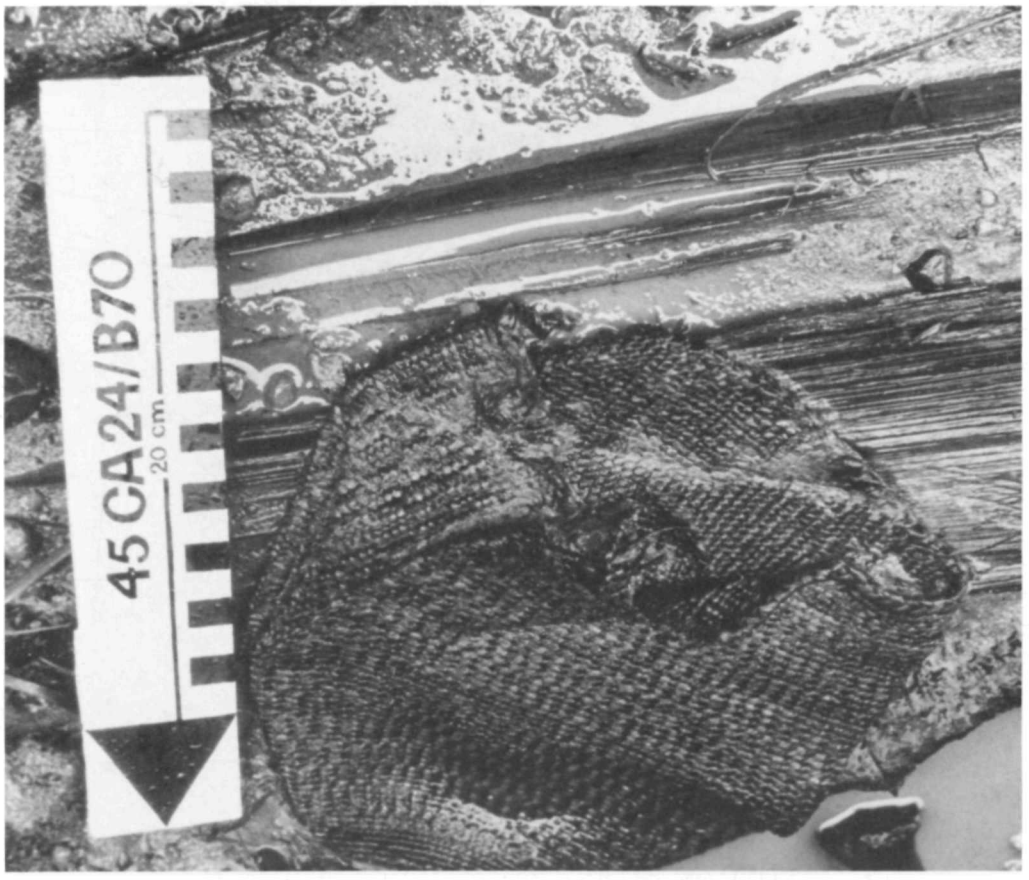


Figure 13. Detail photograph showing basket *in situ* at the base of the Unit IV slide.

the Neah Bay community visited the site and project facilities in town. The interest of the community in the archaeology was multi-faceted. From its inception, the Ozette Archaeological Project considered cooperation with the goals of the Makah Indian Nation an important part of the project. Making these archaeological excavations understandable and relevant to the present generation of Makah was an initial goal, so that the Makah themselves could control the stabilization procedures and storage/accession systems after excavations were completed. Interested Makah students were invited to participate in the summer field schools held yearly at the site, and to learn laboratory procedures by working in the project facilities at Neah Bay. Many Makah students learned about archaeology and the Ozette site, and this created a nucleus of dedicated and knowledgeable people interested in maintaining and strengthening links to their cultural heritage, as represented by the excavations. Makah elders again were asked to recount their traditional knowledge, now with the assistance of viewing recently uncovered objects.

As excavations progressed and the scope of the recovered materials became clear, it was obvious that a more permanent facility would be needed to house the recovered materials and to publicly display the preserved evidence of their ancestors craftsmanship in carving and weaving. These needs culminated in construction of the Makah Cultural Research Center (MCRC), containing a museum and other facilities, opened in 1979.

Information gained from Ozette site material assisted several projects undertaken by the Makah to prepare for the museum. Based on excavated examples, modern copies of hunting and fishing

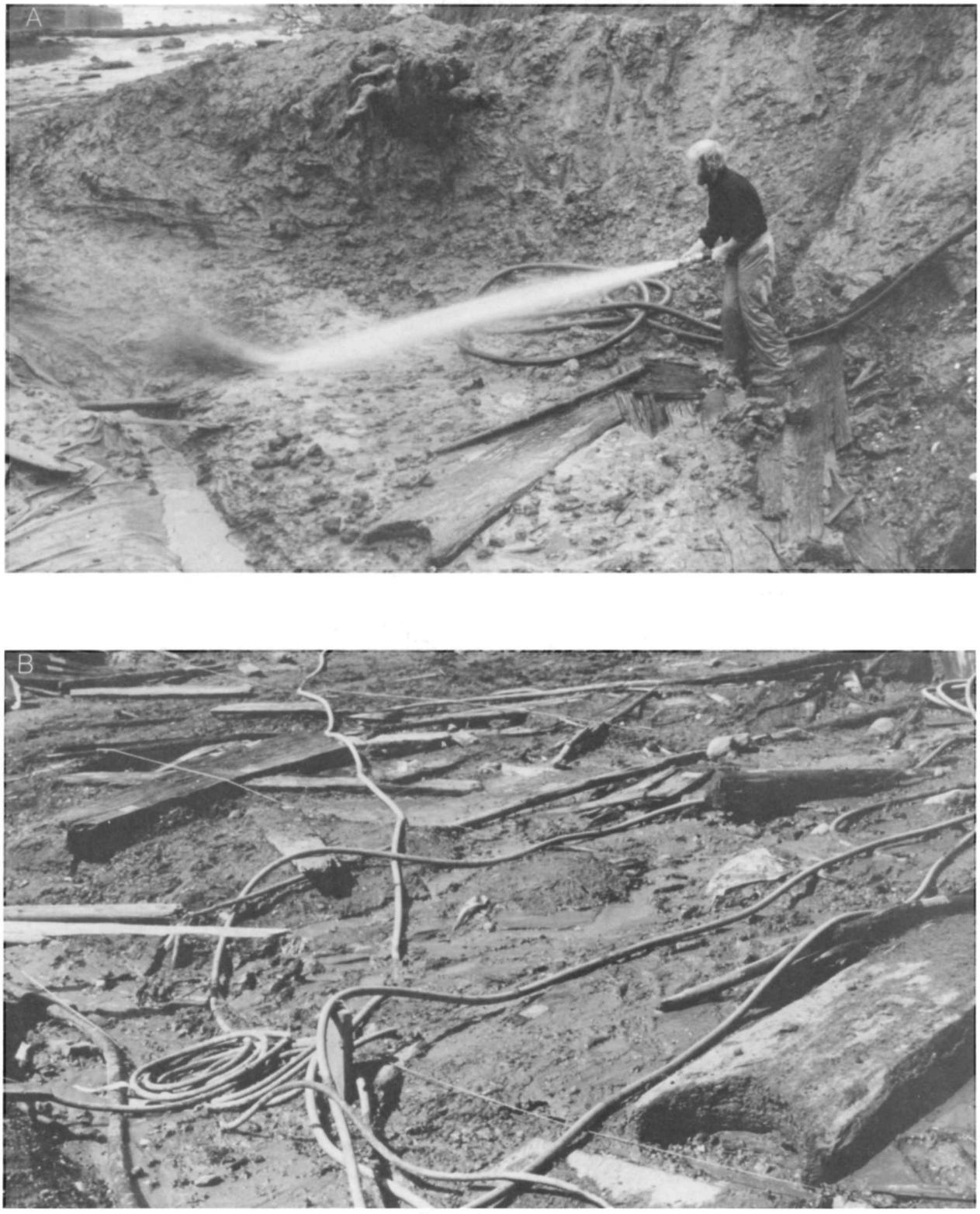


Figure 14. Photographs of Area B70, facing northwest, showing the eastern portion of House 1: A - Removal of Unit IV clay overburden using high-pressure hoses, exposing structural remains (note the rafter-support post in the foreground); B - the same general area, after removal of the Unit IV clay covering.

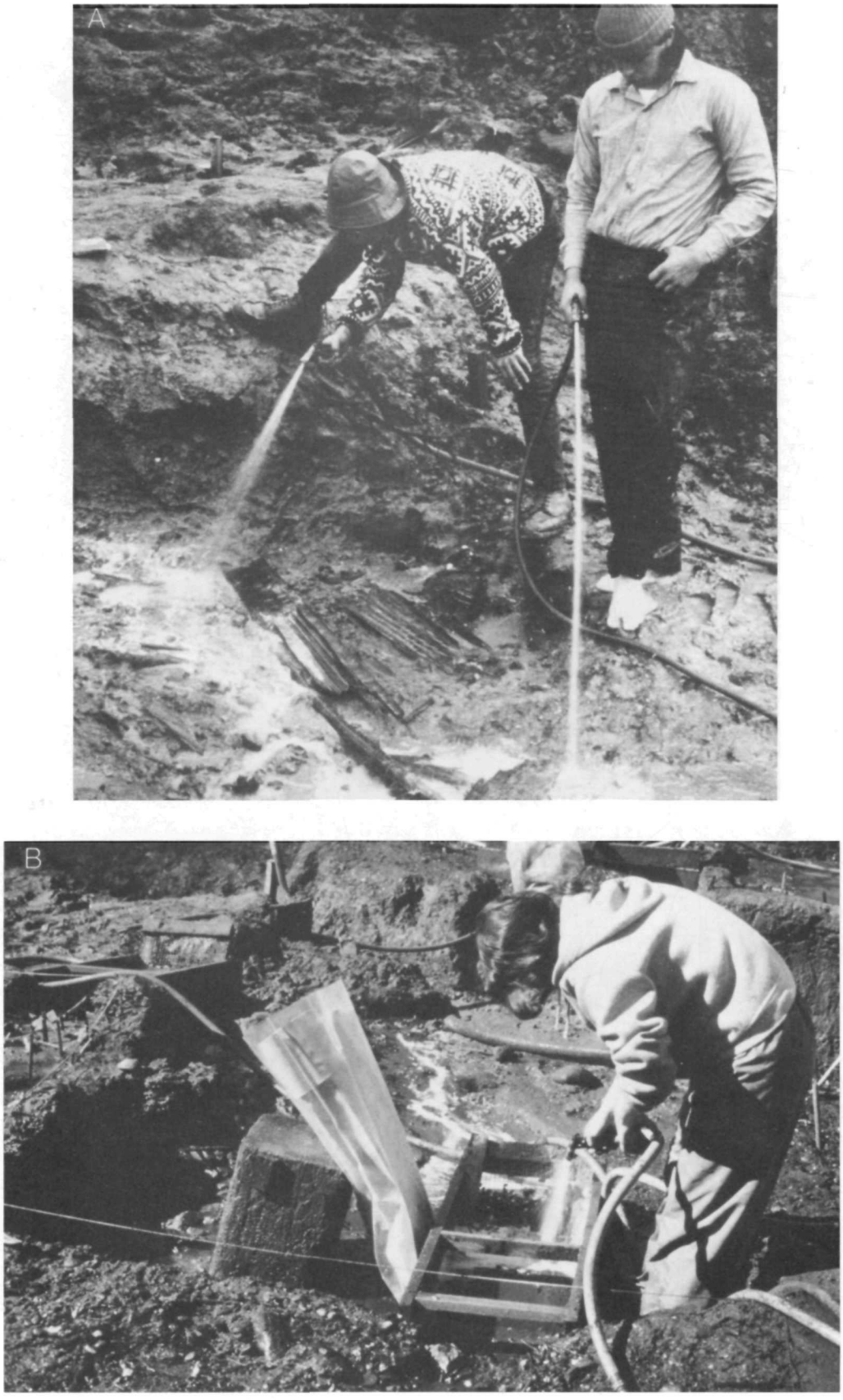


Figure 15. Use of low-pressure garden hoses: A - final removal of Unit IV overburden; B - water-screening *in situ* Unit V midden deposits.

Figure 16. Area B70 settling pond. Photograph facing north, with the excavation area to the right.

tool kits were constructed by the museum staff, which expanded their understanding of weaving and woodworking skills. A longhouse was built in Neah Bay, utilizing construction details discerned from the buried Ozette structures. Over the course of a year it was "seasoned" (used for community events and aged by the weather), then was dismantled and reconstructed inside the museum, becoming a focal point for the permanent exhibit. The MCRC is currently (1991) expanding its facilities, adding additional collection management and research areas. The resurgence of interest in traditional culture also has been expressed with a language program, designed to teach young Makah their ancestral spoken language and to create a modern written equivalent (Makah Language Program 1979; Gill 1983b, Appendix A).

A general description of the cultural stratigraphy of the major excavation area (Area B70) at Ozette reveals four cultural deposits separated by largely sterile massive clay slides or by a series of redeposited clay slurries (Figure 17). The deepest deposit uncovered is a non-cultural basal deposit, formed of unconsolidated gravels, sands, silts, and clays Unit VIII). Above this is the oldest cultural deposit in this part of the site. A single test pit was excavated into this deposit, and organic preservation was excellent. This late prehistoric deposit (Unit VII) has been dated to about 800 years B.P. (790 $\pm$ 80 [WSU 1865] and 810 $\pm$ 70 [WSU 1777]). Subsequently, massive and redeposited clay (Unit VI) raised the ground level up to 2 m during the following several hundred years. The protohistoric occupation (Unit V) in this part of the village has been the focus of excavation and analysis. After leveling the required space, the first longhouse constructed

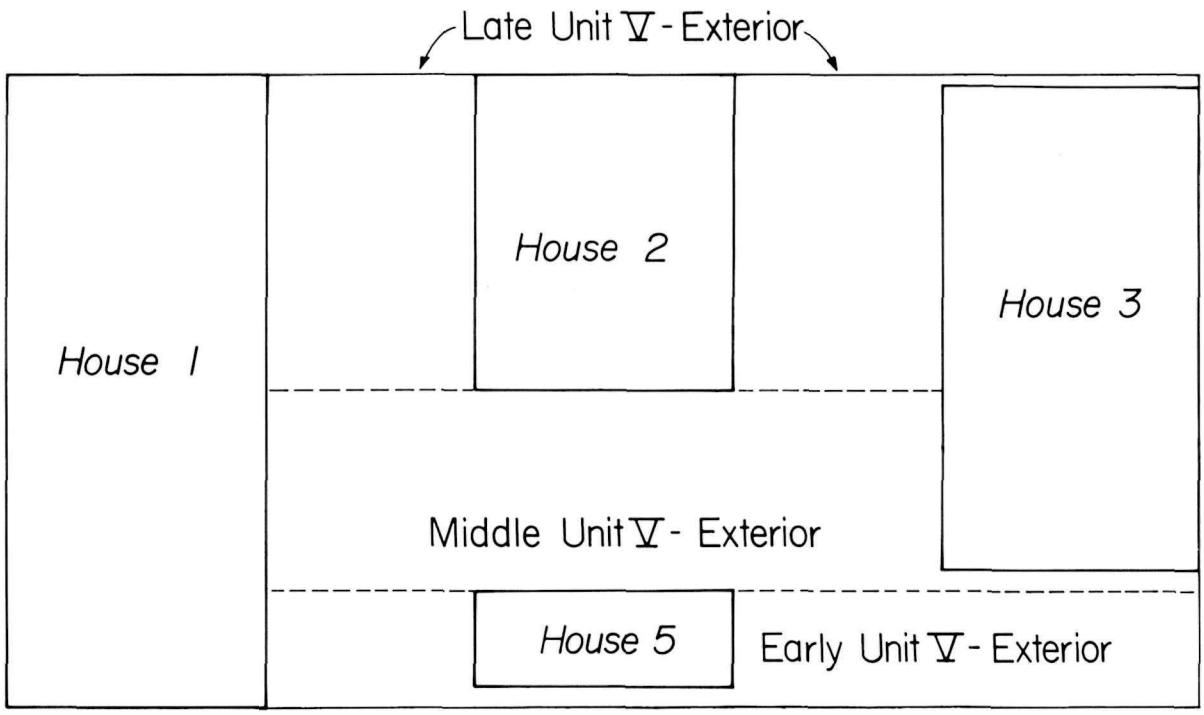


Figure 17. Area B70 general stratigraphic profile, showing relationships among Unit V house floors and exterior midden.

(House 1) was placed with its long axis parallel to the beach, next to the sea bank edge (Figure 18). An early hearth area in this house has been dated to 440 ± 90 (WSU 1778).

A few years after construction of House 1 another structure was built about 2 m to the east. This structure (House 5) was occupied for a relatively short time, then dismantled. Evidence suggests the local conditions were marshy, with frequent clay slurries cascading from the hillside, and this may have made the area undesirable. At about the mid-point of the Unit V occupation (possibly a total length of 75 to 100 years), another structure (House 3) was constructed just north of House 1. Unlike the other excavated houses, House 3 was oriented with its long axis perpendicular to the beach.

Shortly after House 3 construction, another longhouse (House 2) was constructed, again just east of House 1. However by this time, clay slurries and midden deposition had raised the ground surface by about 0.5 m, which was sufficient to reduce the wet conditions and make the area more habitable. At the time of the catastrophic mudslide, Unit IV, which ended the Unit V occupation, Houses 1 and 2 were still being used, but House 3 appears to have been partially dismantled. To some extent the problem of wet conditions with large quantities of run-off water cascading down the slope was faced by the occupants of all these structures (and by the archaeologists, as well). There are water-diversion features associated with all three completely excavated structures.

An historic occupation of this part of the village was uncovered built on top of the stabilized Unit IV slide toe. Excellent organic preservation also was found in this cultural deposit (Unit III), with excavation of a portion of a longhouse and exterior deposits. This occupation apparently dates from the early 1800s, and merging of traditional and imported (Euroamerican) technologies is evident in the artifact inventory. About 1850 another massive slide (Unit II) covered much of this area, which resulted in the excellent organic preservation of Unit III cultural material. The

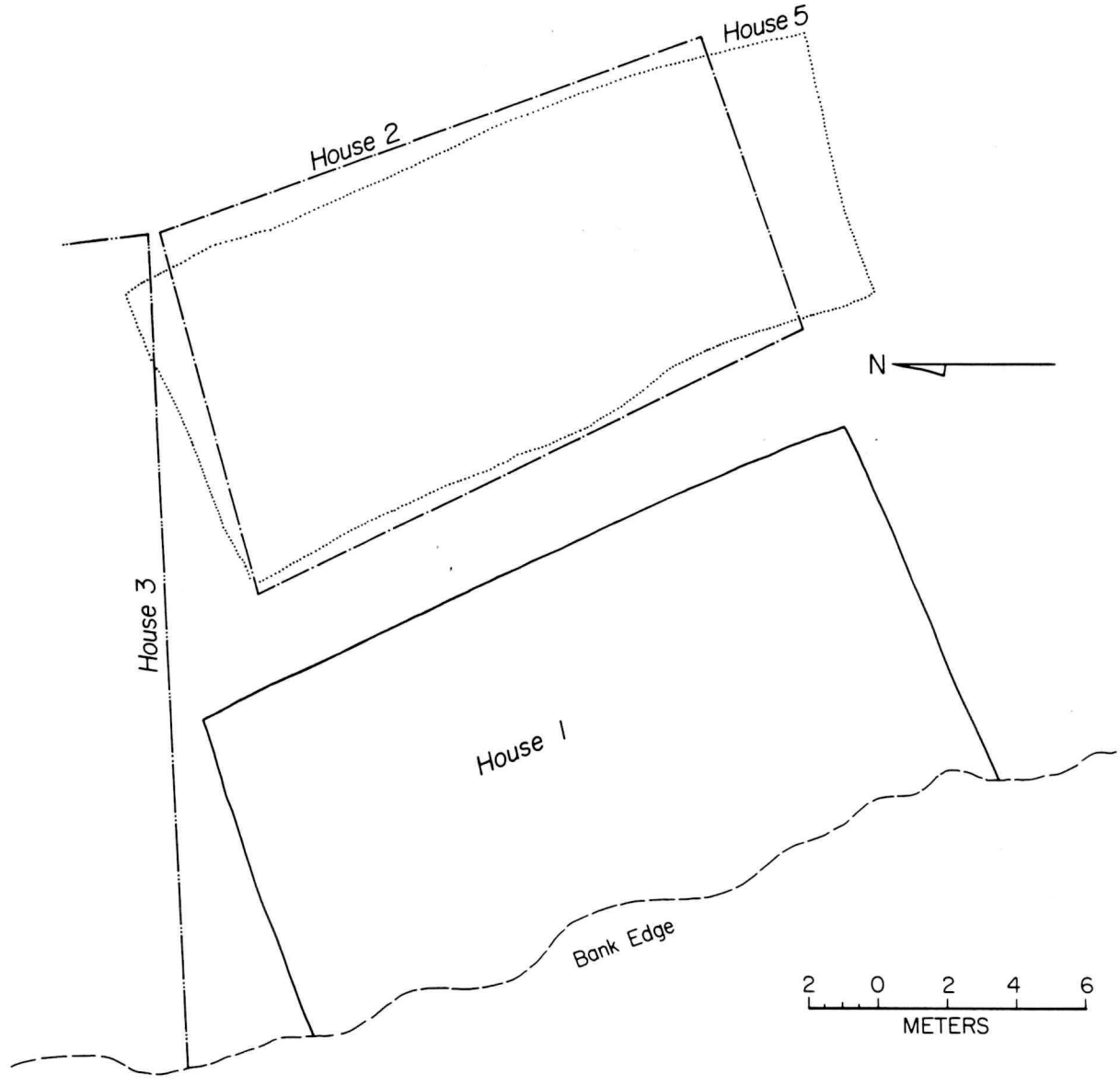


Figure 18. Area B70 - house structure outline maps, showing plan view relationships among floors.

final cultural deposit (Unit I) contains remains at the modern ground surface from an occupation beginning in the late 1800s and continuing until abandonment of the village in about 1910.

The majority of excavation effort was directed towards the protohistoric occupation, represented by Units IV and V. Evidence of eight longhouse structures eventually was uncovered. The remains of Houses 1, 2, and 5 were completely excavated, as were large areas of exterior midden associated with these structures. House 3 was partially excavated with a strip about 3 m wide removed along its entire south wall. The test pit into the corner of House 4, dug in 1967, was re-exposed and expanded in an attempt to discern its limits, but no major excavation of this structure was attempted. Houses 6, 7, and 8 were located south of House 1, and were partially represented by preserved materials. Further details of the site stratigraphy are presented in Samuels' report (part III, this volume).

A series of project reports was generated detailing the excavation and analytic progress from 1971 until 1983 (Gleeson 1973a, 1973b, 1974a, 1974b, 1974c, 1980a, 1983; Gleeson and Fisken 1977; Gleeson, Mauger and Fisken 1976; Mauger 1974, 1975a, 1975b, 1979, 1980). A number of completed analyses have been produced, which will be detailed below. Popular publications (Daugherty and Kirk 1976; Fagan 1988; Kirk 1974, 1975, 1978; Kirk and Kirk 1980; Pascua 1991) also document the excavations, illustrate recovered artifacts, and place the site into the perspective Northwest Coast prehistory.

History of Ozette Analysis

The 11 years of excavation in Area B70 recovered over 55,000 artifacts, 40,000 pieces of structures, and about 1,000,000 faunal remains. The extremely fine preservation of organic materials and large scale excavation which produced this vast collection has provided unique opportunities for archaeologists to better understand the material culture, economic orientation, and relationship between social and economic forces acting in this village. Questions of technology have been investigated in greater detail than possible in other coastal sites, and this research has elucidated patterns of cultural behavior that otherwise would have remained inaccessible to archaeologists.

The analytic philosophy has been shaped by the completeness, diversity, and magnitude of recovered cultural material, as well as the fact that many formal analyses began well after much of the material had been collected. These factors made it more appropriate to begin the analytic process using an "exploratory data analysis" rather than an "hypothesis testing" approach. This did not preclude hypothesis generation and testing, but provided a strong information base from which to generate and test hypotheses. These hypotheses were formed within an explicit and specific research design to prevent the unstructured multiplication of questions, which can actually have the effect of impeding research progress. The studies of material culture and subsistence patterns began with a detailed description of the collection that provides the information base. Hypotheses were then generated and tested concerning social and economic relationships.

Makah social and economic choices were interrelated. Social relationships were expressed spatially through residence choices and economically with distinctions in resource availability. As among all Nootkan speakers, social relationships defined by ethnographers indicate ambilateral rules of descent and marriage were the general pattern (Rossman and Rubel 1971:69). Individuals were given the opportunity to exercise freedom of choice in their decisions pertaining to group membership. This flexible social structure was balanced with a highly formal system of ranking. In practice, the principles of residence and rank shaped an individual's place in social groups (Marshall 1989).

During ethnographic times (the late eighteenth and nineteenth centuries), there were four (or five) scales of inclusive orgainzation within Nootkan society. At the broadest level, the confederacy was apparently used only among West Coast People (Nootkan-speaking groups along the west coast of Vancouver Island). A confederacy linked together different tribes. The Makah apparently did not participate in a confederacy, perhaps because they were the only group of Nootkan speakers on the Olympic Peninsula. The tribe was next most inclusive scale. Tribes were composed of several local groups, each having its own primary village. In turn, each local group was composed of a number of households, each with its own longhouse. The least inclusive scale was the family, and each household was composed of several family units. While ambilocal residence rules allowed an individual to change place of residence over time, any person could be associated with only one group at each scale at any one time. For the Makah, the principle of coresidence linked group members within a nested hierarchical structure of social relationships; families within households, households within villages, and villages within the tribe.

The second principle was that of ranking. Within each social scale, the principle of ranking ordered relationships and roles for each member. Within a single household, the ranking of members was expressed materially in the location of family areas assigned within the longhouse (Gleeson et al. 1979; Marshall 1989). According to ethnographic accounts, resource exploitation also was tied to affiliation with a house group. The individuals residing in a house at any time constituted the minimum exploitive unit (Rossman and Rubel 1971:78). Although movement of a family's residence among houses sometimes occurred, it was usually lower-ranking families (who recognized equally strong ties with other lineages) who shifted frequently from one house to another (Drucker 1951:71), while the higher-ranking families in the house apparently retained their residence for many years, moving primarily when their status changed. Whereas a family's residence might change, the relative rank of family areas within a house remained constant, as did resource-exploitation patterns, as they were tied to the household rather than to a particular family. Ozette analyses make use of these residence and rank patterns to understand links between social and economic relationships.

There are three general divisions into which the analyses stemming from the Ozette Archaeological Project site excavations have been placed: structural/spatial; material culture (artifact typology and manufacturing); and subsistence (floral/faunal) studies. Individually, each completed study provides one view of the culture. When the results from individual studies are approached collectively, a clearer understanding of the entire cultural system becomes possible.

The conceptual structure behind manufacturing and subsistence studies is based on a definition of technology as culturally patterned problem solving. Investigation of specifics has been divided into three related aspects of technology (Huelsbeck 1983b):

1. Procurement technology - the collection of raw materials;
2. Processing technology - the alteration and/or stabilization of raw materials for later use; and,
3. Production technology - the utilization of raw materials in creation or manipulation of desired products.

This conceptual framework puts an emphasis on the decision-making process, with creation of testable linking arguments relating physical evidence to behavior. It also provides an organizational framework for exploring the interrelationships between the individual lines of evidence from each study (Huelsbeck 1983b).

Studies detailing spatial and stratigraphic relationships provide a framework within which aspects of manufacturing and subsistence technologies could be examined. The initial study from the Ozette project to explore spatial relationships in Makah territory identified archaeological evidence of camp and village areas, and described resource locations (E. Friedman 1976). This survey and testing placed Ozette into perspective as one of the five major Makah villages.

Although indications of social relationships among families are not normally recognized in archaeological deposits, at Ozette it was possible to investigate spatially related indications of social affiliation. Kin relationships often directly influenced the use of specific resource locations, and these relationships also manifested themselves in the arrangement of nuclear family living areas within a longhouse and the distribution of longhouses within a village. Thus, study of spatial patterning within floor middens and among floors may indicate the nature of social relationships, a level of information seldom recognized by archaeologists. Other completed studies with a specifically structural/spatial focus include analysis of the longhouse structures (Mauger 1978a) and analysis of floor midden deposits (Samuels 1983a, 1989). As well, many studies focusing on artifact technology or subsistence pursuits also have included a spatial component.

Artifact studies generally have focused on the understanding of manufacturing and utilization technologies, as the rich material inventory provides examples of all stages in the life of a tool,

from blanks and preforms through newly finished items to used up/broken and discarded examples. Composite tools have been found with individual parts still articulated, providing numerous examples of fastening types (bindings and knots), as well as methods of construction for complex tools used for many subsistence activities. Completed typological and technological artifact studies include: basketry (Croes 1977); cordage (Croes 1980); combs (Kent 1975); miniatures (Koch 1975); kerf-corner boxes (Mauger 1982); wood artifact material identification (J. Friedman 1975); and woodworking technology (Gleeson 1980b).

A study of the rock art (petroglyphs) found associated with the site has also been completed (Ellison 1977). These petroglyphs are figures and symbols represented by lines pecked into rock faces. Most are located around a rocky headland (Petroglyph Point) about 1.5 miles south of the excavations (see Figure 4).

In faunal and floral subsistence studies, the technological model is used to define procurement, processing and consumption patterns for several categories of animals which formed the focus for separate studies. These include: birds (DePuydt 1983a), whales (Huelsbeck 1983c, 1988c), other mammals and fish (Huelsbeck 1981b, 1983a), and invertebrates (Wessen 1982, 1988), as well as a study of Makah and Ozette ethnobotany (Gill 1983a). It is in the context of examining variations in economic and social roles among occupants of different longhouses, and among the nuclear families resident within each multifamily longhouse, that structural/spatial studies are analytically related to artifact technology and subsistence studies. Subsistence studies hold particular importance for pursuit of economic and social information through archaeological material. As mentioned, the use of a resource location was tied to social and kin structures. One research hypothesis generated for investigation was that variation in resource availability would correspond to spatially defined units (Huelsbeck 1988a, 1989).

This volume presents reports from two of the structural/spatial studies (Mauger 1978b and Samuels 1983b). Future volumes will include studies of plant utilization (Gill 1983b) and woodworking technology (Gleeson 1980c); and subsistence studies using faunal remains from birds (DePuydt 1983b), whales (Huelsbeck 1983c), other mammals and fish (Huelsbeck 1983b), and invertebrates (Wessen 1983).

Analysis of the structural remains from these longhouses was completed by Jeffrey E. Mauger, and is presented as the first report (part II) following this introduction. It was originally produced as a Ph.D. dissertation (Mauger 1978a), in the Department of Anthropology, Washington State University, and also received limited publication (Mauger 1978b) as a Washington Archaeological Research Center Project Report (No. 73). It utilizes information obtained through 1977 excavations, which included removal of all pieces of the structures incorporated within the base of the clay (Unit IV), and much of the lower sections of the wall and roof-support structures embedded in the midden, and preserved as an *in situ* deposit (Unit V) in the area of Houses 1 and 2.

Mauger's study defines the structural elements of these houses and provides qualitative and quantitative information for major elements of this sophisticated construction system. The structural features of these houses are placed into the context of shed-roof systems used elsewhere in the Pacific Northwest, discussion of the variations are used to develop characteristics of a broader shed-roof architectural tradition in the Pacific Northwest.

Excavations subsequent to 1977 revealed further evidence of other roughly contemporaneous structures and increased stratigraphic complexity. The final feature maps and stratigraphic interpretations are presented in the second half of this volume, as part of analysis of the floor middens by Stephan R. Samuels. This study was completed in 1983, and was first produced as a Ph.D. dissertation (Samuels 1983a), in the Department of Anthropology, Washington State University. The study also formed the subject of a project report (Samuels 1983b), which is the basis for the version presented in this volume (part III). Virtually all recovered upper sections of structural elements were analyzed by Mauger, as were the majority of other major structural elements. Subsequent

excavation has produced no indication that interpretations reached by Mauger need revision. Although the reader will notice differences in maps portraying the extent of excavation between the two documents, Mauger's conclusions remain valid and Samuels' maps record the final extent of excavation for house structures and features.

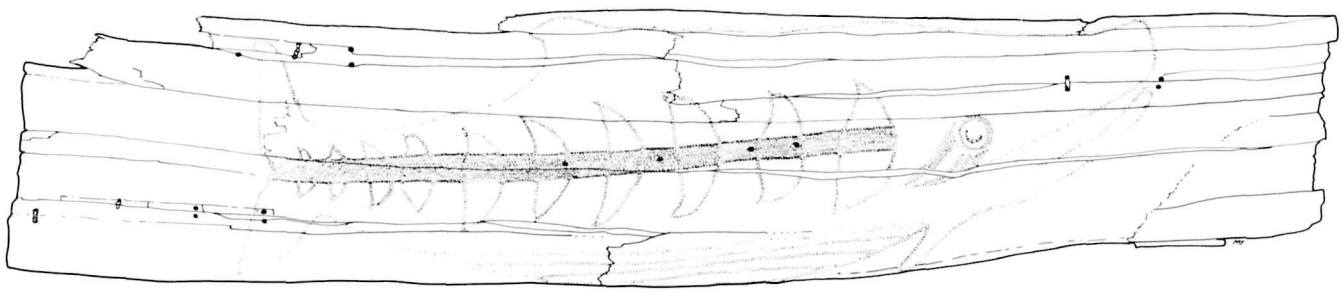
Samuels' study presents details of the cultural stratigraphy of Area B70 and describes the nature of the floor middens and associated cultural features. A series of constructed features associated with house maintenance is described, including those used for bank stabilization and hillside water diversion. This analysis partitions the excavated floor middens into analytic units using a cross-cutting system of nuclear family living areas and depositional zones. Using the partitions as analytic units, the spatial patterning of cultural material within floor middens is investigated, with an emphasis on identifying cultural processes responsible for modification of debris location or condition, such as sweeping or trampling. This spatial research provides a background for investigations focusing on economic and social relationships in artifact technology and subsistence studies.

Part II

SHED-ROOF HOUSES AT OZETTE AND IN A REGIONAL PERSPECTIVE

By

Jeffrey E. Mauger



Carved panel (29/IV/21) with the figure of a whale, found in House 1. This panel is 5.25 m long. Drawing by Madge Gleeson.

Abstract

Excavations have yielded preserved wooden structural remains from a number of protohistoric houses that were collapsed and buried by a massive mudslide. This study presents an analysis of the structural remains from four buried Ozette longhouses. The objective of this study are to define the protohistoric architectural system used at the Ozette site and to relate the architecture of Ozette houses to that of shed-roof houses throughout the Pacific Northwest.

The analysis of Ozette structural remains is presented on two levels: structural elements and structural features. Structural elements first are defined, and then combined to form structural features from the Ozette houses. These features are compared to data on shed-roof houses for the southern and central Northwest Coast, derived from historic and ethnographic sources.

The analysis of Ozette structural remains establishes that the Ozette houses were expressions of a protohistoric architectural system. Although local variations are apparent in shed-roof houses throughout the Pacific Northwest, the Ozette architectural system was but a local manifestation of a broader shed-roof house architectural tradition.

CHAPTER 1

INTRODUCTION

The Northwest Coast of North America is of great interest to cultural scientists because of the extreme elaboration in material and social culture that were developed there on a hunting, fishing, and gathering base. The post-contact culture of this area, particularly that of the nineteenth century, is fairly well documented due to the efforts of anthropological pioneers such as Franz Boas and the collections and writings of a host of explorers, traders, and travelers. These materials clearly indicate that significant changes occurred in the native culture of this area through contact with the British, Europeans, and Americans. These changes were so profound and so rapid that the status of many traditional social and material traits of native Northwest Coast culture prior the contact period is open to question. For this reason, it is desirable to extend our knowledge of this culture area back beyond the limits of the last two hundred years.

Two approaches, ethnohistory and archaeology, are feasible in this endeavor. The ethnohistoric approach in the Northwest Coast culture area is perhaps best represented by Erna Gunther's *Indian Life on the Northwest Coast of North America* (1972). Through the works of the early writers in the area, she attempts to reconstruct the native life as it was first encountered in the late eighteenth century. While Gunther's approach is thorough and penetrating, the data are necessarily limited in completeness and time depth. Although the early visitors to the Northwest Coast documented much of what they encountered, even more was left unrecorded. In terms of time, the ethnohistoric approach can only imply, but not directly attest to the cultural situation as it existed before written records.

Beyond the limits of ethnography and ethnohistory, archaeology is the sole data source for reconstructing the traditional cultures of the Northwest Coast. Such data have been limited, however, by a lack of systematic investigations (but see Fladmark 1974:219). Despite increasing archaeological activity on the Northwest Coast, the data have been constrained by the nature of most archaeological sites. Because of the prevailing climatological conditions along the coast, organic and inorganic materials such as bone, antler, shell and stone tend to be preserved while wood and plant fiber are often subject to rapid and complete deterioration. If the post-contact material culture of the Northwest Coast is at all indicative of the former content of prehistoric archaeological sites in the area, then much has been lost from the artifact inventories of such sites. This situation also is changing, however, with the discovery and excavation of water-saturated archaeological sites on the Northwest Coast.

Water-saturated sites have yielded an array of archaeological materials that would have perished under normal circumstances (Croes 1976). Common to all of these "wet" sites is the fact that vegetal materials are maintained in a water-saturated environment. The anaerobic conditions created in these archaeological sites greatly retards the normal processes of deterioration and allows the recovery of tools and other artifact categories in remarkable states of preservation. This situation is making it possible for the analysis of traditional Northwest Coast material culture and cultural patterns to go beyond the limits imposed by the material in ethnographic collections.

Of all Northwest Coast material culture traits and trait complexes, one which frequently is mentioned, but seldom examined in detail, is that of house architecture. As much as any other trait complex, Northwest Coast house architecture was altered during the early historic period by the introduction of foreign ideas, techniques, materials, and tools. For this reason, ethnographic and ethnohistoric inquiries into house architecture often are frustrated by the rapid evolution these dwellings underwent during the nineteenth century.

Archaeological data on traditional house architecture on the Northwest Coast are limited because the houses were constructed of wood and, once abandoned, were subject to rapid deterioration. Even in the case of wet sites, the preservation of architectural features is exceptional because houses generally were located away from wet areas that created a water-saturated environment. In most archaeological sites, wet or otherwise, such data often are derived from post molds and rock concentrations, and analysis of these phenomena is limited because of the lack of a suitable interpretive base. A major exception to this, however, is found at the Ozette Archaeological Site. The Ozette Archaeological Site is located at Cape Alava, the westernmost point of the contiguous United States. In the summer of 1967 a portion of this site was found to contain the remains of at least one house and its contents which had been buried by a massive mudslide around 300 years ago. The extensive midden in the site area, capped by a thick layer of slide clay, acted as an aquifer and allowed the perishable materials extant at the time of the slide to be preserved in a water-saturated environment. To date, Ozette has proven to be the most productive of the Northwest Coast wet sites, yielding thousands of items of material culture and house remains that would have perished under the circumstances found in most archaeological sites.

This study is concerned with the analysis of the architectural system represented by the prehistoric house remains uncovered at Ozette. The problem with which this study is concerned has two parts: (1) the description and analysis of the precontact architectural system as represented by the structural remains recovered at the Ozette Site; and (2) an examination of the relationship between this local architectural system and the regional system of which it was a part.

The time period with which this study is concerned is prehistoric in that the Ozette mudslide occurred before contact on this part of the Northwest Coast, but since the slide was only shortly before contact and a great amount of early historic data is presented in this study, this time period is designated here by the term "protohistoric." The theoretical approach manifest in this study is that the disciplines of ethnohistory and archaeology, while subject to different constraints, can be employed to reconstruct a protohistoric cultural situation far better than either approach used alone. Indeed, it is due to the fact that they are subject to different constraints that the two approaches complement each other and can be used so effectively.

CHAPTER 2

SETTING

Introduction

The Ozette Archaeological Site is located on the traditional village site of the Ozettes, a winter village community of the Makah Indians. Traditionally, Makah territory was centered around Cape Flattery, the northwest corner of Washington State (see Figure 1). The Makahs claimed the coastal strip from south of Cape Alava on the Pacific coast to east of the Hoko River on the Strait of Juan de Fuca. Like most Northwest Coast native groups, the Makahs' territorial concepts included not only lakes, rivers, and streams, but adjacent marine waters and islands. Since the beginning of the reservation period, Makah territory has been restricted to a reservation around Cape Flattery. The Ozette Reservation, a small tract of land around Cape Alava, was created independently of the Makah Reservation and is geographically separate from it. Administratively, however, the Ozette Reservation is now part of the Makah Reservation.

Linguistically, the Makahs are Nootkan speakers, related to the west coast Indians of Vancouver Island. They are the only Nootkan speakers in the United States and were bounded by Chemakuan and Coast Salish speaking groups. The linguistic geography of the Olympic Peninsula presents a somewhat confused situation. Although a number of scenarios might be postulated to explain the processes leading to the distribution of language groups in the area, none is currently supported by archaeological evidence. There are some indications, at least as far as the Makahs are concerned, that drastic territorial shifts occurred, perhaps in the not too distant past (Irving 1921).

Economy

The Northwest Coast of North America is noted for the abundance and availability of its terrestrial and marine resources. This was no less true for the territory of the Makah Indians. Harvesting of the local resources allowed the Makahs to meet their immediate subsistence needs and accumulate surpluses for storage and trade. The traditional economy of the Makahs may be documented through two sources: ethnographic accounts and archaeological analyses. Both data sources must be used judiciously, however, as the post-contact history of the Makahs is characterized by a shift from subsistence-surplus hunting, fishing, and gathering to a market-oriented cash economy. While archaeological data can identify resources traditionally exploited, incomplete recovery constrains the conclusions based upon such data. Some sites were occupied primarily for the exploitation of only certain resources. In addition, butchering and disposal practices, differential preservation, and archaeological sampling techniques all may skew archaeological faunal assemblages.

The traditional economy of the Makahs was primarily dependent upon the harvesting of marine, tidal, and riverine resources. In particular, they developed a specialization toward sea mammal hunting and were renowned as whale hunters. Several whale species were known to and hunted by the Makahs (Swan 1870:19; Waterman 1920:42). Of these, California grey whales were taken most frequently due to the large numbers available during their annual migrations off the Washington coastline. A few deep water species such as sulphur bottom and right whales apparently were also known to the Makahs.

Other sea mammals hunted by the Makahs included fur seals, hair seals, and sea otters. The hunting of these animals in particular illustrates the changes in Makah economy through the historic

period. Today, only an occasional hair seal is shot in the surf. Whale hunting was completely halted in the period between 1869 and 1890 as the hunters were totally involved in the pelagic sealing market (Waterman 1920:48). The practice was briefly renewed around the turn of the century and the last whale was taken in the first decade of the twentieth century.

In addition to sea mammal hunting, many varieties of fish were available and harvested by the Makahs. Of these, halibut seem to have been the most important (Swan 1870:22–23). Salmon were taken in streams and rivers and by deep sea trolling, and a variety of bottom fish were harvested as well.

In addition to the faunal remains recovered from the Ozette Archaeological Site, the artifact inventory recovered from the buried houses provides ample testimony to the marine orientation of the Makahs. Sea mammal hunting gear is represented by whaling and sealing harpoons, harpoon heads, and seal skin float plugs. A variety of fish and sea mammal clubs were recovered as well as numerous fish hooks of various sizes and types. Fragments of nets and herring rakes also were preserved. The ritual and spiritual practices that complemented the technological components of their economy, although not recovered archaeologically, are still represented in the traditions of contemporary Makahs.

The midden at the Ozette Site, as well as at other archaeological sites in the Makah area, testifies to the importance of shellfish in the traditional food quest (E. Friedman 1976:156–157). The contribution of land resources was fairly minimal: land game formed only a small portion of the Makah diet, both archaeologically and ethnographically (E. Friedman 1976:102; Swan 1870:24–25). Studies of the Ozette material (J. Friedman 1975; Gill 1983b), however, have shown that forest resources, particularly plant, shrub, and wood species were of great significance to the traditional technology.

Settlements

A fundamental point regarding the resources in Makah territory is that they were mostly scattered and seasonal. At certain localities which were better situated than others for the exploitation of particular resources, seasonally occupied settlements were established. These settlements involved the construction of permanent house frames with the plank coverings for these frames being shifted seasonally with changes in residence (Swan 1870:6). Waterman (n.d.) lists eighteen locations of houses in Makah territory (including the villages discussed below). This probably is a minimum number but does convey the dispersed nature of traditional Makah settlements.

Certain problems are inherent in distinguishing seasonally occupied settlements. In the Makah area, at least, summer settlements often were occupied by people from more than one winter village community. These settlements, sometimes termed "camps," were not necessarily small. George Vancouver, passing Warmhouse, the summer residence of the Neah Bay people, in April, 1792, noted that it appeared "extensive and populous" (Meany 1957a:75). In contrast, he did not mention the two winter villages in Neah Bay, despite the fact that he described the bay itself.

Another problem with summer and winter settlements is one of archaeological identification. Edward Friedman (1976:213) has offered several criteria for distinguishing between the two. These criteria include depth of accumulation, spatial extent, and composition of the midden. Considering the problems of site erosion, historic disturbances, archaeological sampling, and other factors, the application of these criteria without historic data would be difficult in the field.

For purposes of this report, summer and winter settlements will be termed "villages." These villages were distinguished by aggregations of house frames that were seasonally occupied. Essentially, summer and winter villages served as bases of operations for the exploitation of the resources of the immediate area in which they were situated.

Ethnographically, three summer villages are listed for the Makahs (Figure 7): Tatoosh Island, Warmhouse, and Archawat (Swan 1870:6). Tatoosh Island lies off Cape Flattery and was important because of its proximity to halibut banks. Curtis (1916:183) notes that all of the winter village communities had rights to Tatoosh for summer salmon trolling and halibut fishing. Test excavations on the island yielded a high proportion of fur seal bones suggesting the importance of the island as a sealing station as well (E. Friedman 1976:207). Historic photographs of the island show several houses on an enclosed beach at the base of rocky cliffs (Figures 19 and 21). The existence of midden on top of the island as well as an early drawing of Tatoosh (Meares 1790) showing houses on top of the island (Figure 20) indicate that summer dwellings were not restricted to the bases of the cliffs.

A second summer village was at Warmhouse on the Strait of Juan de Fuca. This village site also was known as Classet [/**ƛaʔasatx̌**/] or Kydikabbit [/**q̓idi·q̓adit**/]. The beach at Warmhouse is relatively short and enclosed by rocky headlands, and the village stood on a narrow strip of land bounded in front by the beach and by a steep hill to the rear. Only shallow midden deposits were located in the area (E. Friedman 1976:106) although historic house remains are still visible in the brush.

The third summer village site of the Makahs was at Archawat on the Pacific coast, south of Cape Flattery. Although somewhat longer, the beach at Archawat is very similar to that of Warmhouse, enclosed by rocky headlands with a narrow shelf of land at the foot of a steep slope. Again, little midden was located during a site survey (E. Friedman 1976:206) although the remains of five historic houses have been located in the brush.

Five winter villages were used by the Makahs. Three of these, Ozette [/**ʔuse·ʔiƚ**/][1], Tsoo-yes (Tsues) [/**c̓u·yas**/], and Wa-atch (Waatch) [/**waʔaǰ**/], were on the Pacific Coast while the other two, Deah [/**di·ya**/], and Baada [/**biʔidʔa**/], were at opposite ends of Neah Bay on the Strait of Juan de Fuca (see Figure 7). James Swan's (1870:6) census of the winter villages in the early 1860s is presented in Table 1.

Swan's census was taken after the consolidation of Deah and Baada. It is likely, therefore, that Ozette was the largest of the Makah villages. It is probable also that prior to the effects of introduced diseases, Makah population as a whole was somewhat larger than Swan's figures indicate.

Baada was located at the eastern end of Neah Bay and was abandoned after the smallpox epidemic of 1852 (Gibbs 1970:173). No archaeological remains have been located at this village site due to extensive disturbance of the area in historic times.

Deah was located at the western end of Neah Bay. With the amalgamation of Baada and the other winter communities, it grew into the present town of Neah Bay, encompassing the two old village sites and the area between them. A number of midden deposits, which are of a relatively recent age, suggest a generalized economic base for the village (E. Friedman 1976:205).

Barbara Lane (1972:6) notes that Gibbs listed in an unpublished manuscript three villages in Neah Bay: Deah, Baada, and "Kleh-sid-ats-oos" [/**ƛisi·da c̓u·ʔis**/]. The latter village also is indicated on a map of Neah Bay drawn by James Swan as well as another "Chalowetose village" (Office of Indian Affairs: Document 1448/1886). Lane feels that Gibbs was mistaken or that Kleh-sid-ats-oos had merged with Deah early. The former is more likely the case as Waterman (n.d.:34) lists a similar sounding name [/**čalawtu·s**/] for the central portion of Neah Bay beach. In both cases, these anomalous villages simply may have been dwellings apart from the main portion of Deah. Today this name refers to the large, low-lying open area between Neah Bay (on the strait of Juan de Fuca) and Wa-atch (on the Pacific Ocean).

Wa-atch was a winter village site on the mouth of the Waatch River. Surviving archaeological remains are covered by housing for the modern base of the adjacent Air Force station.

---

1. Spellings of Makah village names vary throughout the literature. "Ozette," for example, is also spelled "Hosett" and "Osett." The spellings employed in this study are those in use by the Makah Tribal Council in 1978.

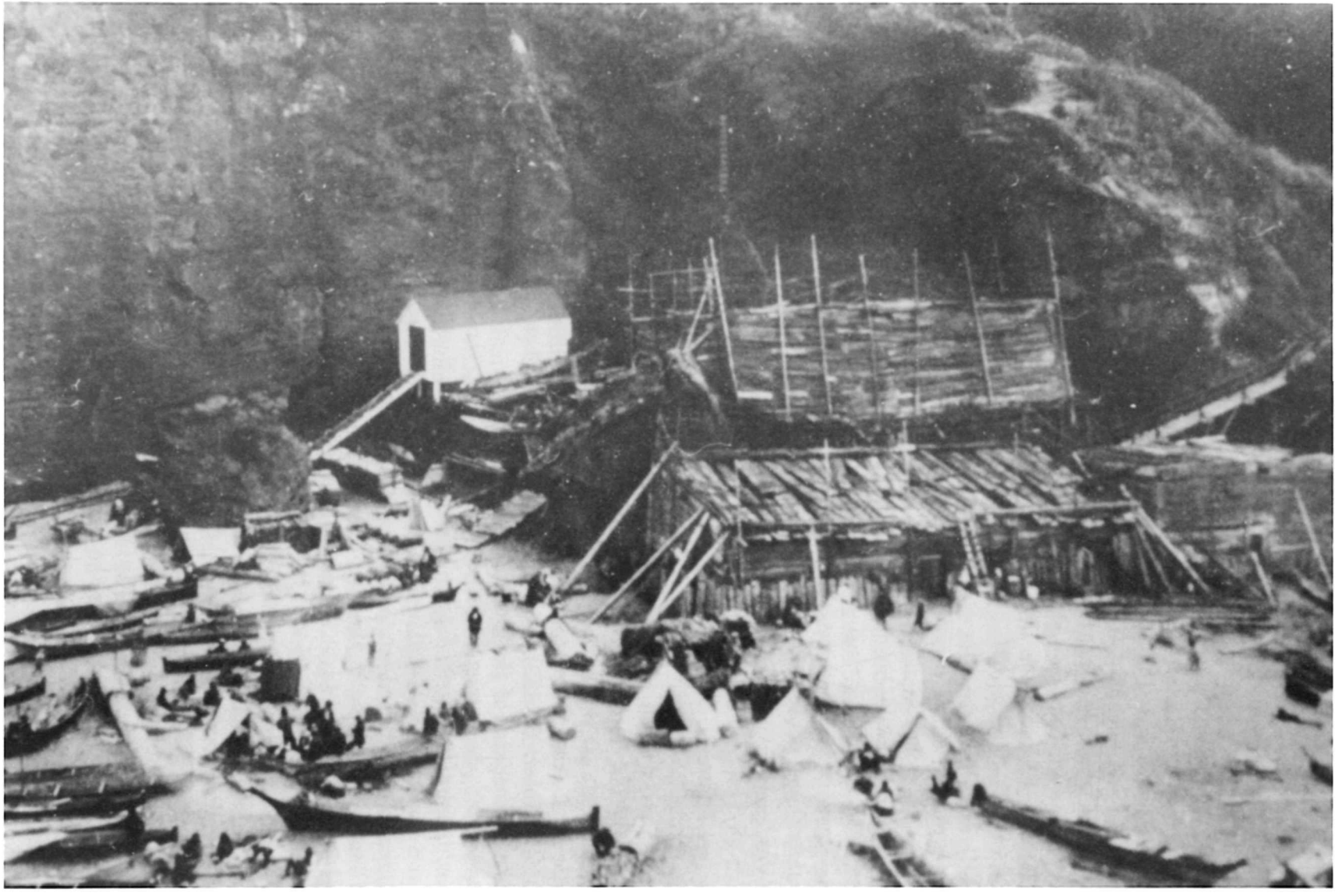


Figure 19. Shed-roof houses on Tatoosh Island.

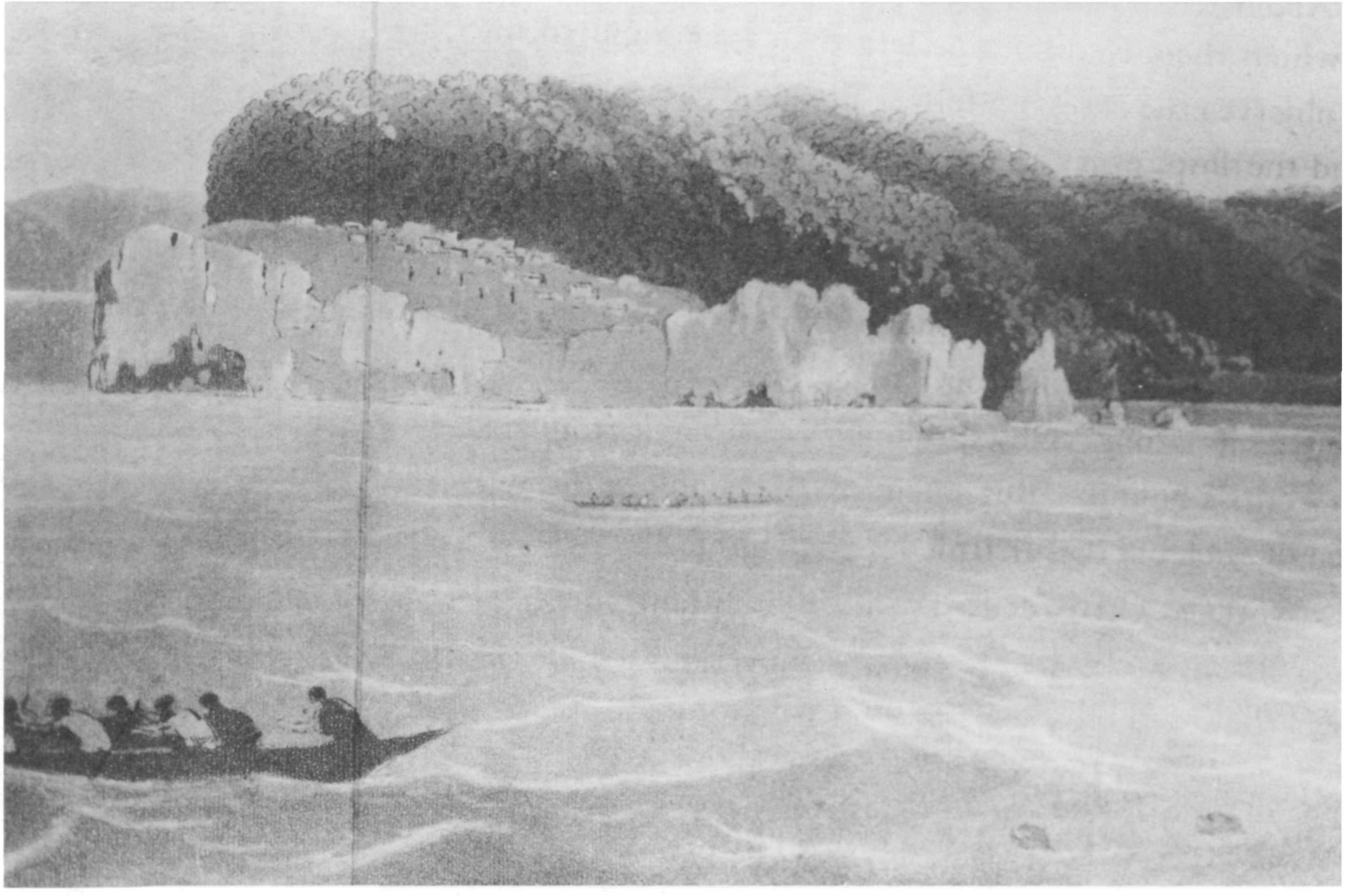


Figure 20. Drawing of Tatoosh Island from John Meares' voyage in 1786–87.

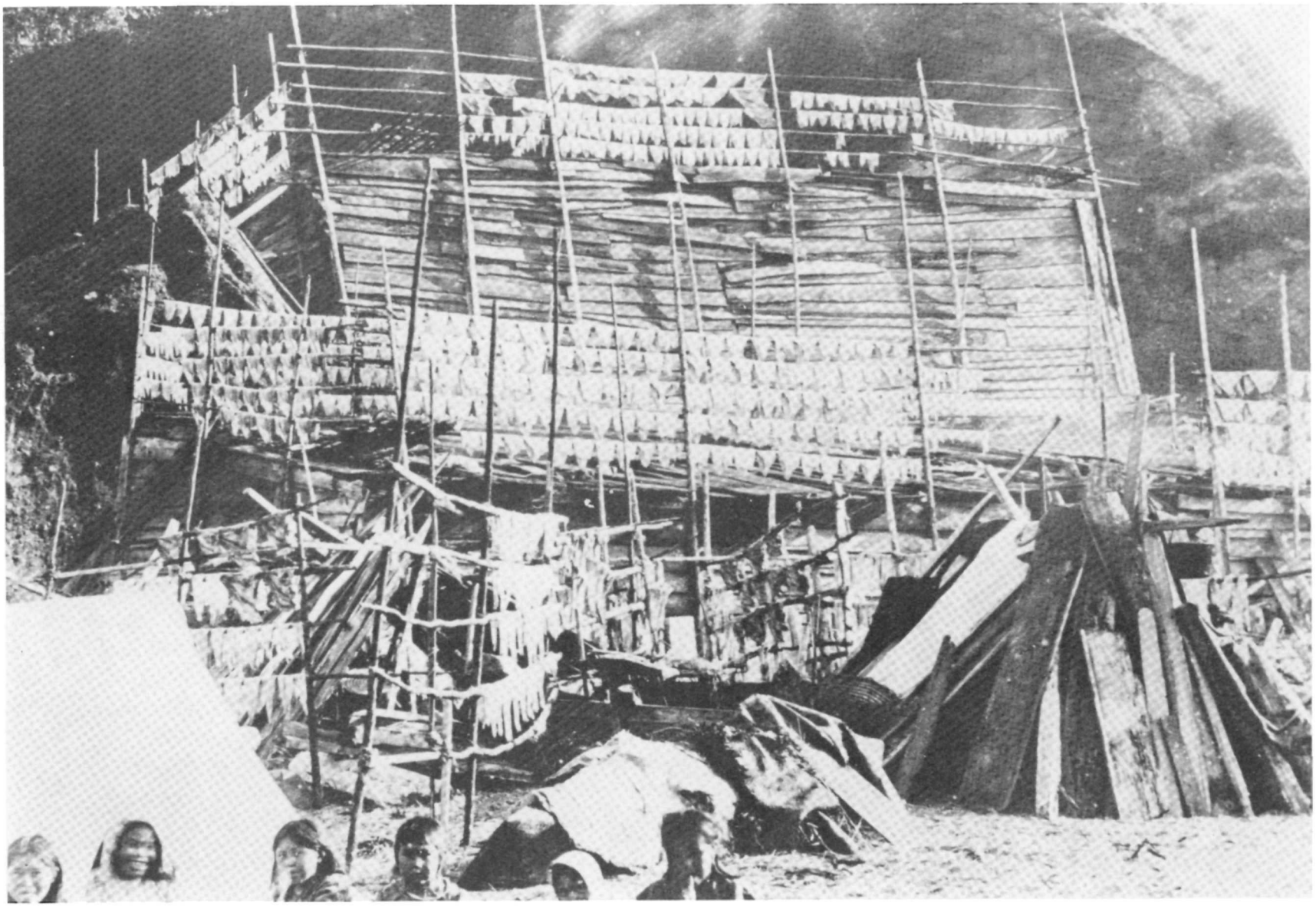


Figure 21. Shed-roof houses on Tatoosh Island with drying fish on racks.

Table 1

Winter Village Census by James Swan in the Early 1860s.

Village	Houses	Population
Ozette	15	188
Tsoo-yes	8	99
Wa-atch	9	126
Deah-Baada	15	241

The village of Tsoo-yes was located on the Sooes River although the site has shifted in historic times (Riley 1968:70). Excavation of midden deposits in the area suggested a diversified economy with the largest variety of bird, fish, and shellfish remains and more deer and elk remains than at any other Makah site tested (E. Friedman 1976:208).

Ozette was located at Cape Alava on the Pacific Coast and was the southernmost of the Makah villages. While the beach at the village site is not enclosed, the village was bounded by the ocean to the west and a steep hill to the east. The beach in front of the village site is quite rocky, and a large reef is exposed at low tide. The protection offered by this reef was advantageous for canoe landings as there is little surf except at the highest tides. A number of islands lie immediately offshore (see Figure 4). Tskawahyah Island (also known as Indian or Cannonball Island) is accessible at low tide and is capped by a midden deposit, probably from its use as a lookout. James Swan notes that the Makahs maintained two palisaded forts in the area, one of which apparently was on this island (Swan 1870:59). Another group of islands and rocks, the Bodelteh Islands, is to the west and Ozette Island lies southwest of the village site. Farther out is Umatilla Reef, which is exposed at low tide.

The abandonment of Ozette village occurred in the early decades of this century. Representatives of the Ozettes signed the Steven's Treaty of 1855. Subsequently, the village was assigned to the Neah Bay agency and the children were forced to attend school in Neah Bay. This apparently was a major factor in the eventual abandonment of the village (Riley 1968:65–66) although it is likely that access to non-traditional goods and the desire to participate in the growing cash economy also played a role in the population shift of the Ozettes to Neah Bay.

The historic period at Ozette village is poorly documented. Although Cape Alava is named on a 1792 Spanish map (Espinosa y Tello 1930) there is no record of a landing there. In part, the absence of Ozette in early written records may be due to the lack of a safe anchorage: the offshore reefs probably caused ships to give the area a wide berth. Probably the most significant event at Ozette village in historic times was the wreck of the Austria, a sailing bark that was driven ashore in front of the site during a heavy storm in 1887 (Gibbs 1971:18–20). The Ozette villagers assisted in the evacuation of the passengers and salvaged much of the remains of the vessel after it broke up on the rocks.

Carroll Riley (1968:79–80) has suggested that Ozette was somewhat independent of the other Makah villages. As evidence, Riley cites dialectical differences, apparently of a minor nature, the fact that the Quileutes distinguished the Ozettes from the other Makahs, and that the Ozettes attended gatherings independent of the Cape Flattery Makahs. All winter village communities were somewhat autonomous, however, and any differences between the Ozettes and the Cape Flattery Makahs might also be explained by the geographical position of the Ozettes. Ozette village was farther away from any of the Cape Flattery villages than those villages were from each other. In addition, Ozette was a boundary village, adjacent to Quileute territory, and the Ozettes probably enjoyed nearly as much contact with the Quileutes as they did with the other Makah villages.

Probably more significant than how non-Makah groups viewed the Ozettes is how the Ozettes viewed themselves. In this regard, there seems to be little question that they linked themselves to the Cape Flattery Makahs when questions of larger alliances were important.

Makah House Architecture

One of the earliest recorded encounters between the Makahs and Euro-Americans was by John Meares in 1788. Meares had anchored off Tatoosh Island during the height of the Makah fishing season and describes the island as being "covered with inhabitants" (Meares 1790:153). A drawing (Figure 20) accompanying Meares' account shows dwellings on the top of the island and is unusual in that later journalists describe the houses as being on the beach.

Manual Quimper, exploring the Strait of Juan de Fuca for the Spanish, landed at Neah Bay in 1790 (Cook 1973:281). He named it "Bahia de Nunez Gaona" and claimed the territory for Spain. Although Quimper apparently had considerable intercourse with the natives of Neah Bay, he made no mention of their villages or houses.

In 1792, George Vancouver reached the south side of the Strait of Juan de Fuca and described Tatoosh Island (Meany 1957a:74–75). He reports a village in a cove of the island and a causeway across the cliffs, over the houses, but gives no account of the dwellings themselves.

Also in 1792, the Spanish attempted to establish a settlement in Neah Bay (Cook 1973:349–352). A stockade was constructed enclosing a number of buildings near the creek at the west end of the bay. Problems with the Neah Bay Indians and international politics of the time forced the abandonment of the settlement after only four months. Unfortunately, despite the close contact with the people of Deah and Baada, no Spanish account of Neah Bay houses is available from this occupation.

Probably the earliest record of Makah dwellings is from the diary of George Wilson (Wilson n.d.). Wilson was a passenger on the brig "Oriental" which was storm-bound in Neah Bay for two weeks in 1850. Speaking of "Flattery Jack's" house, Wilson says:

> It is hewn of large cedar boards. A part of the tribe lives in houses near him. All of the village is enclosed by a strong barricade said to be the remains of an old fort built by the French in former times. His household contains some 30 or 40 Indians consisting of his family and slaves (Wilson n.d.).

This "French" fort probably was the stockade built by the Spanish during their abortive settlement.

In 1855 Neah Bay was visited by a party headed by Isaac Stevens, then territorial governor of Washington, for the purpose of establishing a treaty between the Makah tribe and the United States. The treaty signing was attended by representatives of all the winter communities except Baada, which had been abandoned by that time. George Gibbs, who accompanied the Stevens expedition, wrote a detailed account of house construction in Deah village (Gibbs 1970:174–175). Gibbs reports:

> The Neeah village, at the time of our visit in January, 1855, consisted of two blocks of four or five houses each built close together.... One of the blocks is partially surrounded with a stockade of puncheons twelve or fifteen feet high, strengthened by very large posts, into which a tie-beam is mortised (Gibbs 1970:174–175).

In addition to his written account of the village, Gibbs did an ink-wash drawing of the village (Figure 22). This drawing follows his account closely and shows a number of dwellings with flat, sloping roofs and horizontal wall planking.

Following Gibbs, the next and most complete account of Makah house architecture is that of James Swan (1870:5–6). Swan lived among the Makahs from 1862 through 1866 and was thoroughly familiar with their material culture. Swan also noted that the roofs of Makah houses were flat and

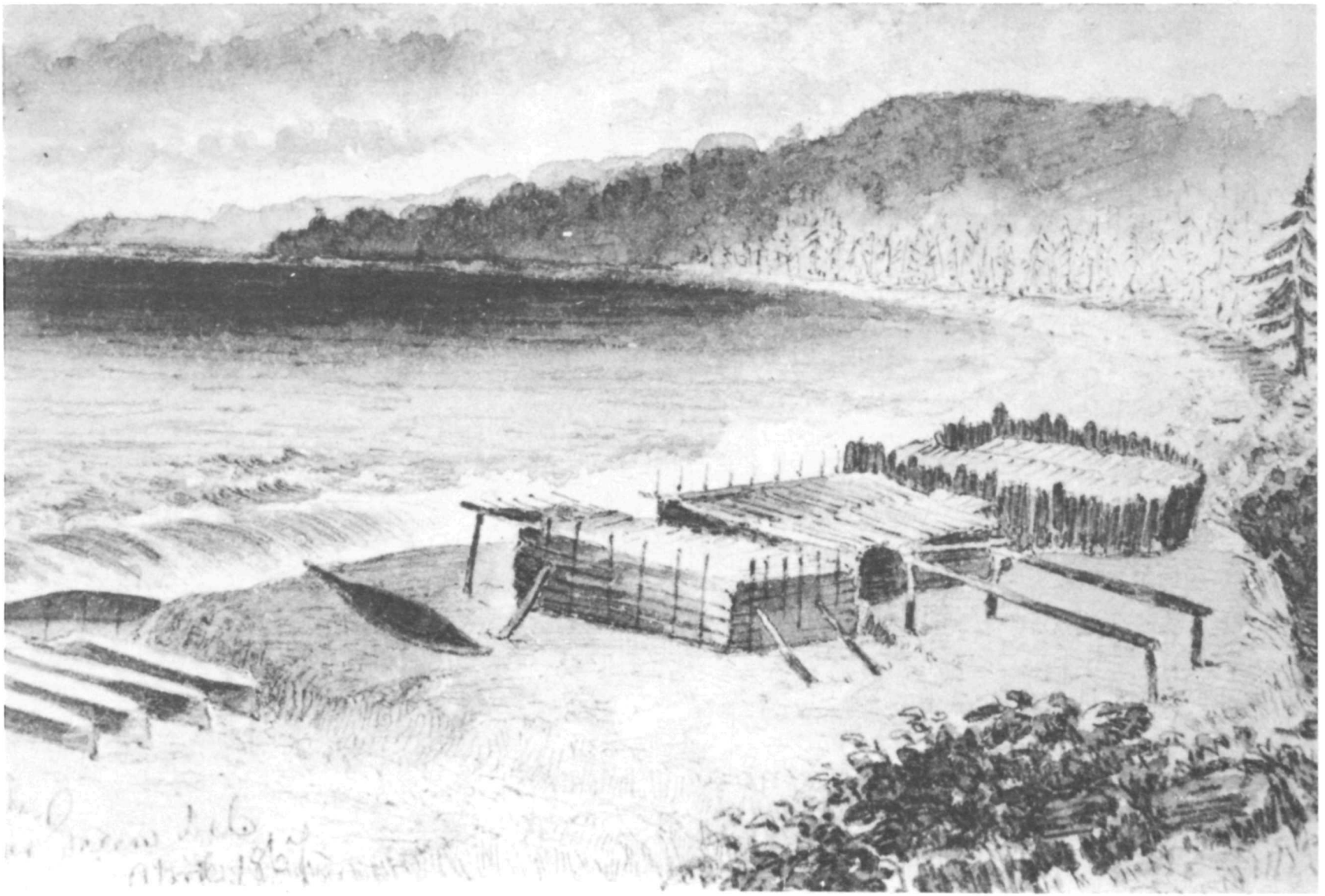


Figure 22. Drawing of Deah village by George Gibbs.

described the construction of house walls with horizontal wall planking. The details of Swan's account are discussed in chapter seven of this report.

In the early twentieth century, Neah Bay was visited by Edward Curtis, who included the Makahs in his study of the American Indian. His volume on the Nootkan includes several portraits of Makahs and one Neah Bay street scene showing an old style dwelling (Curtis 1916: facing page 14). In addition, Curtis includes a scene at the west end of the village, showing several small traditional dwellings (Curtis 1916: facing page 60). In the text, material on Makah and Ozette traditions is included.

T. T. Waterman engaged in fieldwork among the Makahs between 1917 and 1920. One of his unpublished manuscripts refers to a photograph of the ruins of a dwelling in Makah territory (Figure 23). His notes include a sketch of the original outline of this house and the Makah names for various structural features. While the location of this photograph is not identified, it appears to be of a dwelling at Archawat.

Fieldwork in Neah Bay in 1923 and 1926 by Francis Densmore resulted in her publication on Nootka and Quileute music (Densmore 1939). Also included is a great deal of information on Makah material culture. Her description of Makah dwellings, however, draws heavily on the earlier work of James Swan although considerable information was obtained from one of her principal informants, Young Doctor.

Elizabeth Colson's work on the Makahs (Colson 1953), based upon fieldwork in Neah Bay during the early years of World War II, contains few data on traditional Makah architecture. This study mainly was concerned with contemporary Makah social culture.

Erna Gunther has published several works concerned with aspects of Makah culture. They include little information, however, on Makah architecture.

Recent anthropological work among the Makah Indians is limited and none is specifically related to their traditional architectural system. Carroll Riley's 1968 article was based upon field work in the area in 1954 and 1956. This study focused on the political and economic organization of the Makahs and includes data on villages and camps, and the relationship of the Ozettes to the Cape Flattery Makahs. Barbara Lane (1972) discussed the early historic economy of the Makahs with reference to treaty rights and understandings. Her data also include material on villages and camps and resource exploitation.

Prior to the initiation of the Ozette Archaeological Project, systematic archaeological work in Makah territory was limited to several surveys of the coastline (Stallard and Denman 1955; H. C. Taylor 1978: personal communication; R. D. Daugherty 1978: personal communication) and limited excavations at the White Rock village site, south of Cape Alava. Excavations at White Rock village yielded a limited range of historic and prehistoric materials and the settlement is attributed to the Ozettes or Makahs (Guinn 1962:7).

Until the excavation of Ozette, data on traditional Makah dwellings were largely limited to historic accounts. Supplementing these accounts, however, are a number of photographs showing traditional Makah houses in the late nineteenth and early twentieth centuries.

Of particular interest to this study are two photographs of Ozette village, probably dating from the last decade of the nineteenth century. One view of the village (Figure 24) is from Tskawahyah Island and the other is from the beach to the south, facing north (Figure 25). Both photographs show traditional flat roofed houses with horizontal wall planking, gabled structures with vertical wall boards, and dwellings that apparently were older style structures that had been converted to gabled roofs.

Another photograph shows the interior of a traditional Makah house, probably at Neah Bay (Figure 26). The house was still occupied when the photograph was taken and a number of architectural features are visible amid the domestic clutter.

Figure 23. House ruins at the Archawat village site (courtesy of the Washington State Historical Society).

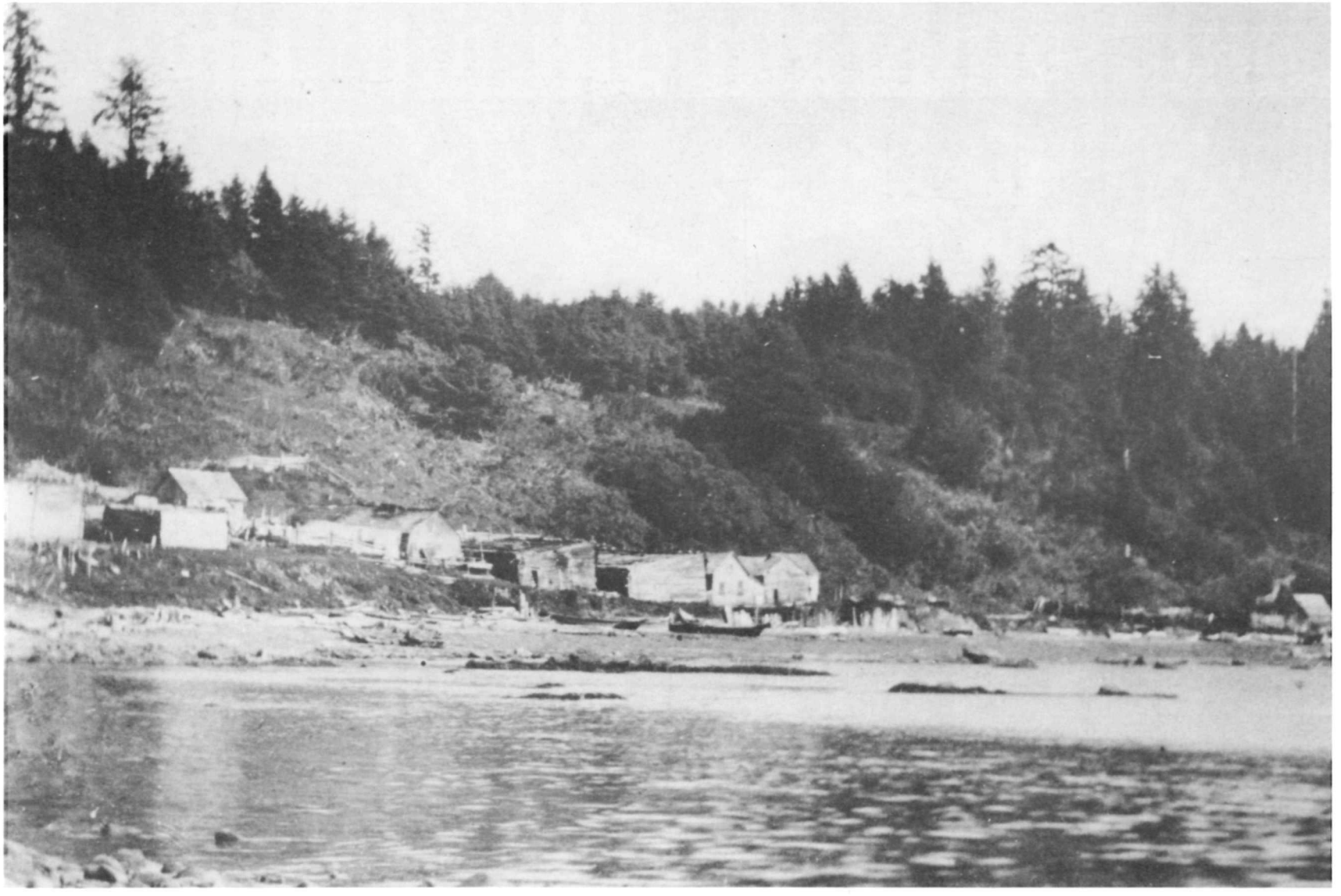


Figure 24. Ozette village viewed from Tskawahyah Island (courtesy of the Washington State Historical Society).

Figure 25. Ozette village viewed from the south (courtesy of the Washington State Historical Society).

Figure 26. Interior of an historic Makah shed-roof house. (courtesy of the Washington State Historical Society).

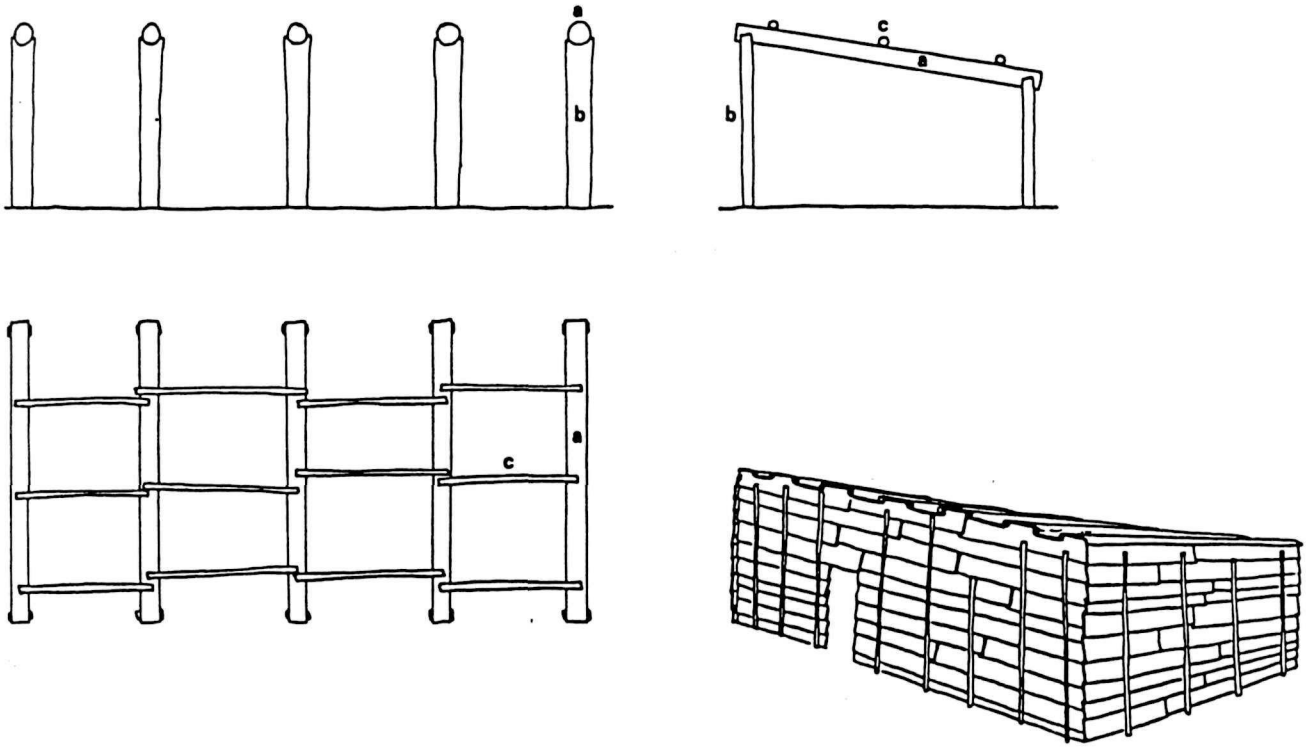


Figure 27. Shed-roof house and house frame: a - rafter beam; b - rafter-support post; c - rafter pole.

In addition to the above are the photographs previously mentioned of houses on Tatoosh Island (Figures 19 and 21) and the ruins of a dwelling, apparently at Archawat (Figure 23). While these photographs are useful in the analysis of traditional Makah house architecture, caution must be employed as all of the dwellings illustrated have incorporated at least some non-traditional innovations.

From the historic photographs of older Makah houses, the Gibbs drawing of Deah village in 1855, and the written accounts of Gibbs and Swan, it is apparent that traditional Makah dwellings had single-pitched, flat roofs and horizontally planked walls. In form, traditional Makah houses were of the shed-roof house type as defined by Philip Drucker (1963:70; 1965:26).

The roofs of shed-roof houses were built of planks and were structurally independent of the house walls. Roof planks rested on poles which, in turn, rested on rafter beams. Rafter beams spanned the width of a house and were supported at each end by rafter-support posts. The unequal heights of each member of a pair of connected rafter-support posts gave a roof the slight pitch characteristic of shed-roof houses. Walls were independent of the roof-support system and were constructed with withe-slung, horizontal wall planking fixed between pairs of vertical poles. Figure 27 illustrates the relationships of the major structural components of shed-roof houses.

Summary

Summer and winter villages were strategically located throughout traditional Makah territory for the exploitation of a variety of resources. These settlements were marked by the existence of aggregations of seasonally occupied houses or house frames.

Architectural data on houses in the Makah summer and winter villages outside of Neah Bay are especially limited. A few deteriorated house timbers are still visible at Archawat and Warmhouse, while the other village sites are evidenced only by their midden deposits. Historic documentation of the other Makah villages is rare since Neah Bay offered the only relatively sheltered harbor in Makah territory. Consequently, most of the non-native attention was directed toward Neah Bay, contributing to the eventual abandonment of the outlying villages.

Until the excavations at Ozette, historic documentation of traditional Makah house architecture was limited to a few historic accounts, photographs, and drawings. Data from the early historic period are particularly sparse although it may be that continuing archival work, especially with the early Spanish material, someday may yield heretofore unknown illustrations and descriptions of Makah houses.

Within the historic period, house architecture among the Makahs evolved under the influence of non-traditional pressures and ideas. As a consequence, by the beginning of the twentieth century, few of the older style houses remained. Of these, many displayed non-traditional architectural features.

Despite the limitations on the available historic documentation, indications are that traditional Makah dwellings were of the shed-roof house type. This is verified by the house remains excavated at Ozette. These dwellings represent the Makah architectural system in the protohistoric period, before the innovation or adoption of construction techniques foreign to the traditional system.

CHAPTER 3

METHODOLOGY

Introduction

Archaeological excavations at Ozette were initiated in the summer of 1966 by R. D. Daugherty, archaeologist at Washington State University, and the Makah Tribe. The first excavations were on the mainland, adjacent to the spit leading to Tskawahyah Island. This area, designated Area A (see Figure 8) was known to contain deep midden deposits. To sample these deposits, a test trench was excavated, extending up the hill from the beach (see Figures 9 and 10). In addition, the 1966 program involved testing of midden deposits in several areas of the site including the summit of Tskawahyah Island and historic deposits in Area B, south of Area A.

The following summer, in 1967, archaeological testing continued in the same locales. A test pit in Area B, well behind the sea bank at the foot of a gully on the hill behind the site, penetrated a thick layer of clay and encountered well preserved basketry and planks. No further excavations were carried out at that time because of the close of the field season.

During the same period, oral traditions were collected in Neah Bay regarding mudslides that had buried dwellings at Ozette village. Years before, T. T. Waterman had recorded a similar tradition stating that a village had been buried in the Ozette village area "by a cave-in of the cliff" (Waterman n.d.:17).

Excavations in this area of the site, designated Area B70, were begun in the spring of 1970, following exposure of preserved archaeological material by extreme tidal and wave action during the previous winter. The history of the following eleven years of excavation has been presented in part I, and will not be reviewed here. In terms of this study, because of the remarkable preservation encountered locally in Area B70 the structures provide insights into the architectural practices of the Ozette-Makahs at a time immediately prior to the drastic and rapid changes that accompanied contact between the traditional cultures of the Northwest Coast and Euro-American culture.

Stratigraphy

Because the stratigraphy of Area B70 at Ozette has been reported in a number of project interim reports, it is only summarized here. The stratigraphic record of Area B70 is represented schematically in Figure 28.

The following is a summary account of the major stratigraphic units identified in Area B70 at Ozette. These units are discussed in greater detail in part III of this volume.

Beach Sand

The earliest stratum encountered in the Area B70 excavations is composed of beach sand. This material represents the active beach at a time prior to the mudslides. At this time, the beach was closer to the foot of the hill and the shelf of land between the present beach and the hill was much narrower than present. Evidence of occupation in the area at this time is very tenuous and little can be said of it at present. During the period represented by this stratum, Ozette village was

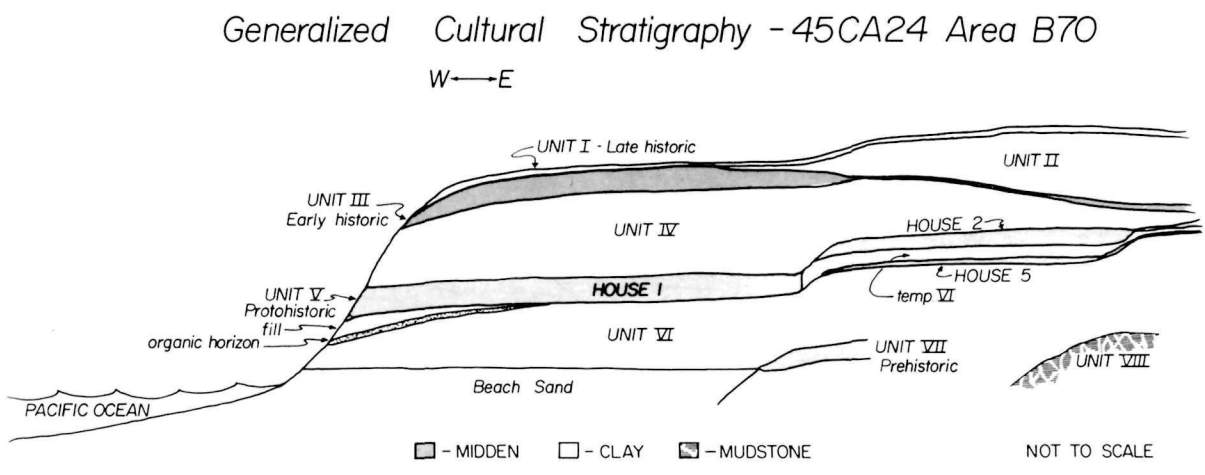


Figure 28. Generalized stratigraphic profile of Area B70.

probably concentrated in Area A, where deep midden deposits were encountered during the 1966 and 1967 excavations.

Unit VII

Unit VII has been exposed in a deep test pit below the area of House 2. This stratum is composed of midden, possibly from the occupation of houses at a time when the shelf of land between the beach and hill was narrower than it is today.

Unit VI

Unit VI is composed of a clay deposit extending from the hill to the present beach and overlying the earlier beach and Unit VII. The origin of the Unit VI clay is uncertain but it may represent an episode of rapid deposition of clay sediments through heavy runoff and minor slurries washing down from the hill rather than a major mudslide. The deposition of this unit expanded the shelf of land at the foot of the hill and provided a greater area for occupation in Area B70. Portions of the upper surface of Unit VI were disturbed by the occupation that immediately followed its formation.

Unit V (including temp. V through temp. VII)

Unit V marks a period of intensive occupation in Area B70. The depositional sequence is detailed in parts I and III. The area affected by the Unit IV mudslide included deposits associated with at least five structures. The occupation of these houses resulted in the deposition of the floor and exterior midden that compose this unit. In addition to floor and exterior middens that accumulated during the period of time represented by Unit V, major constructional features also were constructed adjacent to House 1. These are discussed in part III.

Unit IV

Unit IV is a major mudslide that terminated the Unit V occupation in this part of the village. The slide originated from the hill to the east and thrust to the southwest. To the south, the slide thinned out and finally terminated just south of the south whalebone feature. It is likely that this slide also extended onto the beach that existed at the time. The Unit IV slide was rapid and catastrophic, and the lower portion of the component contains structural material and artifacts from the Unit V occupation as well as some displaced midden that was plucked up or ploughed by the slide.

Unit III

This unit consists of floor midden and the lower portions of a house wall; little exterior midden was found. The Unit III dwelling had been built on the surface of the Unit IV slide, in a location roughly similar to that of House 1, the Unit V structure. The discovery of non-traditional goods in association with traditional implements in the floor midden of this structure indicates that the house was occupied into the early historic period at Ozette.

Unit II

This mudslide flooded the Unit III house and caused its abandonment. The flooding of the house probably was restricted to the easternmost portion of the structure and was not particularly deep. Nonetheless, the dwelling was abandoned and the portions of the house above the surface of the slide were dismantled. Although the Unit II slide is over two meters thick to the east of the Unit III house, within the dwelling it is thin because the structure was situated on a topographic high. The southern extent of this slide was in the south portion of Area B70; the midden accumulation farther north was continuous and unbroken by the Unit II slide.

Unit I

Unit I represents the late historic occupation of Ozette village. A few poorly preserved structural remains from dwellings visible in the late nineteenth century photographs of the village site were recovered from this component (see Figures 24 and 25). By this time, the substantial changes occurring in the traditional culture of the Ozette-Makahs are reflected in the quantity of non-traditional artifacts recovered from the component. In addition to the material changes, economic changes also must have occurred, as suggested by the paucity of Unit I midden. The lack of midden also may be the product of the short period of time represented by this component.

Sources of Incomplete Recovery

Because of the nature of archaeological deposition and recovery techniques, incomplete recovery is nearly always a factor to be considered in analysis of archaeological collections. Artifact assemblages are only partially representative of the total material inventory of the culture from which they were derived. To a degree, this also is true of the Ozette material despite the unusual preservation of the artifacts and the excavation techniques developed for their recovery.

Although the Ozette archaeological collection is unusually complete, there is no basis for assuming that it represents the full range of traditional Ozette-Makah material culture. Seasonality, relative wealth, occupational specialties of the house inhabitants, and other factors may have skewed the material recovered from the site. Of the ethnographically known materials for the Makahs, for example, certain items are notably absent; these include masks, rattles, and drums. Their absence may be related to activities occurring elsewhere in the village at the time of the Unit IV slide or to the seasonal occupation of the houses. It is possible also that some of these items were adopted in historic times and simply were not present in protohistoric Ozette-Makah culture.

Another source of incomplete recovery in archaeological sites is loss through the vagaries of deposition and preservation. While loss through deterioration or lack of preservation has been minimized at Ozette, differential deposition in an archaeological context has had a significant role. The Unit IV mudslide not only collapsed and buried the structures but carried portions of them out onto the beach. As a consequence, portions of the houses were not deposited in the archaeological site. The unrecovered west wall of House 1, for example, apparently met this fate.

In addition to portions of the house structures being eroded away through one mechanism or another, there is good evidence that parts of the houses were salvaged after the slide. The depth of the Unit IV mudslide diminished to the south of Area B70 and it is likely that the upper portion of the south wall of House 1 and the southern portion of House 2 were not collapsed by the slide. The upper portion of the House 1 wall was found snapped off at the same level as the upper surface of Unit IV. Since the slide buried only the lower portion of the wall, the loss of the upper portion seems explainable only through salvage efforts. In House 2, only a few inches of slide clay covered the southern area of the structure. Nevertheless, structural remains from this portion of the house were largely absent.

Excavation

Unit V cultural materials were capped by a deposit of Unit IV slide clay in places over 2 m thick (see Figure 14A). The upper portions of Unit IV were generally culturally sterile and a fast, efficient technique was required for the removal of this overburden. The adhesion of the slide clay to the lower Unit IV and Unit V artifacts and the soft nature of many of the perishable materials rendered the use of the traditional excavation tools, shovels, and trowels impossible. To cope with these problems, a system of hydraulic excavation was developed which has proven quite satisfactory for the excavation of this type of archaeological deposit. This system is discussed in part I.

A grid of two meter squares was imposed over the site area and excavation proceeded within the stratigraphic units of each square. Working within the stratigraphic limitation imposed by the need for drainage, hydraulic techniques at the Ozette site have been refined into an efficient system for the excavation of waterlogged materials.

Field Documentation

The sheer mass of archaeological material exposed at Ozette necessitated preliminary classification in the field. While nearly all of the Ozette material is artifactual in nature, the term "artifact" has been reserved for tools and implements; parts of the actual house structures are termed "structural remains." For consistency, this distinction has been maintained throughout this volume.

The primary documentation of the structural remains excavated in Area B70 was accomplished through maps drawn in the field at a scale of 1:10. All structural remains were mapped and their positions relative to surrounding artifacts and other structural remains were documented. Maps were drawn sequentially as excavation progressed, allowing the demonstration of vertical relationships and the full illustration of the structural remains.

Secondary documentation of the Ozette structural remains was accomplished through the use of photography. Both black and white and color photographs were taken of all structural remains *in situ*. The photographs were taken sequentially within a square, whenever the visible structural remains were removed, and further excavation uncovered others. While maps never have been supplanted by photographs, the latter provided valuable support during analysis of the Ozette material.

Each structural remain encountered during excavation was numbered with an embossed aluminum tag. Numbers were assigned sequentially within each square and stratigraphic unit. A structural remain received a number for each square through which it extended. Large pieces may have received many tags, one for each square. The embossed labels were stapled to the structural remains and remain permanently through their excavation, conservation, shipping, and storage.

Removal catalogs were maintained in the field. These logs documented the status of each structural remain relative to its numbering, mapping, and removal. This system prevented duplication of numbers and was essential because of the high turnover rate of field personnel and the fact that structural remains may have lain exposed for some time before their removal.

Laboratory Procedures

After removal from the field, structural remains were processed through the site field laboratory. There, they were cleaned, described, and their metric data recorded. Conservation of the structural remains also was carried out at the Ozette field laboratory through impregnating with polyethylene glycol. Structural remains from Ozette were shipped to the Neah Bay laboratory by helicopter. There they were given additional conservation if necessary, and were stored for analysis.

Analysis

For several reasons, the analysis of the thousands of structural remains from Houses 1 and 2 has proven to be a time consuming process. While some pieces are small, others require the efforts of several people merely to turn them over. Finally, it has been necessary to collate and reduce the maps and notes that accumulated during years of excavation to understand relationships among these pieces.

The first phase of this analysis consisted of compiling a series of master maps covering large sections of Area B70. Once the masters were compiled, they were reduced to 50% of the field scale and acetate overlays were traced from them. The sheer quantity of structural remains uncovered

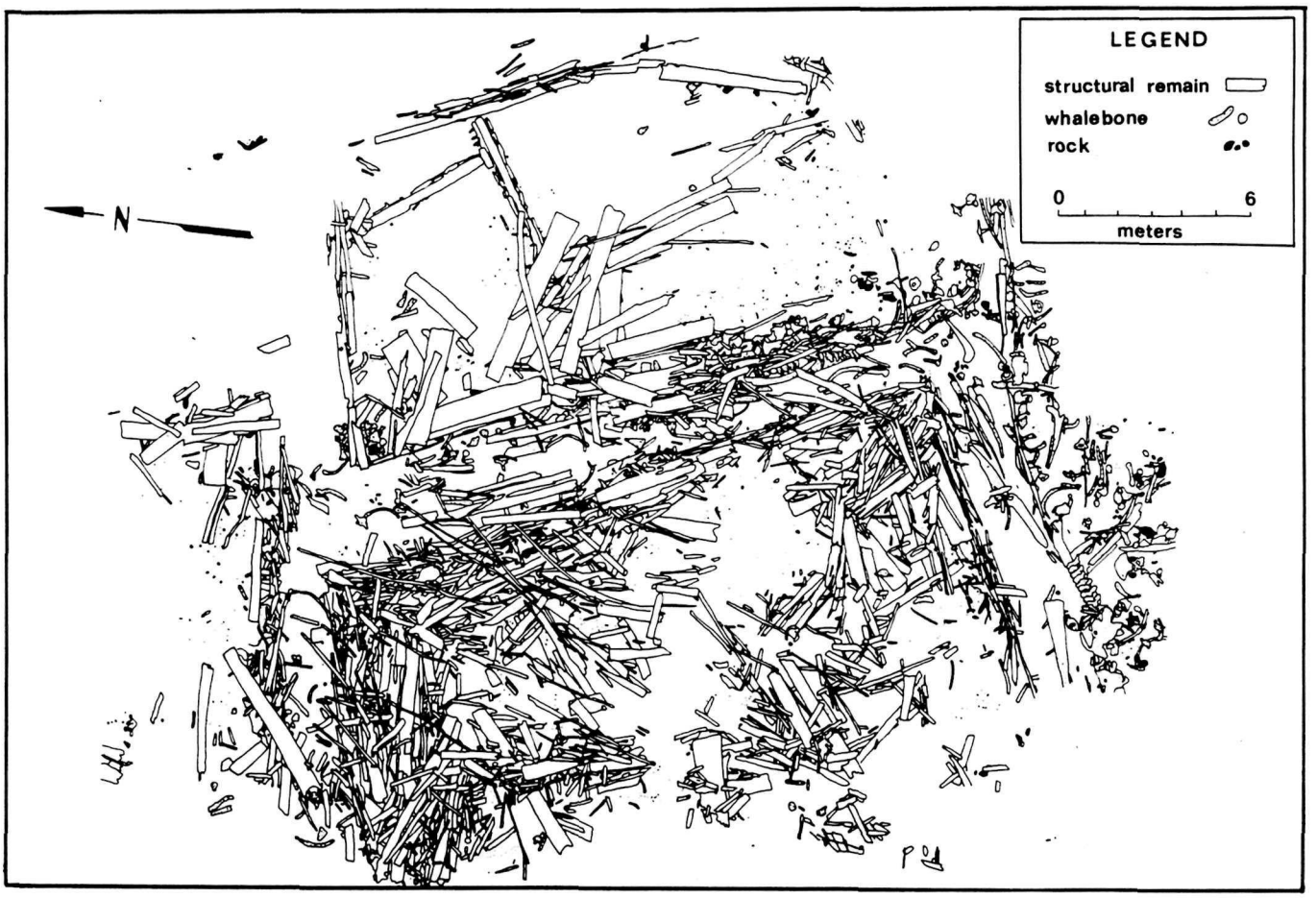


Figure 29. Distribution of Unit IV and Unit V structural remains in Area B70.

in Area B70 is suggested in Figure 29, which shows the distribution of structural remains in the House 1 and 2 area.

Blueline prints were made of the acetate overlays at the 50% reduction stage. Each structural remain was then assigned a key number; this number is the designation of the structural remain from the lowest numbered square in which it occurred.[2] Key numbers are necessary since, for example, some long poles have as many as six numbers assigned to them. Additionally, structural remains were color coded on these prints for rapid identification of functional and morphological classes.

Following the assignment of key numbers and color coding, master maps were further reduced to 25% of the field scale. This allowed large sections of the site to be mapped on single sheets.

Along with the compilation and reduction of the field maps, a card file was developed. This file cross-referenced each number assigned to individual structural remains with their key numbers. These cards also listed data derived from the maps, laboratory catalogs, and the physical examination of the structural remains. The physical examination of the structural remains was greatly facilitated by the use of a large building provided to the Ozette Archaeological Project by the Makah Tribal Council. This allowed all of the structural remains to be brought together in a single

2. Key numbers will be used to identify individual structural remains throughout this study.

area. There, they were sorted by morphological classes and fragmented pieces were reconstructed whenever possible.

In collecting the metric attributes of the structural remains, all pieces from which the original length, width, and thickness could be obtained were measured. Often the number of specimens in a single class with all three complete dimensions was disappointingly few. Many structural remains are incomplete because all of the fragments were not recovered; either they had been washed onto the beach or were salvaged by the residents of Ozette after the slide. The specimens with three original dimensions also were examined for qualitative attributes such as dressing and other tool marks. The remaining pieces in the collection were surveyed for similar attributes and exceptional or noteworthy pieces were recorded.

Due to the difficulty in fitting together fragments of structural remains and locating whole pieces, the measured sample is not as large as expected. For example, of the dressed planks in the Ozette collection, only eight exhibit all three original dimensions. Of the remainder, five dressed planks yield a full length measurement but not a full width measurement and six planks have their full width but not length. While a thickness measurement can be obtained on virtually every fragment, it is mainly useful in separating plank classes; within a class there is little variation along this dimension.

Documentary Sources

Protohistoric studies, whatever the subject, are generally limited to three sources of direct and indirect documentation; early historic accounts, informant or ethnographic accounts, and whatever archaeological information that might be available. The archaeological data employed in this paper are primarily those obtained from Ozette. The other sources are used to the extent that information is available.

Early historic accounts of Northwest Coast native culture are of particular interest in that they represent the impressions of the first non-native visitors to the area. This was at a time when the native culture had not yet been altered to any great degree through contact. The earliest available accounts are those that resulted from the voyages of exploration, mainly by the British and Spanish, and from the commercial voyages that opened up the sea otter fur trade in the late eighteenth and early nineteenth centuries. These descriptions refer to a few scattered geographical centers such as Nootka Sound and Clayoquot Sound at which the exploration and commercial activities were based. Generally, these accounts of native life and culture are spotty and impressionistic since they were recorded by observers with little or no experience in ethnographic observation. Mundane matters often were passed over as the emphasis was upon recording those aspects of native life that struck the chroniclers as strange or unusual. Often the voyages of exploration included artists whose job it was to pictorially record the native cultures encountered. The drawings and paintings from these expeditions are of value because an artist could record aspects of culture without understanding their social or cultural significance. As a data source, however, these illustrations are limited. Often the pictures were only bare impressions of what was actually seen. In some cases, they are so stylized as to be valueless and even misleading. Detail and accuracy often suffered because sketches were made on the spot and were worked up later, during or after the return voyage.

Also of value in reconstructing aspects of traditional native life on the Northwest Coast are the accounts of travelers and non-native residents in the nineteenth century. Notable among these are the drawings and paintings of Paul Kane (Harper 1971) and the work of people such as James Swan (1870) and Gilbert Sproat (1868).

Photographs, which provide a somewhat more objective record of material culture, came relatively late in the historic period. By the late nineteenth century, the period to which the earliest

historic photographs date, traditional Northwest Coast culture had been substantially altered in many respects. Several photographers, apparently realizing the rapid erosion of native art, technology, and ceremony, attempted to use the then-new medium to preserve what remained. As a result, the photographs of such pioneers as Edward and Ashael Curtis, Samuel Morse, and C. F. Newcombe provide twentieth-century viewers with glimpses of an earlier time and culture.

As far as architectural data are concerned, the early photographers generally show villages and house exteriors. It is unfortunate that more interior views are not available, but this endeavor may have been limited by the existing technology and the social situations in which photographers found themselves. Few early photographs show dwellings without some degree of non-traditional influences such as milled planks and the use of nails over traditional methods of fastening. Consequently, architectural data from photographs must be assessed along with other historic and ethnographic documentation.

Some early historic works, particularly James Swan's (1870) *Indians of Cape Flattery*, qualify as descriptive ethnographies, despite the fact that they were written by amateurs before the maturation of the discipline. All ethnographic studies dealing with local groups were made after 1900; the efforts of early ethnographers such as Boas and Swanton were concentrated to the north of the area of interest here.

By the twentieth century, the knowledge of native informants regarding the traditional life of their people was necessarily limited. In many cases, their lives had been preceded by nearly a century of increasingly intensive acculturation and cultural change. Elizabeth Colson, who did field work in Neah Bay in 1941 and 1942, clearly stated the problem in dealing with contemporary informants:

> the very oldest people can describe the building of the old "smokehouse" as it was done when they helped in the construction. Those in their sixties and early seventies lived in the old-style houses as children until they went to the boarding school, but they returned home to live in "modern" houses. They can describe the appearance of the houses and the arrangement of people and furnishings, but they rarely mention any details regarding methods used in the construction of the buildings. Others in their fifties never lived in the old houses, though they visited older relatives who still inhabited the few remaining structures. Those under fifty have only a hearsay knowledge of the old smokehouses, the methods of construction, the arrangement of the interiors, and the manner of life led within them (Colson 1947:175).

Colson's statement is particularly relevant to this study since it uses as an example the gathering of architectural data. Whereas some ethnographers are careful to note data that have validity for the protohistoric or precontact period, others do not. Care must be exercised in dealing with these accounts and they must be compared with other historic data sources.

CHAPTER 4

OZETTE ARCHITECTURAL ELEMENTS

Introduction

Shed-roof dwellings at Ozette, as well as those recorded historically, may be seen as involving a number of discrete constructional ideas. Walls, for example, were built independently of the roofs; roof coverings were essentially independent of the roof-support frames. These, and other constructional ideas relating to such things as benches, partitions, and storage shelves are referred to here as structural features. Taken together they constituted the finished building.

Structural features are not irreducible, however, but were generated through different combinations of structural elements. Structural elements are the basic parts, defined on the basis of morphology, function, and, in some cases, material from which a house was constructed. In practical terms these elements were irreducible as far as their relationship to a finished structure was concerned.

In this and the following chapter, I discuss the structural elements and features that made up the Ozette dwellings. The Ozette data are derived from all structural remains recovered in the protohistoric components of the site (that is, Units IV and V) through 1977. Included in the sample may be remains washed into these house areas from structures not yet identified. The structural features discussed in the next chapter are limited to those encountered in House 1 and House 2. The remains from both of these dwellings were almost completely excavated while House 3 and House 4 have been only sampled. Recovered House 5 structural features (the dwelling above which House 2 was constructed) were few in number as the structure was abandoned and dismantled. In addition to the architecture of House 1 and House 2 found at Ozette, a number of other architectural manifestations are discussed. These accessory features did not contribute directly to the structural integrity of the Ozette dwellings but related to the houses indirectly in a maintenance function. In any event, they are considered part of the Ozette architectural system as it is defined here.

Structural Elements

The structural elements involved in the shed-roof houses found at Ozette are relatively few in number. These elements are as follows:

1. Planks
2. Poles
3. Posts
4. Beams
5. Stakes and pegs
6. Withes
7. Roof weights
8. Post linings
9. Whalebones

The first six structural elements listed are all made of wood. Indeed, the nearly exclusive use of wood in constructing the Ozette dwellings is a primary characteristic of these as well as of all Northwest Coast houses. This dependence upon wood distinguished the permanent dwellings of the

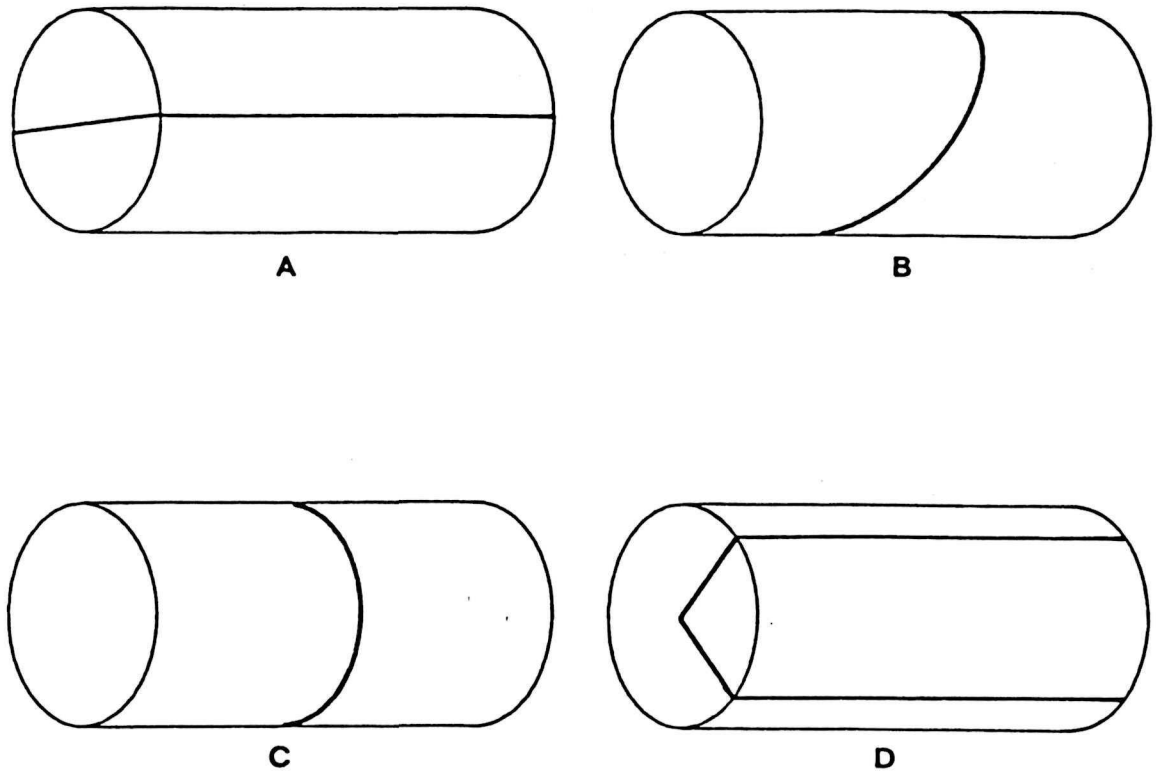


Figure 30. Segmented cylinders: A - longitudinal; B - diagonal; C - transverse; D - radial.

Northwest Coast from other native American houses which frequently employed materials such as stone, skins, sod and mud, as well as wood.

Wood was available to the protohistoric Ozettes in the form of standing trees and driftwood. While the trunks and branches of trees may occur in all stages of maturity, they share a single morphological characteristic: tree trunks and branches are always long relative to their width and are circular in cross-section. In geometric terms, they are elongated cylinders. Viewed in this way, the Ozettes manufactured the bulk of their structural elements from wooden cylinders.

Given the needs of the Ozettes and the technologies available to them, cylinders of wood may be segmented in a limited number of ways: radially, transversely, longitudinally, and diagonally (Figure 30). Of these, diagonal segments rarely occur in the structural elements except in sharpened poles and bevel-cut planks. Radial segments are limited to firewood and withes. Transverse and longitudinal segmentations are involved in the manufacture of nearly all of the structural elements. Combinations also occur; a plank with bevel-cut ends, for example, involves both longitudinal and diagonal segmentation.

Planks

Planks are the most common structural element in the Ozette collection. The covering of the Ozette houses was entirely of planks; the other structural elements and features simply held them in place. Inside the houses, planks were involved in a variety of functions such as benches and partitions.

Planks are distinguished by minimal thickness relative to length, and a length greatly exceeding the width. Generally the sides of planks are parallel and often the ends are squared. All of the planks in the Ozette collection seem to have been made of cedar. Gibbs (1970:215) notes that sometimes fir was used by the Makahs in addition to cedar, whereas Swan (1870:47) implies that all planks manufactured by the Makahs were of cedar.

The selection of cedar for plank manufacture is unquestionably related to characteristics of the wood itself. J. Friedman (1975:74–76) has listed the properties of western red cedar that made it preferable to other woods for the Ozette woodworkers. These properties include low cleavability, straight grain, lightness, durability, resistance to rot and, possibly relevant to its use for house coverings, high insulating qualities. The great height and large diameter to which cedar trees grow, as well as their relative freedom from knots, made cedar particularly useful for the manufacture of canoes and houses.

Logging

The first step in the manufacture of planks for dwellings was to obtain suitable logs. Swan (1870:4) states that drift logs were used by the Makahs whenever available for manufacturing planks and canoes. This source must have been undependable and much less abundant in protohistoric times than at present. Within the historic period, commercial logging operations account for the bulk of the drift logs cast up on the Makah coastline. Swan (1870:4) mentions that the cedar around Cape Flattery was "small and of inferior quality" and that most of the planks used by the Makahs were bartered from Vancouver Island. While this may have been true for the period of Swan's residence in Neah Bay, it was during the time when Makah culture was changing rapidly. Also, while cedar trees close to saltwater are generally small, larger trees occur farther inland. Considering the quantity of planks involved in the Ozette structures, it is unlikely that the source for the bulk of the planks was distant. It is more likely that the planks were logged and manufactured locally.

There are few data on the traditional logging practices of the Makahs. Swan (1870:36) reports that the felling of canoe logs was accomplished with "stone hatchets." Densmore (1939:16) states that trees were felled through the use of chisels with elk bone tips. She illustrates a chisel bound with withe on the end opposite the blade (Densmore 1939: plate 10a). Similar withe-bound chisels were recovered at Ozette although these generally were metal bitted. The proximal ends often were mushroomed over from being struck, presumably with stone mauls. In addition, stone mauls, similar to the one illustrated by Densmore (1939:plate 10c) were found at Ozette. Trees for canoes were felled by cutting two notches in the trunk of a tree a short distance apart and splitting out the wood in between (Densmore 1939:19-20). This technique also may have been employed protohistorically to provide logs for plank splitting.

Plank Splitting

Although information on the traditional logging practices of the Makahs is limited, more information is available on the process of plank manufacture. Planks were formed by splitting them from logs, the only practical means within the limits of traditional Makah woodworking technology. Again, the straight grain and low cleavability of western red cedar made this wood particularly suited for plank splitting. Despite his assertion that most of their planks were obtained from across the Strait of Juan de Fuca, James Swan provides an excellent account of plank manufacture by the Makahs; the tools used were withe-bound wedges and pestle-like stone mauls.

> The Indian first strips the bark from the log, and cuts off the end as squarely as he can; he next cuts transversely through the top of the log, as far from the end as the required length of the plank, and as deep as the required thickness. A horizontal cut is then made across the end of the log with the axe, and into this are inserted the wedges, about three inches apart. These are struck successively with the stone hammer till the split is effected; more wedges are then inserted in the longitudinal split on each side of the board, and all being regularly driven in, the board comes off very straight. The first piece being rounded on the top, is a mere slab. The process is repeated until the log is entirely split up. The widest and best boards are from the centre, and are highly prized. I have measured some of them which were over five feet in width. The choicest are reserved for use in the interior of the lodge, or to paint their rude devices upon (Swan 1870:4–5).

In an unedited transcript a later Makah informant described the process in much the same way:

> It was made out of cedar log. They used to have wedge made of yew wood about three feet long. They used to have dozens of them. They used some kind of black stone for maul. They used to split that big piece of cedar up to four or five feet wide boards. They used to use that wedge somewhere there they can put it to make it flat, until they can get so many pieces out of one log (Swindell 1941:28).

It may be assumed that plank splitting proceeded from the top to the bottom of a horizontal log. No mention is made in either of the above accounts to reducing a log by half of its diameter, turning it over, and reducing the remaining half.

The woodworking tools recovered from Ozette indicate that planks were manufactured in much the same manner as described above. In addition to the stone mauls mentioned previously, many wood wedges have been recovered. Some wedges had not been used and exhibit a conical point over which a withe collar was to be placed. Others exhibit withe grommets and their proximal ends are mushroomed-over from battering with mauls. As with the collared chisels, the withe binding prevented the body of a wedge from splitting under the blows of a maul. Of a sample of 438 wedges in the Ozette collection, 88% were of the compression wood of spruce and less than 10% were of yew (J.Friedman 1975:119).

Recent efforts at hand splitting planks in Neah Bay suggest that the process is not as simple as one might assume from the published accounts. While low cleavability is a characteristic of western red cedar, individual trees may vary considerably in this quality. Knots present particular problems when splitting and freeing planks from a log. Grain may spiral around a log, resulting in twisted planks. Partially split planks may suddenly dive into a log, or surface early resulting in a prematurely terminated plank.

Although sorting for function probably occurred after a number of planks had been split, some forethought as to function must have been required during splitting. Bench planks, for example, are considerably thicker than other planks. Roof planks also must have been split thicker than other planks to allow for the subsequent dressing to produce raised edges.

The thickness of a plank was controlled by the placement of the wedges. The length of a plank was governed by the length of the original log from which it was split or, if the log was longer than the required planks, by cutting a notch across the log in the manner described by Swan. While longer planks probably were desired, one which feathered out could be trimmed. The ends of planks in the Ozette collection show a single bevel in most cases. Plank widths were controlled by the portion of the log from which the plank was derived, becoming progressively wider as the center of a log was reached. As Swan notes, the Makahs regarded the best planks as coming from the centers of logs.

Dressing

While Swan did not mention alteration or dressing of planks after splitting, roughly half the wall planks in the Ozette collection are dressed to some degree on one or both sides. Roof planks and benches all exhibit extensive alteration.

According to Swan, the woodworking tools of the Makahs included knives, stone hatchets, and chisels of mussel shell. He also illustrates both elbow and D-adze forms (Swan 1870: Figures 15 and 16). Chisels and knives armed with metal blades were recovered at Ozette but adzes form only a small proportion of the woodworking tool inventory. Ozette woodworking tools are the subject of a separate study (Gleeson 1980b) and many of his conclusions apply to the structural remains and plank dressing in the Ozette collection. This study of woodworking technology is to be part of a forthcoming volume in this series.

Although it is likely that knives, chisels, and adzes were involved in dressing the surfaces of the Ozette structural remains, the applications of these tools are indistinguishable as far as this study is concerned. Therefore, the term "dressing" will be used in this study to cover use of these tools when they are applied to the structural remains for smoothing and trueing.

Several distinct dressing styles are exhibited on the structural remains in the Ozette collection. The scars from these vary in size, depth, alignment, and regularity. In some cases, they grade into one another on a single plank. The styles that appear on the Ozette structural remains may represent general styles popular among the Ozettes or may reflect woodworking styles of single individuals. In a few cases, the tool marks on several planks are so similar as to suggest that they were the work of the same implement.

The readily identifiable dressing styles include random, aligned, and fluted dressing. Random dressing shows no particular pattern, although scars may have the same orientation, depth, and size on a single plank, particularly if the same tool and fabricator were involved in its manufacture. Aligned scars occur in such a way as to suggest that successive blows were in a line, resulting in roughly parallel rows of scars running the length of a plank (Figure 31). Fluting is similar to aligned dressing except that the alignment and depth of the scars are so regular that longitudinal ridges result (Figure 32). The troughs between the ridges may vary in width or depth and some are so narrow that they must have been carved with knives.

Dressing seems mainly to have been applied to wall planks for the purpose of trueing them. Some styles, especially fluting, appear more elaborate than was necessary for this purpose. It has been casually suggested that fluting may have been done on roof planks to facilitate water drainage but the style does not appear to be restricted to such planks. Another possibility is that elaborately dressed planks may relate to the social realm: perhaps as an exhibit of the owner's or household's wealth through the investment of labor necessary to manufacture them.

Sanding might be considered a form of dressing and Densmore (1939:20) reports that historically, at least, canoe bottoms were smoothed with whale vertebrae. While some structural remains in the Ozette collection are so smooth as to suggest sanding, there is no direct evidence to indicate this technique was employed at Ozette. Materials available for sanding, if in fact it was done, would include sharkskin, sandstone slabs, and whale vertebrae.

Morphological Classes

Examination of the planks in the collection of structural remains from Ozette reveals a number of distinct morphological classes. These classes resulted from the application of dressing techniques after the planks were split from logs. One class, split planks, is distinguished by the lack of further alteration.

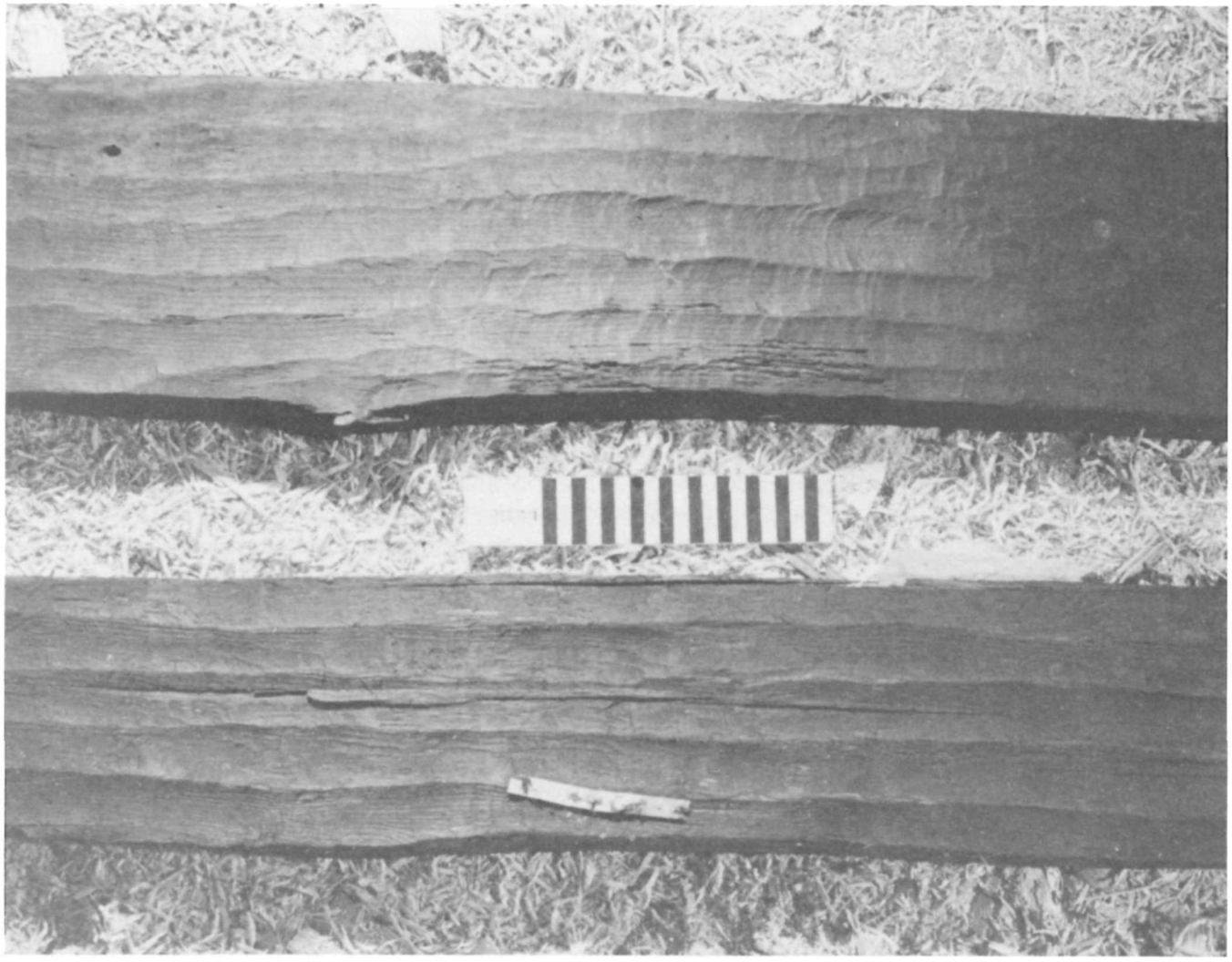


Figure 31. Planks displaying aligned dressing scars.

Split Planks. Whereas all of the planks in the Ozette collection, with the exception of cross-grain planks, were manufactured by splitting techniques, the term as used here indicates a lack of further alteration or dressing on the surface. The metric attributes of this class are listed in Table 2. Length measurements were derived from a sample of 10 planks and width from a sample of 14. In this and following tables displaying metric attributes, the average measurement ($\overline{X}$) and the standard deviation (sd) also are presented for each dimension. Split planks apparently satisfied the morphological requirements for their intended function. While some of the planks in the sample are twisted or distorted, this generally was the product of burial by the Unit IV slide and exposure through archaeological excavation.

Slabs, the first and last planks to be removed from a log, occur infrequently in the Ozette collection; only a few have been found. Apparently they were undesirable as construction material, perhaps because of their plano-convex cross-section, and either were discarded or used for other purposes.

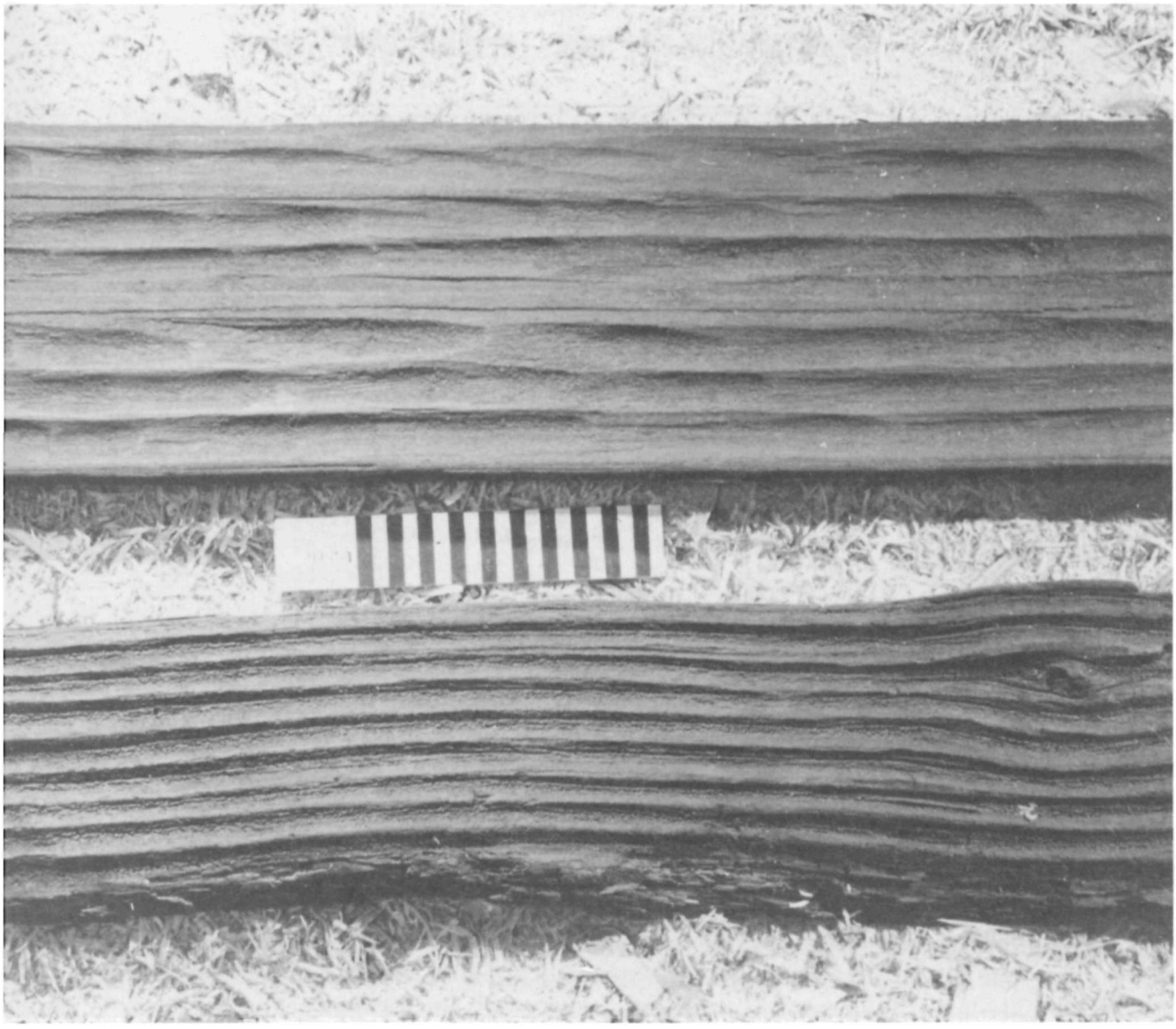


Figure 32. Planks displaying fluted dressing scars.

Dressed Planks. The members of this class show some degree of dressing on one or both surfaces. Bilaterally and unilaterally lipped planks are subtypes in this class but are discussed separately.

Several factors may have been involved in the decision to dress certain planks. These planks may have been thicker than desired and were dressed to bring them into the required range of thickness; this may be indicated by the fact that the average thickness of dressed and split planks are identical. A more likely explanation is that dressing was applied to true a plank, both laterally and longitudinally. Although cedar splits straight, some unevenness may occasionally result. It would be difficult to construct a weather-tight wall with withe slinging techniques if irregularities on plank surfaces were not corrected. It also is possible that the decorative effect of an adzed plank played some role in the decision to dress certain planks.

Table 2

Metric Attributes of Split Planks (in Meters).

Key Number	Length	Width	Thickness
6/IV/17	2.15	—	0.025
29/IV/28	3.91	0.29	0.02
31/IV/37	—	0.41	0.03
40/IV/39	5.36	0.24	0.02
40/V/130	—	0.23	—
41/IV/1	3.17	—	0.03
75/IV/1	—	0.38	0.035
75/IV/19	—	0.49	0.03
75/V/17	—	0.25	0.02
76/IV/21	—	0.34	0.03
76/IV/23	4.15	0.27	0.02
110/IV/26	3.43	0.30	0.02
111/V/15	3.85	—	—
129/IV/30	—	0.28	0.02
164/V/2	2.25	—	0.03
164/V/179	6.98	0.29	0.03
73/S/24	—	0.31	0.02
178/T7/2	4.31	0.30	0.03
$\overline{X}$=	3.96	0.31	0.03
sd=	1.43	0.07	0.006

The metric attributes of the dressed planks in the Ozette sample are listed in Table 3. Complete length was obtainable from only 13 and width from 14 of these planks.

Bilaterally Lipped Planks. Bilaterally lipped planks are distinguished by a raised lip along both edges of one surface of the planks. Two basic production techniques were involved. On some planks, lips were formed by carving out the center of a plank leaving lips along each edge of one side (Figure 33A). With this method, the center thickness is less than the edge thickness. A second method involved forming lips on one side of a plank by carving gutters near each of the plank's edges (Figure 33B). Relatively little wood was removed by this technique.

In addition to guttered and troughed planks, some fluted planks might be considered a form of bilaterally lipped planks. In such cases, the flutes immediately adjacent to the edges of the planks formed the lips (Figure 33C). Troughed and guttered planks occur with nearly equal frequencies, whereas fluted planks are rather rare.

As with all planks in the Ozette collection, fabrication of bilaterally lipped planks was begun by splitting boards from logs. The average thickness at the center of bilaterally lipped planks (2.8 cm) is somewhat greater than that of plain dressed planks (2.6 cm). This slight difference suggests that bilaterally lipped planks were split slightly thick or that thicker planks were selected for roof boards after splitting. Since the fabrication of the troughs and gutters involved reducing the thickness of such boards, selection of thicker planks might be expected in order for them to maintain strength. Metric data on bilaterally lipped planks are listed in Table 4.

Following the splitting and selection of boards intended for such planks, the boards were dressed and the lips were formed in the process. While it was necessary to dress the surfaces with lips, dressing of the opposite sides would have been optional. Roughly half of the bilaterally lipped

Table 3

Metric Attributes of Dressed Planks (in Meters).

Key Number	Length	Width	Thickness
3/IV/23	5.23	—	0.03
6/V/35	3.80	0.20	0.025
7/V/1	5.43	—	0.02
22/V/3	2.79	0.47	0.02
30/IV/12	3.12	0.40	0.03
30/IV/41	4.60	0.77	0.02
30/IV/77	—	0.31	0.02
33/IV/34	—	0.44	0.035
35/IV/2	3.69	—	0.03
43/IV/11	5.28	0.59	0.02
63/IV/24	—	0.41	0.02
71/IV/16	—	0.48	0.035
75/IV/45	2.95	0.40	0.04
76/IV/45	2.50	0.38	0.02
111/V/34	—	0.30	0.02
111/V/56	3.98	—	0.03
111/V/57	3.94	0.31	0.02
12/IV/1	—	0.33	0.03
161/T7/2	3.58	—	0.025
$\overline{X}$=	3.915	0.414	0.026
sd=	0.97	0.14	0.007

planks in the Ozette sample were dressed on both sides. This probably was for purposes of truing and smoothing as many of these planks were used as roof planks and it was particularly important that they laid flat. In addition, the edges of such planks had to be straight and even for the planks to lock together. Trimming of the edges of bilaterally lipped planks is generally visible.

Cross-Grain Planks. A number of planks in the Ozette collection were fabricated from the sides of canoes. These planks are distinguished by their cross grain; that is, the sides of the planks show the grain curving back on itself while in edge view the grain is diagonal from one side to the other. In addition, these planks generally are smooth on both sides and larger pieces show some degree of lateral and longitudinal curvature. While several fairly large examples of cross-grain fragments exist in the Ozette collection, most are small fragments broken before or during the Unit IV mudslide.

The grain exhibited on cross-grain planks indicates that they were fashioned by carving at an angle to the natural grain of the log rather than by splitting with the grain. A number of specimens in this class exhibit attributes that generally are associated with canoes (Swan 1870:35–38; Waterman 1920). On a few pieces, strips are sewn onto one edge of the larger fragments. These strips originally were gunwale strips and the larger sections of plank are hull fragments (Figure 34). The free edges of the gunwale strips often are rounded and indented from paddles scraping against them.

Pairs of drilled holes, often plugged with the remains of withes, are found on a few of the specimens. These holes are the perforations in the hulls of canoes through which passed the withes that bound the thwarts in place (Figure 34). Other holes also occur but are filled with pegs. These

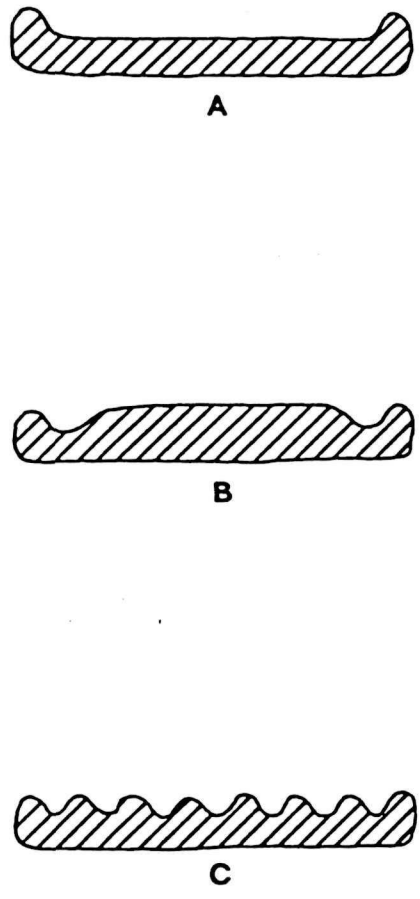


Figure 33. Bilaterally lipped plank cross-sections: A - troughed; B - guttered; C - fluted.

were drilled during the manufacture of the canoes for gauging the thickness of the sides and bottoms, and later were plugged.

The presence of canoe fragments as structural remains at Ozette may be explained through the principles of recycling and economy. Canoes were rendered unusable through excessive checking or their bottoms wearing out. Once this had happened, the sides were cut out for use as planks.The more strongly curved portions of the canoes, near the bows and sterns, were not used as structural components in houses.

Unilaterally Lipped Planks. A number of planks in the Ozette collection are unilaterally lipped. Lips occur on one side of one edge of these planks, or, more rarely, on both sides of one edge (Figure 35). These planks also are distinguished from other plank classes by greater widths and thicknesses.

Boards intended as unilaterally lipped planks were split much thicker than other planks to allow for the fabrication of the lips. This suggests that at the plank splitting stage, the function of these planks had already been determined. Fabricating the lips on these planks involved dressing one or both sides of the planks. The lips vary considerably in depth; when they are excessively developed, they are termed "fronts" (Figure 35B, C). Metric data on unilaterally lipped planks are listed in Table 5.

Table 4

Metric Attributes of Bilaterally Lipped Planks (in Meters).

Key Number	Length	Width	Thickness
027/IV/11	4.00	—	0.05
027/IV/6	4.38	—	0.05
02/IV/1	—	0.30	0.02
3/IV/10	—	—	0.025
8/IV/2	—	—	0.03
9/IV/1	—	0.64	0.04
22/V/1	—	0.47	0.025
27/IV/1	4.85	0.39	0.035
29/IV/15	—	—	0.04
30/IV/10	—	—	0.035
30/IV/27	4.65	0.30	—
30/IV/37	—	—	0.03
32/IV/52	—	—	0.04
35/IV/2	—	—	0.03
36/IV/70	—	—	0.025
38/IV/43	—	—	0.02
43/IV/9	5.18	0.49	0.025
43/IV/11	—	—	0.03
44/IV/2	5.32	—	0.03
45/IV/5	6.15	0.37	0.03
57/IV/1	5.20	0.54	0.045
58/IV/13	4.23	0.51	0.02
59/IV/5	—	—	0.025
63/IV/30	—	—	0.025
63/IV/31	—	0.30	0.025
63/IV/41	—	0.29	0.02
73/IV/4	—	—	0.03
73/IV/7	—	—	0.03
74/IV/4	—	0.32	0.02
108/IV/16	—	0.48	0.03
110/IV/14	—	0.31	0.02
111/IV/22	—	—	0.02
129/IV/25	—	—	0.025
129/IV/31	—	—	0.025
130/IV/32	—	—	0.025
130/IV/36	—	—	0.03
131/IV/18	—	—	0.025
133/IV/12	—	—	0.03
142/IV/11	4.07	0.27	0.03
142/IV/14	—	—	0.03
144/IV/17	—	—	0.02
145/IV/20	—	—	0.025
145/IV/61	5.18	—	0.02
166/V/1	—	—	0.02
UK-31	—	—	0.025
$\overline{X}$=	4.84	0.40	0.028
sd=	0.65	0.11	0.008

Functional Classes

The classification of planks presented so far has been based upon morphological criteria representing specific decisions and actions during the manufacture of these planks. These decisions and actions related to the dressing of the planks; whether or not it was applied and, if so, the degree and manner in which it was applied. The plank classes produced by this approach are monothetic

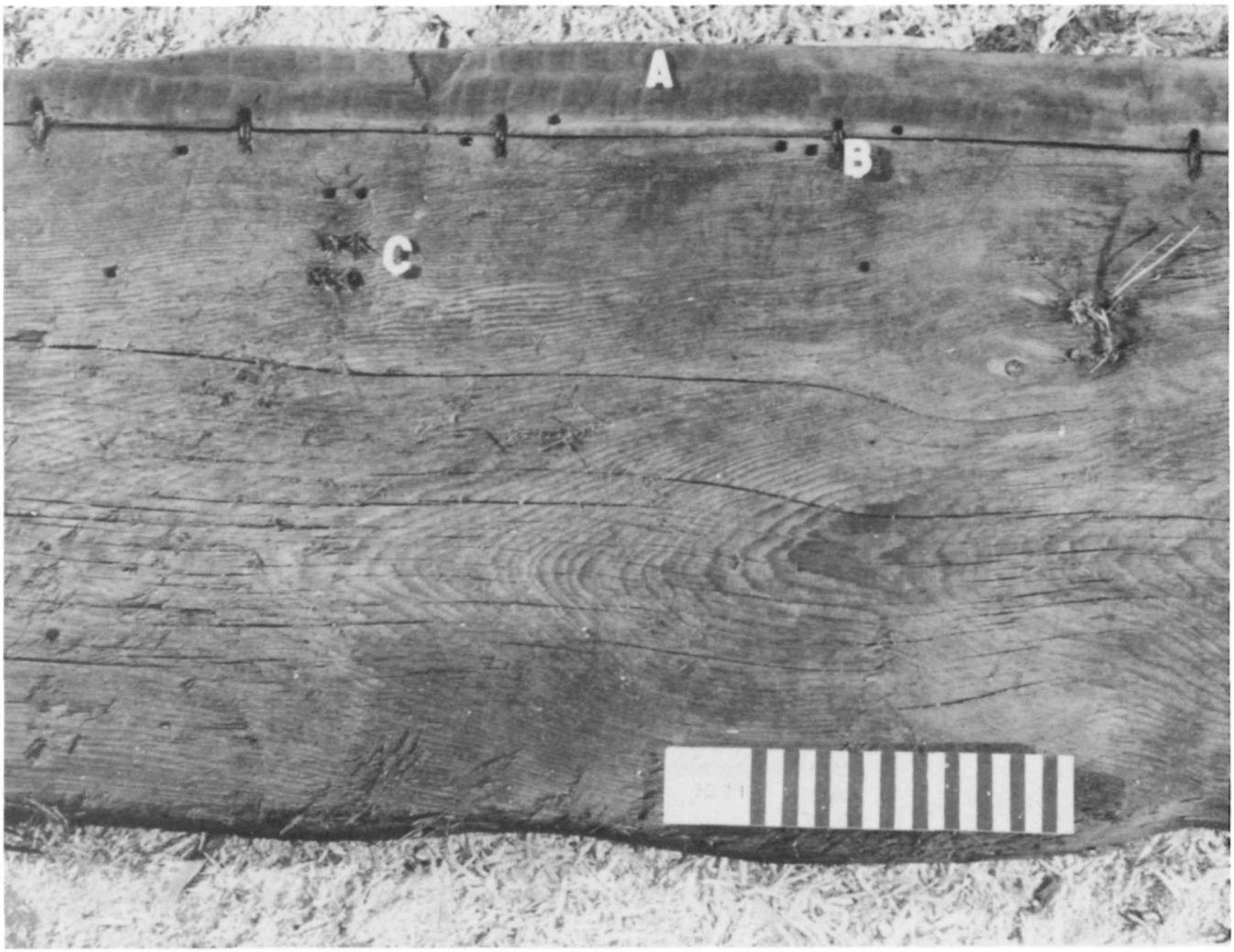


Figure 34. Cross-grain plank derived from a canoe side: A - gunwale; B - gunwale ties; C - thwart ties.

(Clarke 1968:37); that is, membership in a class requires the possession of certain attributes and these attributes are sufficient for membership in a class.

The morphological classification was useful in the preliminary sorting of the Ozette structural remains and in defining certain recurring morphological forms. This approach does not, however, go far in elucidating the role of these planks in the houses, nor do the classes share a one-to-one correspondence with a functional classification of the same structural remains. Often the relationship between the morphological classes and a functional classification of the planks is one way; for example, all unilaterally lipped planks were benches but not all benches were unilaterally lipped. The same relationship holds between bilaterally lipped planks and roof planks.

A functional classification of the Ozette structural remains is, by necessity, polythetic; membership in a functional class requires the possession of certain attributes, but no one attribute is necessary and sufficient for inclusion into that class. This is due to the fact that function is not only related to manufacturing and morphological attributes, but involves other factors, often social or circumstantial. Fronted benches, for example, may have belonged to wealthier members of a household as a result of the greater amount of wood and labor involved in their production. Another

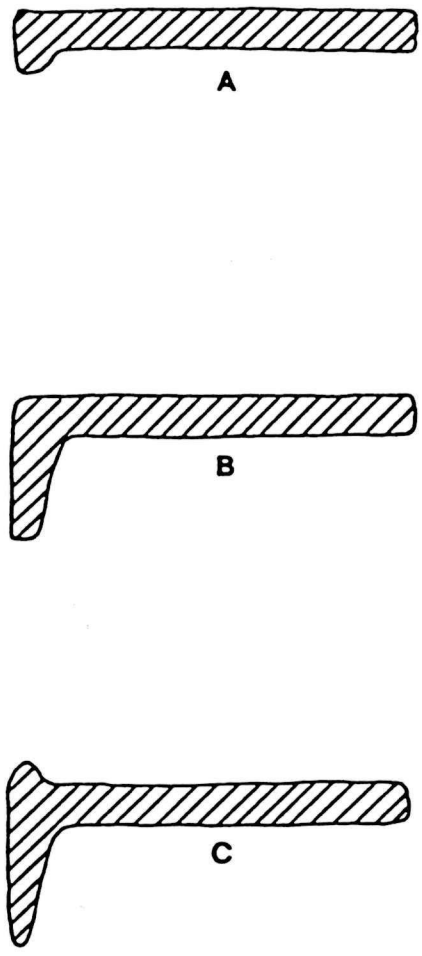


Figure 35. Unilaterally lipped plank cross-sections: A - single lip; B - single front; C - double-lip front.

possibility is that their use may have been an inherited right of only a few members of a household. Such factors may account for morphological variation in a single functional type, yet are difficult to identify archaeologically.

In a household coping with daily problems and the real world, circumstantial factors also must have affected the function of certain morphological classes of structural elements. A damaged bilaterally lipped roof plank might be replaced with a plain-dressed or split plank until another could be fabricated. Indeed, some households may not have been able to muster the manpower nor afford the time to fabricate structural elements according to existing cultural norms. Economy and recycling, often evidenced in the Ozette structural remains, were necessitated by the labor required to fabricate structural elements. This resulted, for example, in walls of the Ozette dwellings being made up of split, dressed, and bilaterally lipped planks. With these limitations in mind, a functional classification of the planks in the structural remains from Ozette is presented below.

Table 5

Metric Attributes of Unilaterally Lipped Planks (in Meters).

Key Number		Length	Width	Thickness
027/IV/13		2.11	0.63	0.05
25/IV/1		3.63	0.75	0.05
26/IV/5		3.93	0.74	0.05
29/IV/32		2.87	0.71	0.05
30/IV/13		3.81	—	0.05
30/IV/45		3.74	0.72	0.055
30/IV/111		3.13	0.65	0.05
58/IV/14		2.77	—	0.05
110/IV/20		2.91	0.82	0.04
142/IV/18		5.91	0.64	0.05
144/IV/61		3.21	0.80	0.05
	$\overline{X}$=	3.46	0.72	0.05
	sd=	0.98	0.07	0.0035

Wall Planks. Wall planks are functionally defined as those planks involved in the construction of the walls of the Ozette houses. In terms of morphology, split, dressed, and bilaterally lipped planks all were associated with Ozette house walls. Split and dressed planks dominate this functional class while bilaterally lipped planks occur less frequently.

Since the walls of Ozette houses were mainly constructed of split and dressed planks, it is of interest to compare the average length, width, and thickness measurements of the two plank classes (Tables 2 and 3). Despite the small sample sizes, the average lengths are within 5 cm of each other. The average widths of the two plank classes vary by over 10 cm, however, while their average thickness is within 0.5 cm.

The fact that the average lengths of the two plank classes are so close suggests a norm for wall plank lengths. A consideration of the ranges of lengths in the two plank classes, however, indicates that such was not the case. Split planks range between 2.15 m and 6.98 m in length while dressed planks range between 2.50 m and 5.43 m. The lengths of split planks vary by a factor of three while those of dressed planks vary by a factor of two. Split planks have a range over 60% greater than dressed planks. It seems that there was not a decided preference for wall plank length and considerable variation was allowed by the protohistoric Ozettes.

In the case of width, there must have been a practical minimum for wall planks as successive courses of planks were overlapped along their longitudinal edges. This minimum may be reflected by the minimum widths in the Ozette sample: 23 cm for split planks and 20 cm for dressed planks. In terms of maximum width, there was no practical limit on planks except for the size of available trees. The walls of Ozette houses could accomodate planks of virtually any width beyond a minimum of approximately 20 cm. The similarity in the average thickness and range of thicknesses for split and dressed planks suggests that there may have been a norm for this dimension. Such a norm may have resulted from several factors. The weight of a wall may have been a structural consideration. Since a given square footage of wood was required to cover a wall, the only dimension in which weight could be reduced was in the thickness of the planks. In addition, because of the labor involved in obtaining a log for plank manufacture, it probably was desirable to produce as many square feet of planks from a log as possible. The only option available, then, was to minimize plank thickness

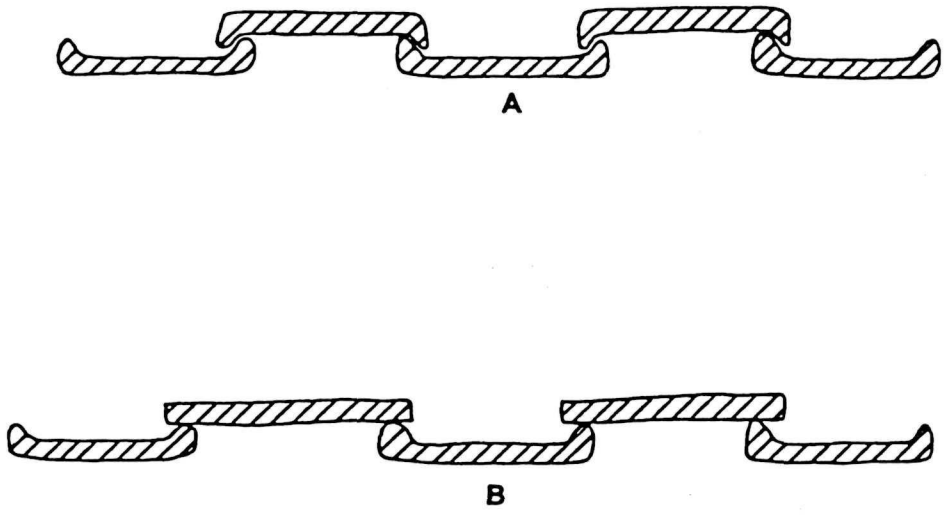


Figure 36. Roof construction technique cross-sections: A - bilaterally lipped planks for both the upper and lower courses; B - plain planks for the upper course and bilaterally lipped planks for the lower course.

without compromising strength. In summary, the length and width of the dressed and split wall planks in the measured sample from the Ozette collection do not reflect particular cultural norms. Thickness was, however, subject to cultural controls for very practical reasons.

Split planks tended to be employed in the lowermost portions of house walls and baseboard features while dressed planks generally were involved in the portions of the walls that were above the floor level. The occurrence of bilaterally lipped planks in house walls was random and they seem to have been employed as necessity dictated or opportunity allowed. When bilaterally lipped planks were used in a house wall, the lips of such planks were non-functional. Their occurrence in walls probably was the product of recycling after they had been broken and were no longer of use as roof planks. Unilaterally lipped planks were never found as structural components of the walls of the Ozette houses, probably because of their thickness and consequent weight.

Roof Planks. According to James Swan (1870:5), the boards forming the roofs of Makah dwellings "are made slightly concave on one side and convex on the other, and are set alternately, overlapping like tiles." Gibbs (1970:174) also reports that "the roof ... was made of boards, guttered out and overlapping one over another." From these accounts, there can be little question that the bilaterally lipped planks in the Ozette collection originally were intended as roof planks, and, as such, were laid with the lipped sides alternately up and down (Figure 36A). This allowed the edges to lock together and water to drain off the roofs without seeping into the houses.

Considering the roof areas of the dwellings uncovered in the protohistoric levels of Ozette, bilaterally lipped roof planks are poorly represented in the collection. Several explanations for this are possible. Since the roofs of these houses were structurally independent of the walls, the roofs may have been floated free by the Unit IV mudslide and washed onto the beach and lost or salvaged. Another possibility is that not all of the roof planks were present at the time of the slide. Swan (1870:6) notes that roof boards often were removed to the summer villages by the Makahs. Depending upon the season (the Makahs began utilizing the summer villages in the spring), the protohistoric houses at Ozette may have been only partially roofed.

A third explanation for the relative paucity of bilaterally lipped planks in the Ozette houses is that roof planks may not have been exclusively of that morphological type. Breakage or damage

to bilaterally lipped planks may have necessitated the expedient use of non-lipped planks on the roofs of houses. This would have been possible especially with the upper layer of roof planks where lips were not essential for water drainage as long as the lower layer of planks was lipped and well overlapped (Figure 36B). Evidence that the roofs of Makah dwellings were not composed exclusively of bilaterally lipped planks may be seen on the photograph of the Tatoosh Island summer dwellings (Figure 19). Close examination of the eaves of these dwellings does not reveal lipped planks.

Whereas the morphological distinction between guttered, troughed, and fluted bilaterally lipped planks is clear, the reasons for producing these different styles are not. They may represent particular styles or they may have been laid differently. Troughed planks, for example, would seem to have been more effective as the lower layer of planks because they could carry more water without overflowing the lips.

Metric data on bilaterally lipped planks are listed in Table 4. In width, these planks fall between split and dressed planks. The average length and thickness, however, is greater than either type of wall plank. Longer planks probably were desired for roof planks, thereby reducing the number of plank courses necessary and contributing to weather tightness.

In summary, bilaterally lipped planks were designed primarily as roof planks for the Ozette dwellings. Necessity and expediency, however, may have resulted in non-lipped planks in roof structures. Unfortunately, no intact roof features were recovered at the Ozette site; as a consequence, the use of non-lipped planks in the roofs of these houses remains an undemonstrated possibility.

Benches

The literature on Makah and other shed-roof houses in the Pacific Northwest indicates that benches functioned for sleeping, lounging, and work. Generally, benches were close to and paralleled walls of houses. As a functional class, benches recovered at Ozette are distinguished by morphological and locational criteria. Using these criteria, both dressed and unilaterally lipped planks were found to have functioned as benches.

Unilateral lips distinguish the majority of planks identified as benches in the Ozette structural remains. Lips on these planks ranged from thin swellings along one edge of one side of a plank to full fronts with lips on both sides of one edge (Figure 33C). The latter, double-lipped, planks are comparatively rare in the collection.

The function of the lips is not known. From the location of the unilaterally lipped benches found in the house ruins at Ozette, it is apparent that the lips were toward the center of the houses and faced downward. It is possible that the lips may have prevented the benches from sliding off their support stakes. The lips on fronted benches also may have served as back rests.

Metric data on benches from Ozette are listed in Table 6. Ozette benches vary greatly in length. There was no limit on maximum length other than that of the original log and the length of a house wall against which a bench was to be placed. The variation in length suggests that this dimension was not necessarily related to function although there must have been a minimum length for benches to have been useful.

The variation in the width of benches is much less than that of length. Converting the extremes in length and width to a standard, (z scores; Edwards 1966:101–104) for comparison, the range in length is 4.49 units on a z scale while the range in width is 4.33 units. The only non-cultural limiting factor on the width of benches was the width of the available logs. The smaller variation in width as compared to length suggests that this dimension was subject to some cultural norms. This selection probably was related to the function of benches and was applied in terms of minimum width; that is, the function of benches imposed a minimum width while the limiting factor on their maximum

Table 6

Metric Attributes of Benches (in Meters).

Key Number	Length	Width	Thickness
027/IV/13*	2.11	0.63	0.05
10/IV/2	2.50	0.67	0.04
25/IV/1*	3.63	0.75	0.05
26/IV/5*	3.93	0.74	0.05
29/IV/32*	2.87	0.71	0.05
30/IV/13*	3.81	—	0.05
30/IV/45*	3.74	0.72	0.055
30/IV/48	3.50	0.70	0.05
30/IV/111*	3.13	0.65	0.05
58/IV/14*	2.77	—	0.05
58/IV/21	2.20	0.67	0.06
78/IV/1	3.28	—	0.04
110/IV/20*	2.91	0.82	0.04
129/IV/20*	3.28	0.72	0.04
130/IV/41	1.67	—	0.04
134/IV/1	1.33	0.52	0.05
142/IV/18*	5.91	0.64	0.05
144/IV/61*	3.21	0.80	0.05
60/IV/5	—	0.91	0.05
99/IV/1	—	0.78	0.05
$\overline{X}$ (of all benches) =	3.10	0.71	0.05
sd (of all benches) =	1.02	0.09	0.005
$\overline{X}$ (of unlipped benches) =	2.41	0.71	0.05
sd (of unlipped benches) =	0.86	0.13	0.007

* Unilaterally lipped plank; see Table 4.

width was non-cultural. Among the functional prerequisites of benches was that they had to be at least the width of a person since, among other things, they served as beds.

The thickness of benches in the Ozette collection also related to their load-carrying capacity. The minimal range in thickness (4 to 6 cm) was the result of the fabricator's ability to accurately place their wedges and control the dressing of the planks.

Tool marks frequently are visible on benches as cuts, scratches, and punctures, and apparently resulted from activities on the benches. Functional wear often is visible as rounding and polishing on the ridges formed by the intersection of dressing scars.

Benches also frequently have square holes near their ends. One bench has a square hole near each corner whereas another exhibits four holes across each end. These holes are not related to mending and their function is unknown. The fact that they are square is the result of their manufacture with chisels or adzes. They do not appear to be associated with the bench-support systems or the functions of the benches. Possibly, they may have been used for supporting accessory structures such as canopies or puberty enclosures. The only other occurrence of large square holes in the Ozette structural remains is on rafter-support posts.

In summary, the benches in the Ozette collection are the thickest and often the widest planks manufactured by the protohistoric Ozettes. Unilateral lips tend to characterize members of this functional class although these were not a necessary attribute for inclusion in the class.

Plank Repair

Planks in houses at the Ozette Archaeological Site were prone to damage by checking from drying and to longitudinal and lateral breakage through use. Mending techniques were applied to repair planks when such damage occurred and to prevent further splitting. Although there was no method for repairing laterally broken planks, longitudinal cracks were repaired by sewing techniques. These techniques involved threading a withe tie through perforations made on either side of a crack and drawing the crack together. Sewing as a repair technique is well evidenced among the Ozette structural remains (Figure 37) and it also was employed as a repair and manufacturing technique in other artifact classes, particularly bent-corner boxes.

In the mended examples among the Ozette structural remains, perforations are either round or square. In the former case the holes were drilled; square perforations were chiseled or adzed. Square holes often correlate with thicker planks such as benches. On such planks, heavier withes were required because more force was necessary to prevent a crack from continuing. Since the thicker withes necessitated perforations of a diameter beyond the capacity of the Ozette's drills, the perforations were adzed or chiseled.

Perforations for mending were formed in pairs, one on either side of a crack. Once withe ties had been threaded through the perforations on either side of a crack, they were held by friction (Figure 38A), by whipping one end around the other strands (Figure 38B), or by driving pegs into the holes (Figure 38C). Whipping was done with one end of a tie (Figure 38B) or with a separate withe (Figure 38E). The functions of whipping included securing the ends of a tie, applying more tension to a crack, or protecting ties from abrasion.

In one example of plank repair, adjacent pairs of withes were drawn together with another withe. This may well have been a tightening technique to apply more tension to close the crack. Another tightening technique involved driving a splint between a mending tie and a plank (Figures 38D and 39). This technique is evidenced on one plank that had been salvaged from the side of a canoe. Whether the mending was originally on the canoe or applied only after its use as a plank cannot be determined. The splint-tightening technique also occurs on a single bent-corner box in the Ozette collection.

Evidence has not been found for use of pegging as a repair technique in the Ozette structural remains although pegs were used for securing withe ties. Pegging is primarily a construction technique applied to boxes and canoes.

Repair by mending in the Ozette sample is largely restricted to benches and dressed planks. This may reflect the greater labor invested in the production of those particular plank classes. Mending is not found on bilaterally lipped planks despite the labor involved in their manufacture, possibly because of the difficulty in making the mends absolutely watertight.

Knotholes presented special problems because they could not be drawn together like simple cracks. These holes resulted during the manufacture of a plank if a knot was not split through. They also might occur after manufacture due to differential shrinking of the knot and the surrounding wood. Repair techniques for knotholes have not been discovered in the Ozette collection.

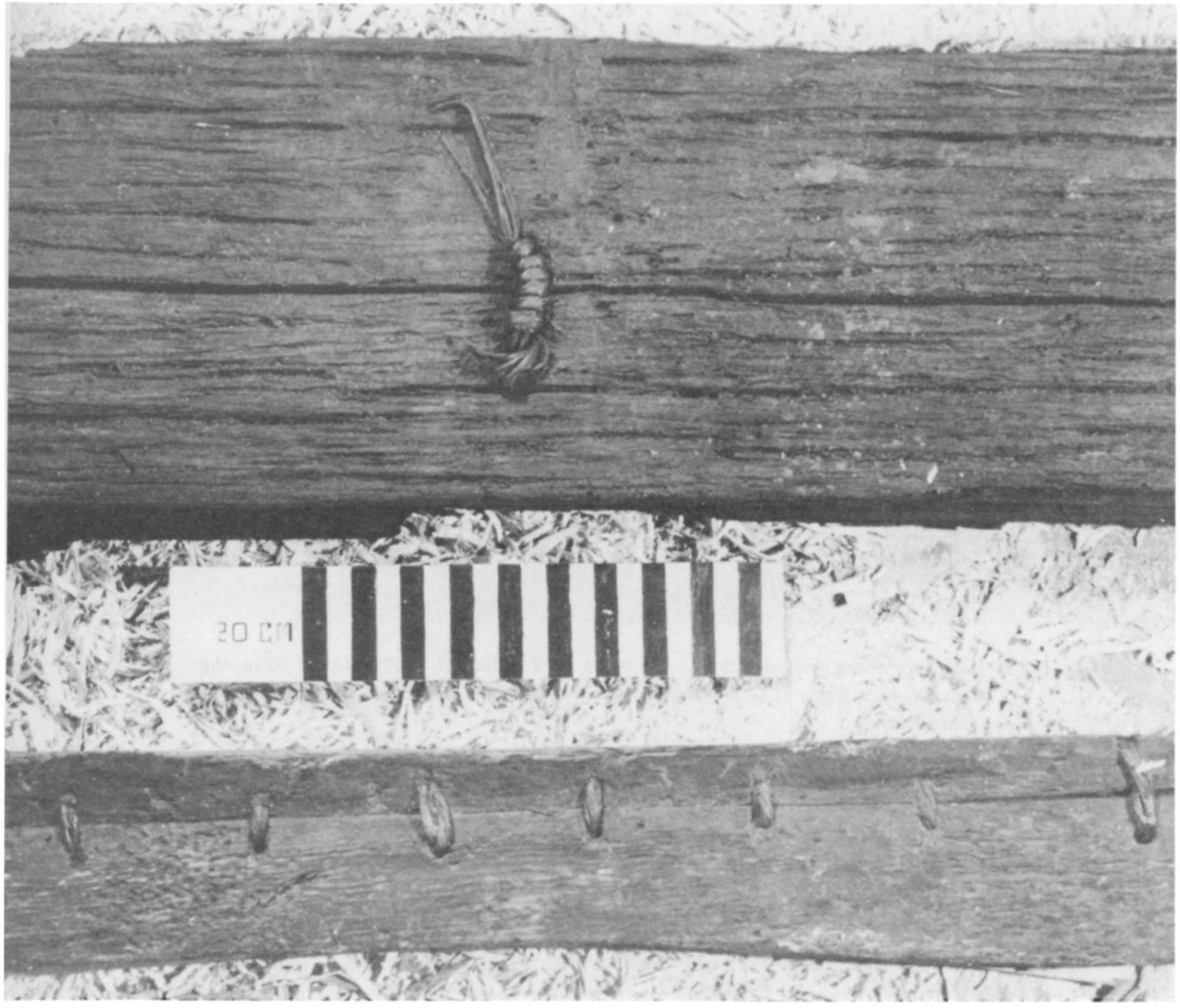


Figure 37. Planks mended by sewing with withe ties.

Posts

Posts are distinguished from other structural remains in the Ozette collection by locational, functional, and morphological criteria. Perhaps the most distinguishing feature of posts is that they were set upright and carried a load parallel to their long axis. This distinguishes them from beams, for example, which may share a similar morphology but whose load was perpendicular to their long axis. Poles also were set upright and carried loads parallel to their long axes but may be distinguished from posts in that the former are of a smaller diameter, particularly in relation to their length.

In cross-section, posts vary from circular to trapezoidal or rectangular depending upon their manufacture and function. The manufacturing complexity of posts also varied; while some simply were cut to length and their bark removed, others were the product of rather lengthy manufacturing procedures. Specific data are not available on the logging of timbers for posts; it may be presumed,

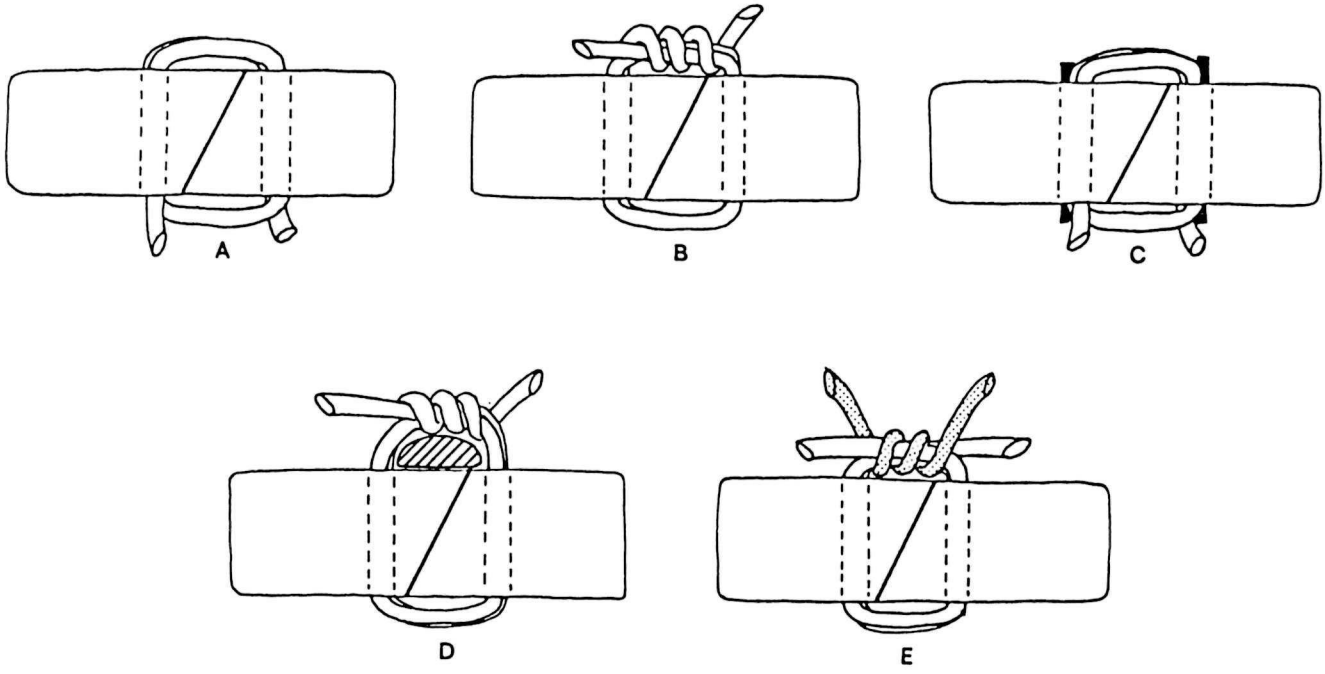


Figure 38. Plank mending techniques: A - securing by friction; B - securing by whipping; C - securing with pegs; D - tightening with a splint; E - tightening by whipping with a separate withe.

however, that the logging of posts was similar to that presented in the previous section on plank manufacture. Since most posts are as wide as the trees from which they were derived, it is apparent that they were manufactured from whole trees rather than slabs.

Post length was critical since this dimension determined the height of whatever feature they supported. The diameter of posts also was related to their function; posts supporting heavy loads necessarily were of a greater diameter than posts supporting light loads. Timbers for posts must have been selected with their eventual function in mind since the length and diameter were particularly relevant to their eventual function.

All poles in the Ozette collection were stripped of their bark. Further dressing, however, varied. Some posts are unaltered except for cutting to length and removing their bark. Others are partially or extensively dressed. Although dressing does not seem to have been related to function, it generally occurs only on rafter-support posts.

The preparation of rafter-support posts involved a lengthy manufacturing process. Since this process was directly related to the particular morphology required for the function of these posts, their manufacture will be discussed following the discussion of their function.

Rafter-Support Posts

Rafter-support posts functioned as an integral part of the roof-support system. Their main purpose was to receive and support rafter beams which spanned the widths of the dwellings. The distinguishing attribute of such posts is a semi-circular notch hewn into the top ends of the posts to receive rafter beams (Figures 40 and 41).

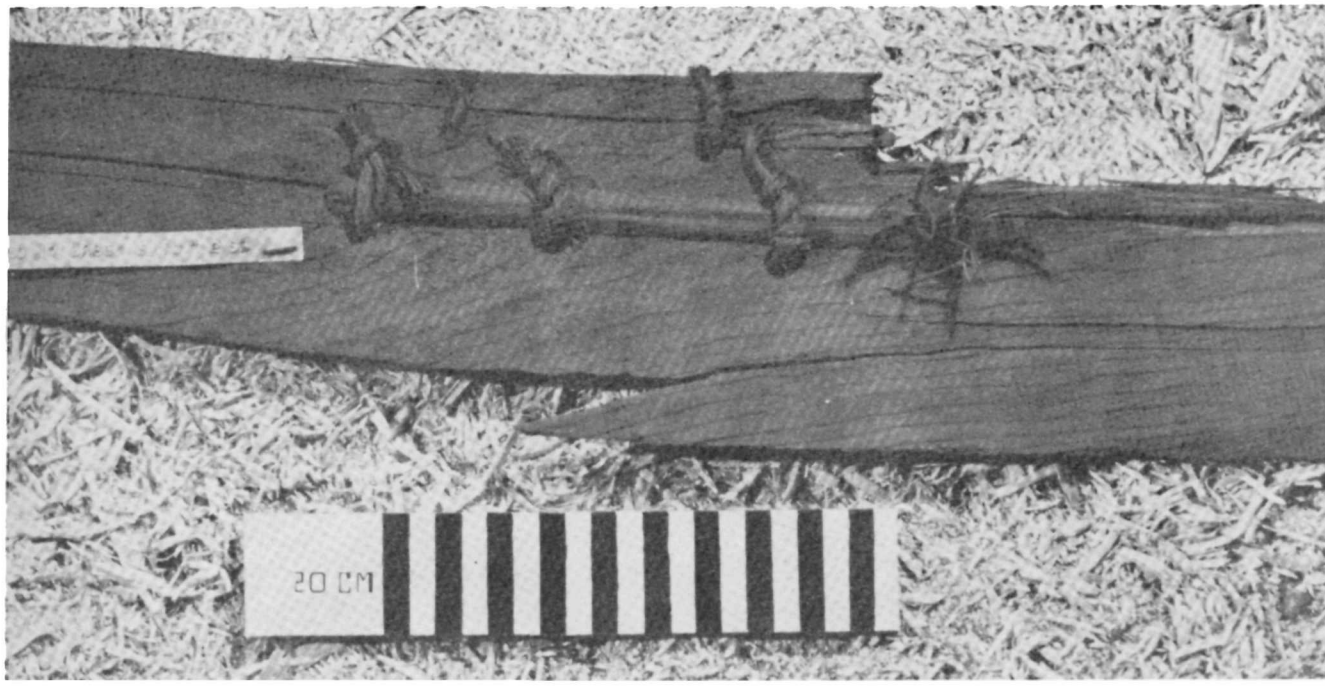


Figure 39. Mending ties tightened with a splint.

The placing of these posts was significant in terms of the overall dimensions of the houses. The distance between pairs of rafter-support posts determined the width of a house and the number and spacing of the posts controlled the length of a dwelling. The differences in heights of rafter-support posts along opposite walls of a house controlled the slope of the roof. Because rafter-support posts governed the size and height of a dwelling, they were the first elements to be erected in the process of house construction (Swan 1870:5).

Five timbers identified as rafter-support posts in the Ozette structural remains are complete. These were either uprooted intact by the Unit IV mudslide or were pieced together later from scattered fragments. Of the remaining specimens, 3 are upper ends, 1 is a medial section, and 11 are lower ends (Table 7). Many of the lower ends of rafter-support posts were recovered in place in the Unit V floor midden where the mudslide had snapped off the above-ground sections of the posts.

In order to receive rafter beams, rafter-support posts were placed adjacent to the intended locations of the long walls of the houses. House 1 was spanned by five rafter beams and four beams spanned House 2. A single rafter-support post was located near each corner of the houses and the remainder were spaced at roughly equal intervals along the east and west walls of the dwellings (Figures 42 and 43).

Only one rafter-support post was recovered in place in the west wall area of House 1. The others had been carried onto the beach by the mudslide or had been eroded out subsequently by tide and wave action. Two rock concentrations were found along the west wall line of House 1. These were found almost exactly opposite rafter-support locations along the east wall line and very likely represent post hole linings for two of the missing west wall rafter-support posts.

Lower ends of rafter-support posts were found *in situ* along the interior side of the east wall of House 1. In three of these locations pairs of lower ends were recovered. The significance of

Figure 40. Rafter-support posts *in situ* in the north part of the House 1 east wall.

these "double" rafter-support posts will be discussed in a later section. Other rafter-support post fragments found in the interior of House 1 (Figure 42) originated from either House 2 or House 3 and had been swept in by the Unit IV slide.

Manufacture. Rafter-support posts in the Ozette collection were manufactured by splitting logs longitudinally. In this sense, they are similar to planks although of a much greater thickness. The split sections were then hewn and dressed to fulfill the morphological and functional requirements of rafter-support posts. Clear wood was not necessary for their manufacture and a number of posts in the Ozette collection are somewhat knotty. Four of the rafter-support posts in the collection have been identified as being of western red cedar (J. Friedman 1977: personal communication) and the rest appear to be of the same species.

Cross-sections of the rafter-support posts from the Ozette houses vary from roughly rectangular with curved sides to plano-convex with the convex side slightly flattened (Figure 44). Several posts

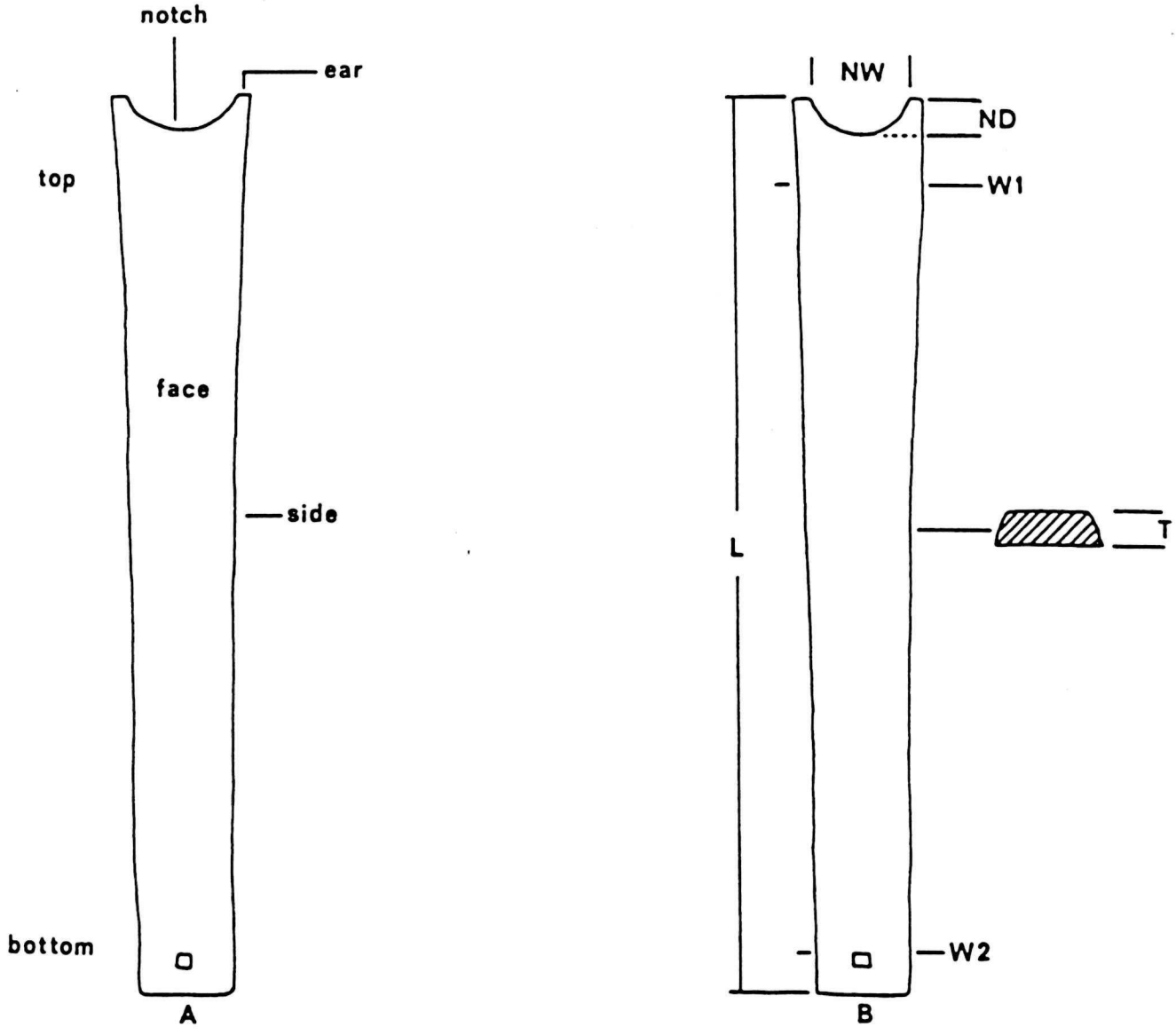


Figure 41. Rafter-support post: A - nomenclature; B - measurement locations (NW - notch width, ND - notch depth, W1 - width near top of post, W2 - width near bottom of post, T - thickness, L - total length).

probably were split from the same long, thus contributing to the varying cross-sections. Occasionally both faces of posts with plano-convex cross-sections were dressed flat. The thickness of the rafter-support posts was determined when splitting the posts from logs or by subsequent hewing of the faces. Rafter-support post thicknesses in the Ozette collection range between 9 cm and 24 cm (Table 7).

The lower ends of rafter-support posts generally were cut square across the width of the posts; on occasion, they were bevel cut across their thickness. The five complete posts in the sample range between 3.92 m and 5.07 m in length. Two posts from the east wall of House 1 (40/IV/26 and 75/IV/16) are the shortest of the five and differ in length by 19 cm. This difference suggests that

Table 7

Metric Attributes of Protohistoric Ozette Rafter-Support Posts (in Meters).

Key Number	L	W1	W2	T	NW	ND
Complete posts						
03/IV/1	5.07	0.65	0.42	0.23	0.51	0.19
65/IV/7	4.76	0.55	0.43	0.24	0.42	0.08
75/IV/16	4.11	0.57	0.44	0.15	0.42	0.19
82/IV/2	4.50	0.59	0.43	0.12	0.49	0.085
40/IV/26	3.92	0.44	0.39	0.15	0.32	0.095
Upper ends						
60/IV/7	—	0.51	—	0.09	0.35	0.12
110/IV/13	—	0.45	—	0.11	0.33	0.18
132/IV/2	—	0.43	—	0.20	0.33	—
Lower ends						
5/IV/55	—	—	0.30	0.18	—	—
5/IV/196	—	—	0.26	0.16	—	—
41/V/32	—	—	0.36	0.11	—	—
75/V/185	—	—	0.33	0.10	—	—
93/IV/19	—	—	0.53	0.14	—	—
110/V/10	—	—	0.36	0.12	—	—
138/A2/3	—	—	0.47	0.18	—	—
145/V/30	—	—	0.22	0.13	—	—
203/A-IV/1	—	—	0.36	0.12	—	—
214/TV/36	—	—	0.41	0.24	—	—
NN	—	—	0.30	0.18	—	—
$\overline{X}$=	4.47	0.52	0.38	0.16	0.40	0.13
sd=	0.47	0.08	0.08	0.05	0.07	0.05

Note: measurement locations are listed in Figure 41.

some length variation was allowed between adjacent posts and probably was equalized by the depth to which the posts were buried.

The only alteration to the sides of the rafter-support posts in the Ozette sample was the removal of bark. Only one post shows extensive dressing of its sides. Although the faces of the rafter-support post occasionally were dressed, this dressing often is minimal and no particular style was preferred. Only one post shows aligned dressing scars. On the others, scars are random and vary in size, frequency, and depth. Dressing appears to have been applied to true the shape on spiral grain logs and to flatten convex faces.

After splitting, and possibly dressing, notches were hewn into the ends of the posts. Due to the natural taper of trees, the end of a log nearer the base of a tree is always wider than the other end. From Table 7 it may be seen that notches always were formed in the wider ends of the logs; in other words, rafter-support posts were erected in an inverted position relative to the trees from which they were derived. This may relate to the fact that notches were sized according to the rafter beams that they received and smaller trees could be used if the base of the tree was wide enough to accommodate the rafter beam.

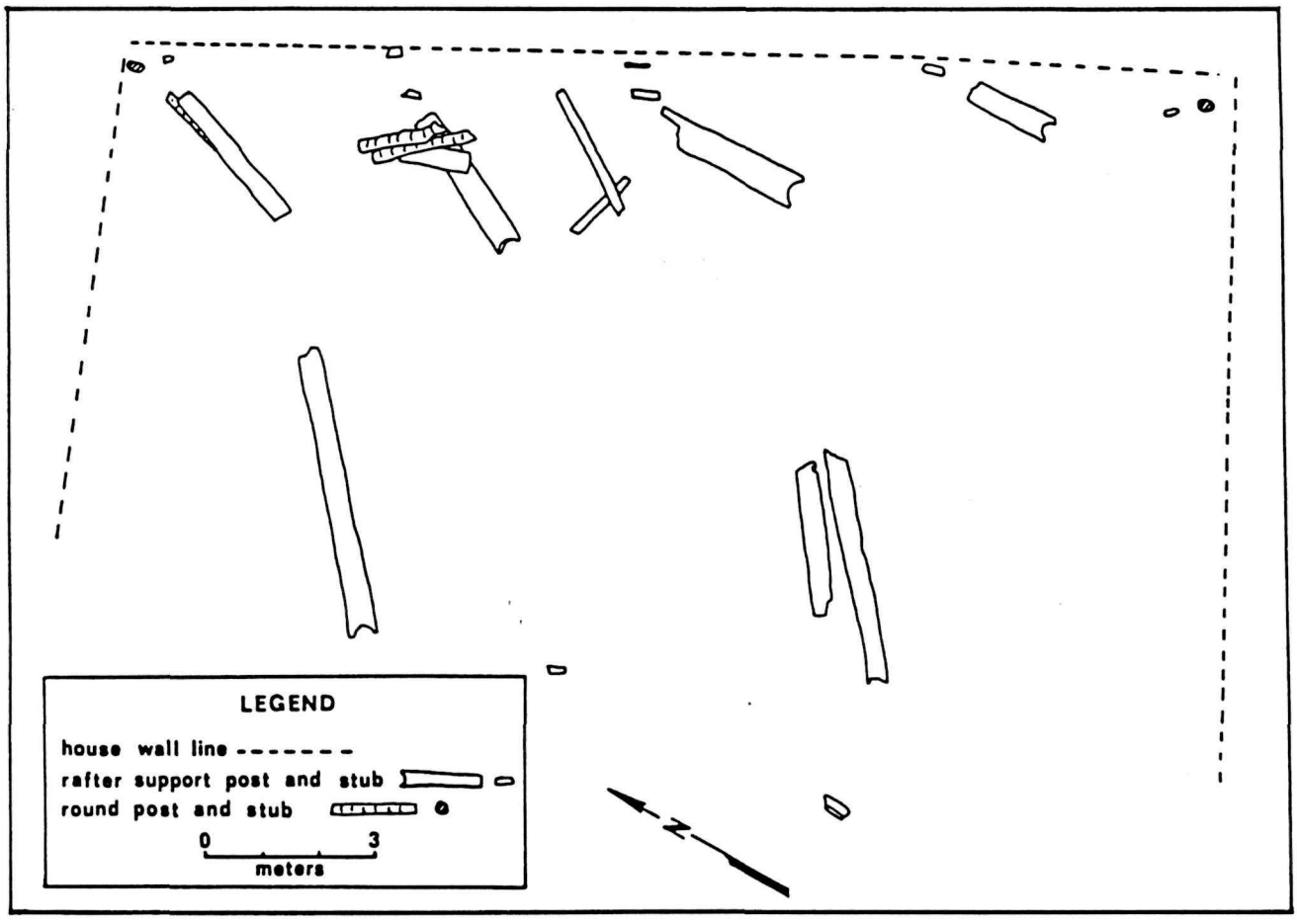


Figure 42. House 1 posts and post stubs.

Hewing in the notches of the rafter-support posts from Ozette is fairly coarse. As seen in Table 7, the width of notches generally is not quite that of the posts and notch width varies with the width of the posts. The depth of the notches also varies but this does not seem to be related to any other variable on the posts. It is possible that the notches were matched to the beam ends prior to erection of the posts to ensure that a good fit between the two timbers was obtained.

No repair techniques are evidenced on the rafter-support posts in the Ozette collection. Although checking or splitting of the upper ends of the posts might be expected from the weight of the rafter beams, none is visible.

Square holes were cut through the lower ends of five rafter-support posts in the Ozette sample (Figure 45). These penetrate from one face to the other and range between 14 cm and 16 cm from the lower ends. The holes are between 6 cm and 7 cm square and were cut from both faces. Since they were buried below the level of the floor when the posts were upright, their function is unknown. They are not universal among the posts and it is therefore unlikely that these holes relate to their function as rafter support.

One rafter-support post with a nearly plano-convex cross-section exhibits a groove on the convex side near the lower end. Another fragment, apparently from a rafter-support post, has a similar groove. A third post fragment exhibits notches in both edges near the lower end, forming small ears. In all three cases, the functions of these features are enigmatic.

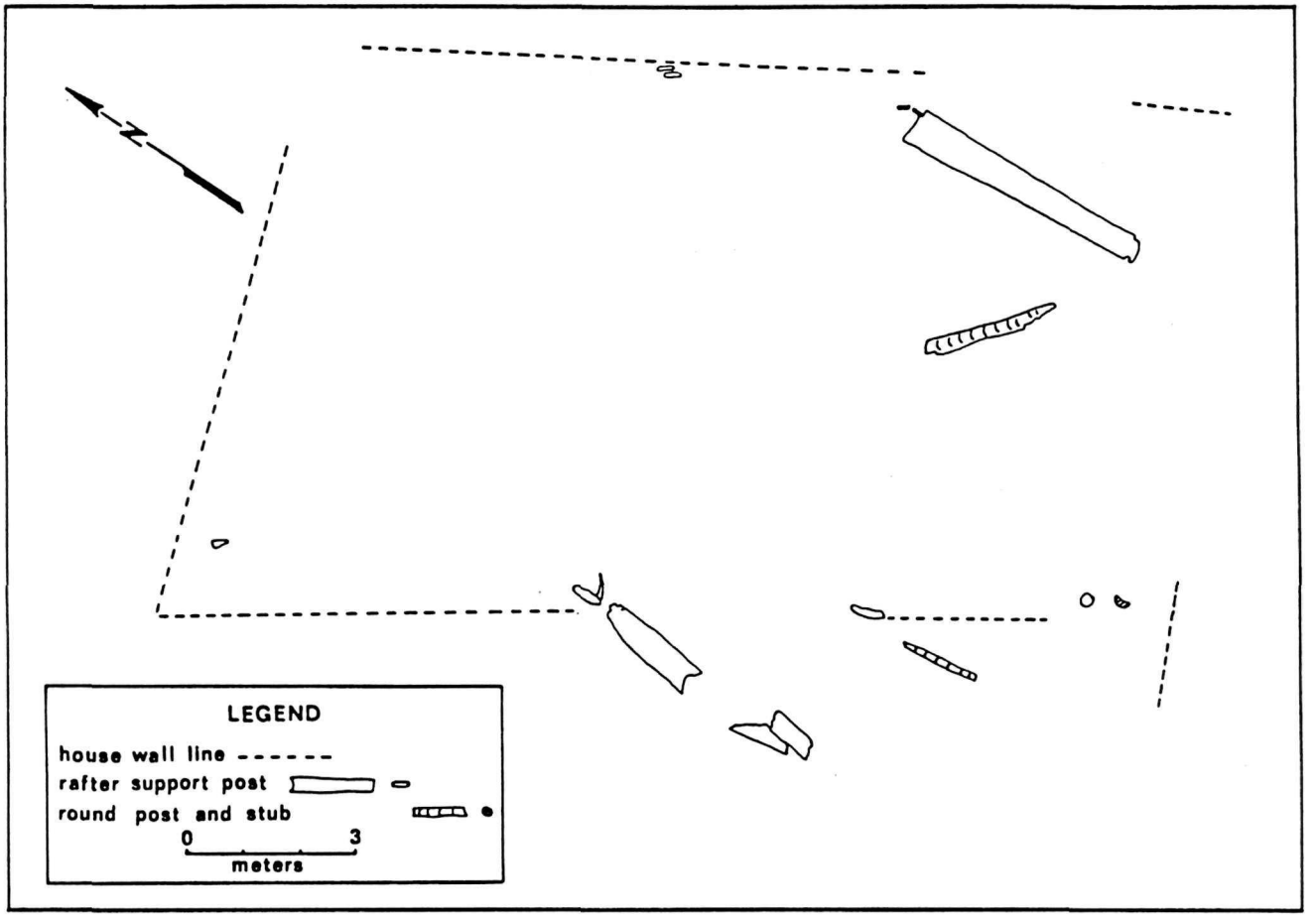


Figure 43. House 2 posts and post stubs.

Comparative Data. There are few comparative data on rafter-support posts for Makah dwellings. Swan (1870:5) mentions only that they were "stout posts, notched on the top." The only other data available from the Makah area are from historic house remains still in the brush at Ozette and at the summer village site of Archawat. In the historic photograph of the Archawat house ruins (Figure 23), rafter-support posts are visible; these posts appear to be dressed on their faces and possibly their sides. The cross-sections of the posts, however, cannot be determined with certainty from the photograph.

Metric data on the historic rafter-support posts at Ozette and Archawat are presented in Table 8. These may be compared to the protohistoric Ozette data in Table 7. No length measurements could be obtained from the historic Ozette remains. Although the protohistoric Ozette posts may appear to be longer than the Archawat samples, the measurements from Ozette represent the full length of the posts whereas the Archawat rafter-support posts were measured from their tops to the surfaces of the house floors.

Figure 46 is a plot of the standard deviations of the ranges in width and thickness of rafter-support posts from the protohistoric Ozette, historic Ozette, and Archawat samples of rafter-support posts. Curiously, the range in width of the rafter-support posts at Archawat appears closer to the protohistoric Ozette sample than the historic Ozette posts. While the difference between the protohistoric and historic samples at Ozette might be ascribed to temporal change, the relationship between the Archawat and protohistoric Ozette sample is enigmatic since the Archawat sample is

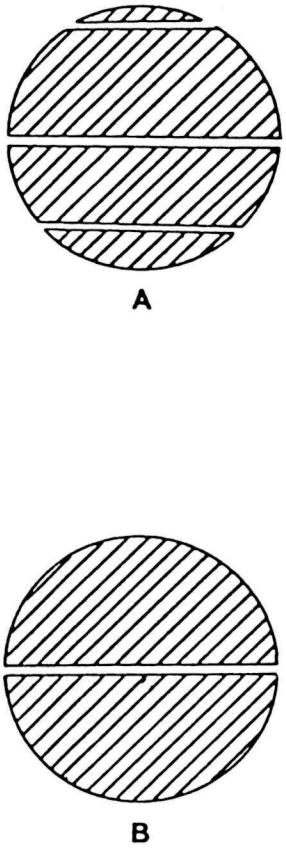


Figure 44. Rafter-support post cross-sections: A - Ozette; B - Archawat.

closer to the historic Ozette sample in time. Unfortunately, the validity of these trends is questionable because of the small sample sizes and the disparity in size between the protohistoric and historic samples.

Another noteworthy point in comparing the three rafter-support post samples is that the variability in cross-sections of the protohistoric Ozette rafter-support posts is not apparent in the other samples. With one possible exception, the rafter-support posts in the historic samples are plano-convex in cross-section. Although plano-convex rafter-support posts occur in the protohistoric components at Ozette, other cross-sections also were involved. The fact that both historic post samples share the same cross-section suggests a preferential change through time despite the small sample sizes.

Other Posts

A number of post fragments, other than rafter-support posts, were recovered at Ozette (Figures 42 and 43). The morphologies of these posts vary and their functions are uncertain. Generally, they differ from rafter-support posts in cross-section, ranging from plano-convex to fully round. The manufacture of these posts was quite simple: the posts were cut to length and stripped of their bark.

Figure 45. Rafter-support post stub with square hole cut near one end.

Round post fragments were found in association with the eastern corners of House 1 and the southeast corner of House 2 (at the time of this writing, not all of the House 2 floor midden had been excavated). These posts were between the rafter-support posts associated with the house corners and the corners themselves (Figure 47).

One complete post with both ends cut was found in the northeast corner of House 1. A second post, similar in appearance, was found near the east wall of House 1. This post also is intact, but one end is slightly indented; the nature of the indentation is not clear but it may have resulted from bearing a horizontal pole or beam. In both cases the posts are stripped of bark but not dressed.

These posts are not classified as rafter-support posts, and their function is unknown. Meaningful subclasses are not apparent among them. Metric data for these posts are presented in Table 9.

Rafter Beams

Rafter beams were an integral component of the roof-support systems of the Ozette houses, each of the ends resting on a rafter-support post and supporting the roofs of the dwellings. As with most shed-roof houses in the study area, the rafter beams in the Ozette dwellings spanned the widths of the houses.

Five rafter beams had to have been used in House 1 and four in House 2 but surprisingly, none was recovered during the archaeological investigations there. The beams apparently had been

Table 8

Metric Attributes of Historic Ozette and Archawat Rafter-Support Posts (in Meters).

Number	Length	Width	Thickness
Archawat			
1-1	3.10	0.44	0.20
1-3	3.04	0.47	0.19
1-4	—	0.34	0.17
1-7	3.14	0.47	0.25
2-3	3.15	0.43	0.18
2-4	3.14	0.44	—
3-1	—	0.47	—
3-2	—	0.42	—
3-3	—	0.40	—
3-4	—	0.34	0.12
4-1	—	0.40	0.20
4-2	—	0.40	—
$\overline{X}$=	3.11	0.42	0.19
sd=	0.05	0.045	0.04
Historic Ozette			
1	—	0.50	0.14
2	—	0.50	0.14
3	—	0.46	0.17
4	—	0.54	0.20
$\overline{X}$=		0.50	0.16
sd=		0.03	0.03

washed onto the beach or salvaged after the Unit IV mudslide. Data on the rafter beams in these houses are, therefore, limited and inferential.

Photographs of the house ruins at Archawat (Figure 23) and the Makah house interior (Figure 26) both show rafter beams. In these illustrations, the beams are round, lacking bark and are at least partially dressed. One beam in the house interior photograph exhibits aligned or fluted dressing scars. Swan (1870:5) mentions that rafter beams were "hewn down evenly."

Rafter beams in House 1 at Ozette must have been around 12 m long to span the width of the houses; in House 2 they must have been approximately 9 m in length. The notch width (NW) measurements for the rafter-support posts (Table 7) from Ozette suggest approximate figures for the diameter of these beams. A statement by Gibbs (1970:174) seems to imply that some rafter beams in Makah houses were 18 in (46 cm) in diameter; unfortunately, the referent of the phrase is ambiguous and the figure may represent the diameter of rafter-support posts.

Some rafter beams in the study area were notched near their ends to lock into the concavities on the rafter-support posts (Boas 1890:563; Waterman and Greiner 1921:28). There is no direct evidence that this was done at Ozette and the Archawat photograph indicates that the Makahs did not practice this technique in historic times.

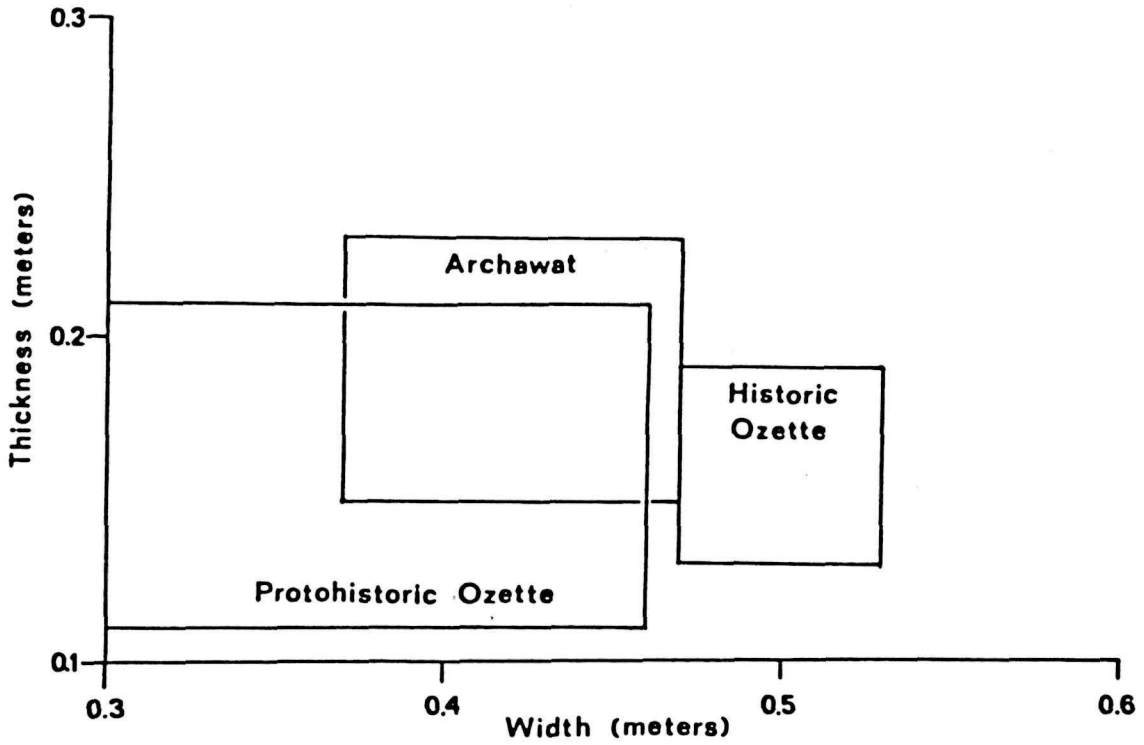


Figure 46. Ranges in width and thickness of rafter-support posts to one standard deviation.

Poles and Stakes

Round posts, poles, and stakes all are morphologically similar in that they essentially are elongated cylinders. Despite this similarity, poles and stakes are of a substantially smaller diameter and are considered here apart from posts. Even with such a restriction on this class considerable variation in length and diameter is found among the poles and stakes in the Ozette collection.

The main morphological attributes of poles and stakes are a circular cross-section and a narrow diameter, relative to length. Members of this class range from tiny pegs found in the floor midden of Houses 1 and 2 to very long fish-drying rack poles that reached above the eaves of the houses. Most poles and some stakes functioned to support various structural features in the Ozette houses. Poles were integral elements in walls, roofs, and accessory features such as fish-drying racks while stakes provided support for benches and for planks such as baseboards which were set on edge.

Considering the number of stakes located in the floor middens of House 1 and House 2 (Figures 48 and 49), well away from any structural features, it is apparent that many of the stakes were involved in non-architectural functions. In addition to the morphological class already described, another class of stakes exists that is characterized by rectangular or triangular cross-sections. These stakes were manufactured by splitting, often from planks. Because stakes were found without association with architectural features, they are not considered in detail in this discussion.

Poles and stakes are physically represented at Ozette by the actual remains of these elements and the molds that resulted from their disintegration in place or removal. Many poles were uprooted and broken by the Unit IV mudslide (Figures 50 and 51). Others that had been set into the floor at the time of the slide were snapped off at floor level, leaving their buried ends in place. Stakes often were driven into the floor after use or buried by the accumulated floor midden. Molds were preserved by the compact nature of the floor midden into which the stakes were driven. Hydraulic

Figure 47. Photograph of round and rafter-support post stubs in the southeast corner of House 1.

excavation allows the loose material that filled these molds to be washed out and their depth and diameter measured. In some two meter excavation units, stakes and stake molds numbered into the hundreds and their functions are only partially understood at present. Further analysis of stakes and postmolds within the house floors is presented in part III.

No single species of wood was used for poles and stakes in the Ozette houses. A small sample of poles has been identified as including western red cedar and western hemlock with the hemlock

Table 9

Metric Attributes of Posts Other Than Rafter-Support Posts (in Meters).

Key Number	Length	Width	Thickness
07/W/1	—	0.27	—
S/IV/75	2.82	0.16	—
40/IV/3	—	0.27	0.15
62/IV/14	2.33	0.15	—
68/W/1	—	0.17	0.13
90/IV/2	—	0.27	0.11
93/W/1	—	0.17	—
145/V/12	—	0.20	—
145/V/18	—	0.17	0.13
169/TV/16	—	0.20	—
203/A2/1	—	0.32	0.12
212/TV/1	—	0.20	—
NN	—	0.30	0.17
	$\overline{X}$=	0.22	0.135
	sd=	0.06	0.02

poles outnumbering the cedar (J. Friedman 1977: personal communication). Hemlock also was used for halibut hooks, float plug stoppers, harpoon foreshafts, and wood points (J. Friedman 1975:135). The use of this wood for poles may relate to its availability near the Ozette village site and to its stiffness which, while moderate, still was greater than many other woods available to the protohistoric Ozettes (J. Friedman 1975:134). The higher frequency of hemlock over cedar also may be a function of the small size of the sample examined.

On occasion, artifact classes such as harpoon fragments and broken wedges were recycled for use as stakes. This resulted in the introduction of wood species into this class which normally may not have been selected. The problem seems not to occur among poles, however, probably because few artifact classes satisfied the morphologies required.

The technology involved in the manufacture of poles was relatively simple. Standing poles were cut in the forest, the branches trimmed, and the poles cut to length. Probably some selection occurred as to diameter and length. Branch wood occasionally may have been used for smaller poles and stakes. Felling the poles as well as cutting to length involved cutting a notch around the circumference of a pole. The pole was then either snapped off when weakened or cut through. Sharpening is nearly always on the thicker end of a pole and left a conical point.

Although some uses of poles may have required bark removal, many poles were recovered with the bark intact. Bare poles, stripped of bark, also were recovered. In these cases, the bark either was stripped off during manufacture or lost while the poles were in the houses. The present collection is somewhat skewed toward bare poles because deterioration from burial for several hundred years loosened the bark to such a degree that some was lost during excavation and removal.

The functions of many of the poles from House 1 and House 2 can be determined from their locations and association with other elements. Often their function determined certain metric attributes such as length and diameter. Considerable variation in these dimensions occurred, however, resulting in a lack of functional clustering in the graphic illustration of the lengths and widths of complete poles (Figure 52). Consequently, it is difficult to determine the functions of these elements simply from their metric attributes except in extreme cases such as fish-drying rack poles.

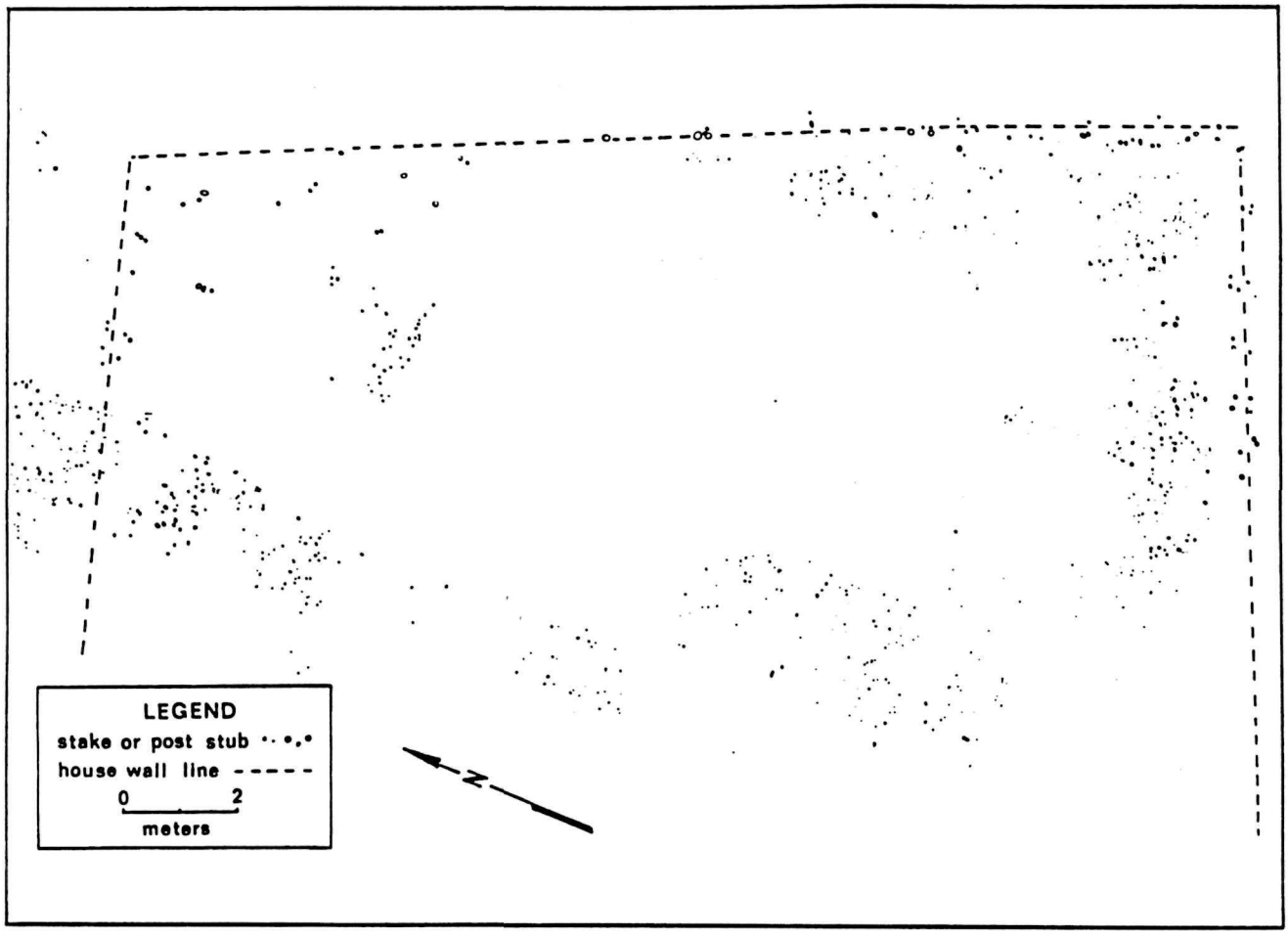


Figure 48. Distribution of pole stubs and stakes in House 1.

Functional Classes

Fish-Drying Racks. Uprights in fish-drying racks are presented in Figure 52 by the maximum extremes in length and diameter. These poles extended above the roofs of the Ozette houses and therefore had to be over three meters in length in order to reach above the eaves of the dwellings. Their greater diameter, relative to other posts, probably was a function of their length since most of the stress on them was transmitted longitudinally.

Wall Poles. Wall poles generally range in diameter from just a few centimeters to eight or nine centimeters. The maximum lengths of wall poles were determined by the heights of the house walls against which they were placed. Not all poles reached the eaves of a dwelling, however, and lengths consequently ranged from less than a meter to three meters. In part, thickness must have been selected as a function of the lateral strength necessary to hold the wall planks in place and stabilize the walls against wind. Much of the stress on wall poles, however, was transmitted longitudinally through the poles because of the weight of the wall planks.

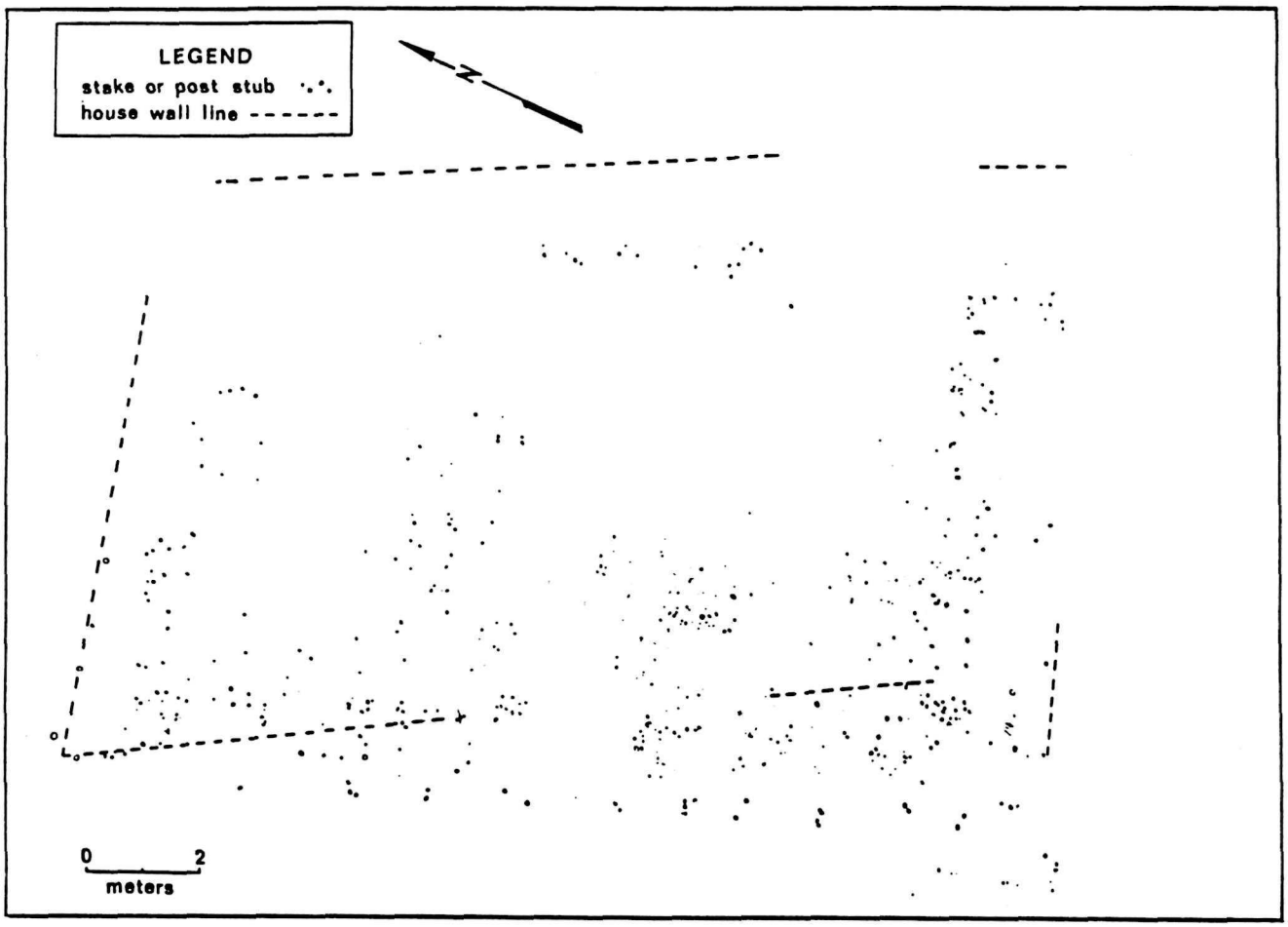


Figure 49. Distribution of pole stubs and stakes in House 2.

Rafter Poles. Since roof features were not found intact at the Ozette site, rafter poles have not been positively identified in the Ozette collection. From the function of these elements, however, some of their attributes may be postulated. Since the stress on rafter poles from the weight of the roofs was transmitted laterally, they probably were thicker than wall poles. As rafter poles spanned the rafter beams of House 1 and House 2, their lengths had to be at least equal to if not greater than the distances between the rafter beams; that is, between four and six meters.

Wall Buttresses. Wall buttresses were used in House 1 to reinforce part of a wall against the pressure of midden that had accumulated outside. The lengths of wall buttresses varied according to the heights of the wall areas that required buttressing. Such poles found in the southern portion of the east wall of House 1 are thick relative to their length since stress was transmitted laterally rather than longitudinally. These poles range between nine and 13 cm in diameter.

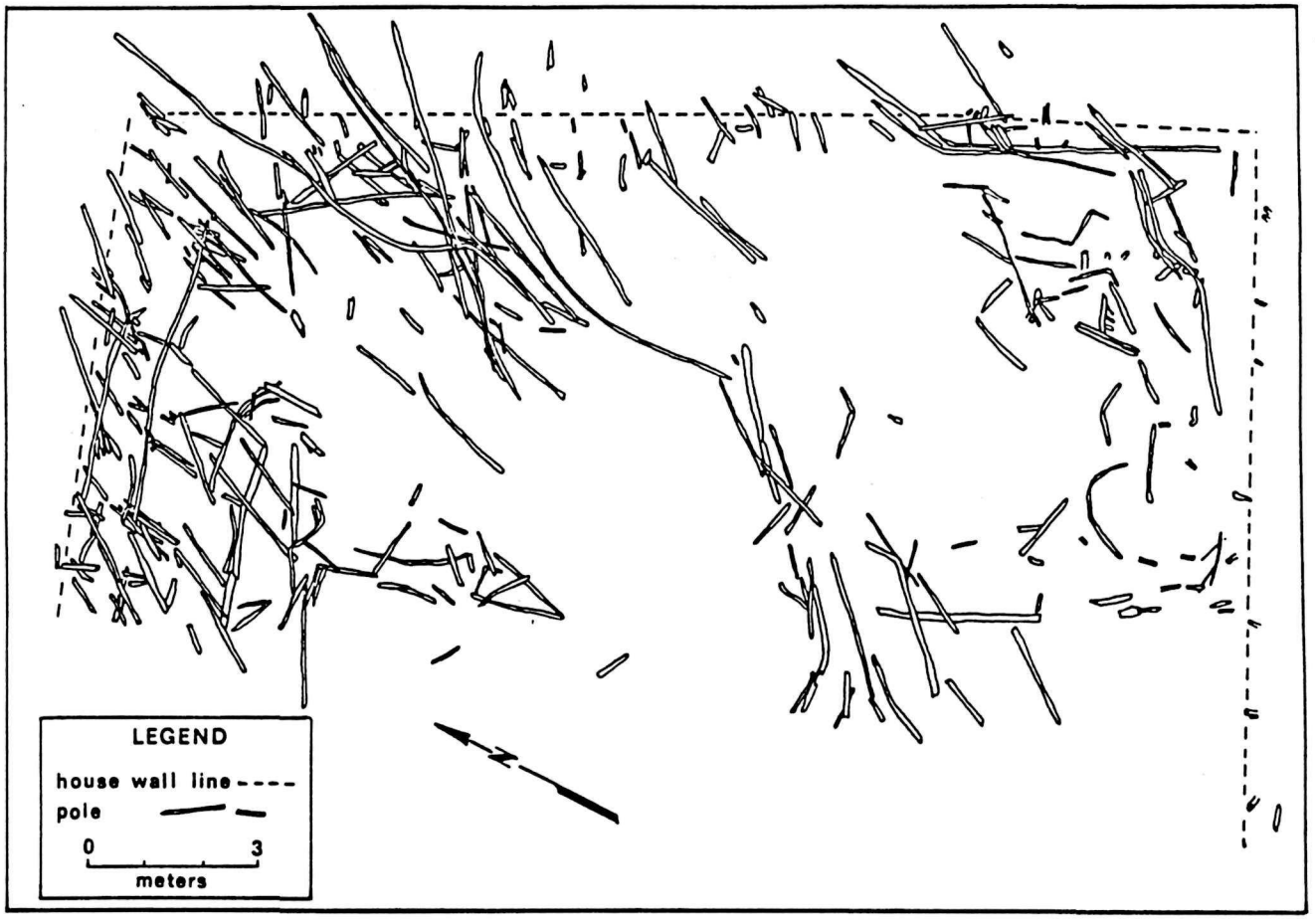


Figure 50. Distribution of poles in House 1.

Withes

Twisted cedar withes, although technologically simple, were an important part of the construction of the buried houses. Virtually all lashing was accomplished using withes of various thickness and degrees of twist. This included not only the lashing of house components, but the lashings or ties used in plank repair, box manufacture and repair, fastening canoe thwarts, and so forth.

For use in the walls of a dwelling, withes were employed singly. Several techniques were used when greater strength was required: thicker withes were used, single strands were allowed to double back on themselves forming double strand withes, or strands were coarsely braided together.

James Swan has little to report about withes except that they were "twisted cedar limbs" (Swan 1870:5). A detailed account by Boas (1921:120) on withe manufacture probably is applicable not only to Makah territory but the entire study area. Among the Kwakiutls, cedar limbs were gathered, heated by fire and their bark removed, twisted and soaked in urine to prevent their deterioration.

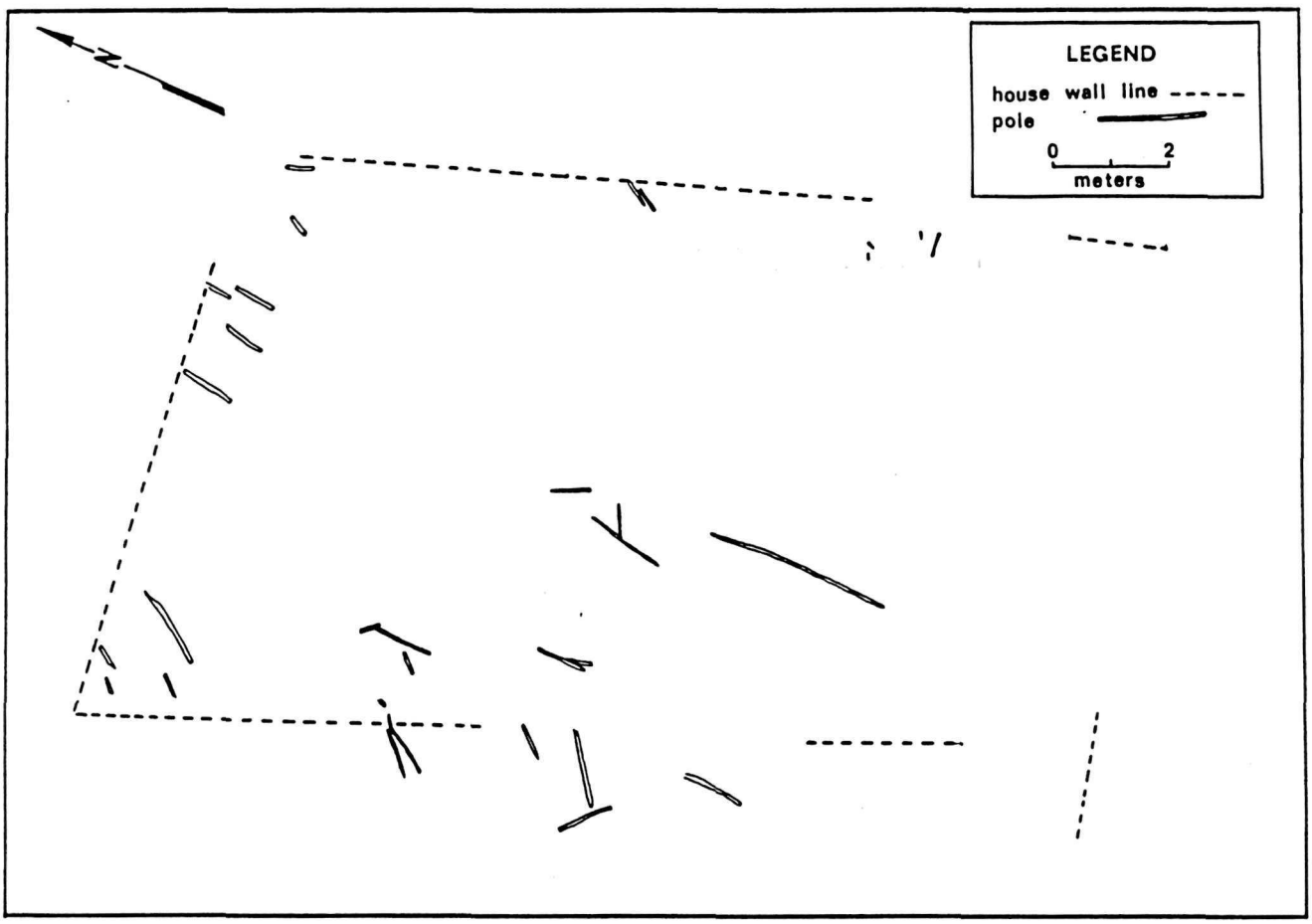


Figure 51. Distribution of poles in House 2.

Roof Weights

Roof weights in the Ozette houses are not directly evidenced because no portions of the roofs survived intact. It is known ethnographically, however, that the Makahs placed small logs and boulders on the roofs of their houses to hold the planks in place. Both may be seen on the roofs of the dwellings on Tatoosh Island (Figure 21).

A number of large stones were found on the floors of both House 1 and House 2 (Figures 53 and 54). At least some of these may be roof weights that fell through the roofs as the houses collapsed. As roof weights, probably the only selection criterion involved was weight: rocks had to be heavy enough to hold the planks in place yet light enough to be passed up onto the roofs and moved when planks needed shifting for light and ventilation. Rocks for roof weights would have been readily available on the beach in front of the village.

Post Linings

Rocks also were found lining the pits for rafter-support posts (Figure 55). The rocks in these pits are of larger (cobble) size and no selection for rock type is apparent. In at least one case, one rock in a pit lining had been used previously as a whetstone.

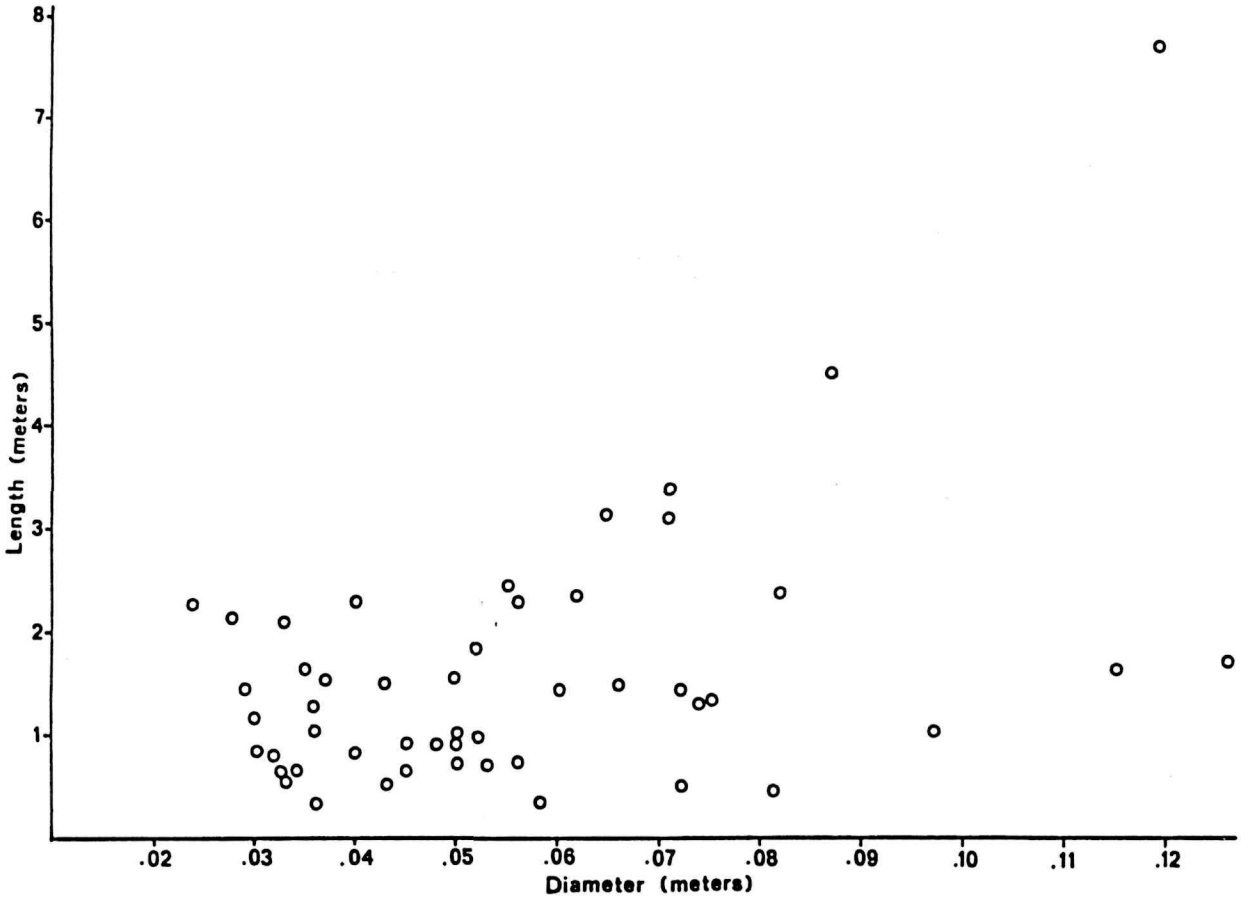


Figure 52. Scattergram of pole lengths and diameters.

Whalebones

Whalebones were not directly involved in the Ozette houses as structural elements. Their main functions were as material for the construction of drainage features and to stabilize the clay and midden banks adjacent to the houses. Final excavation maps of these features are presented in the discussion of bank-stabilization and water-diversion features in part III (see chapter one). Some selection appears to have been exercised as long narrow bones or groups of bones were used: ribs, mandibles, and sections of vertebrae for example. No modification of the whalebones was necessary for their use in these functions. Alterations frequently appear on these bones, however, as a result of their use as a source of material for tools.

Summary

This chapter has been concerned with the definition and description of the structural elements involved in the construction of the protohistoric houses at Ozette. Alone or in combination, structural elements were used to form structural features, detailed in the next chapter.

The structural elements in the Ozette houses may be categorized into a series of morphological and functional classes. Morphological classes are distinguished by certain shared attributes that

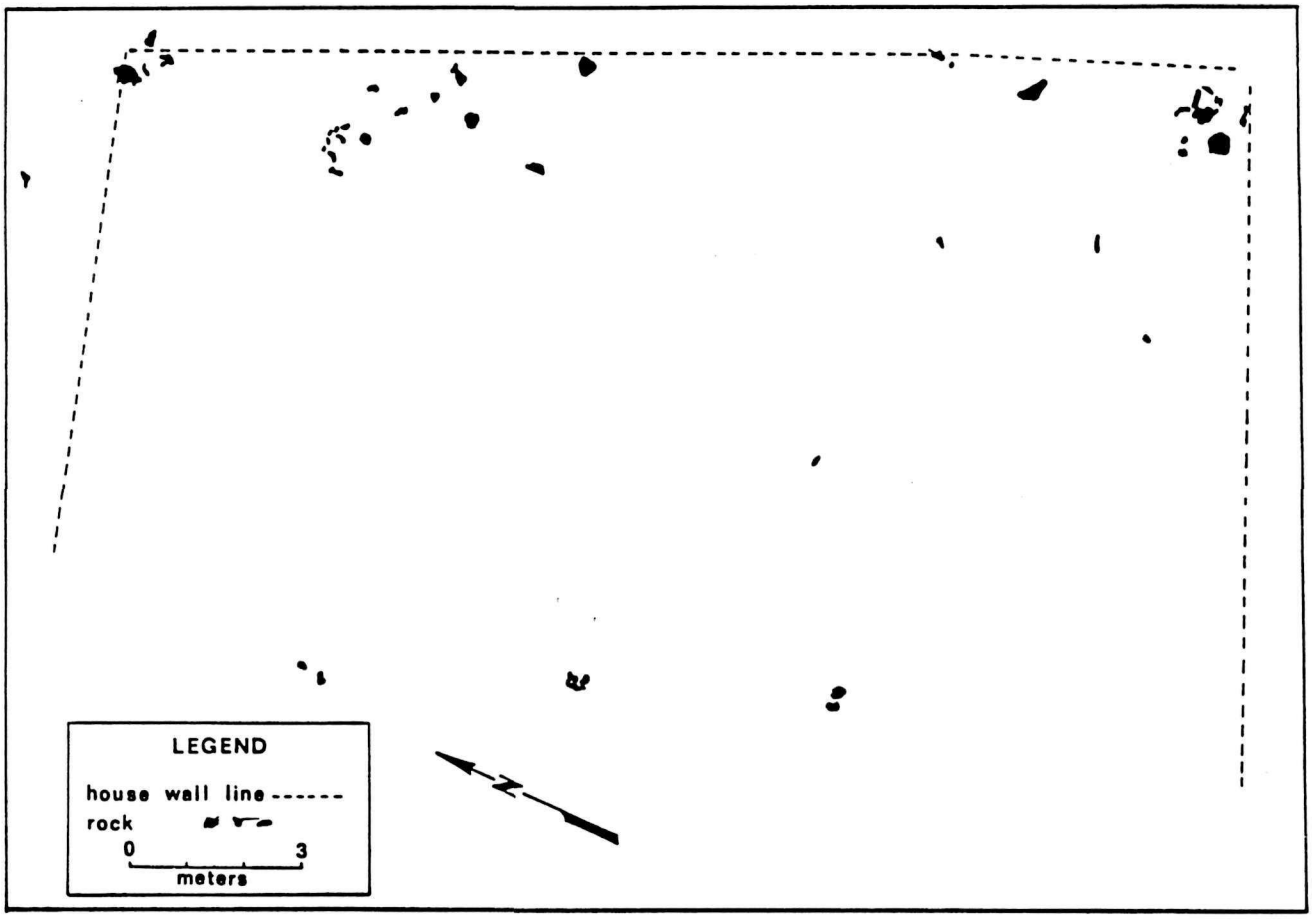


Figure 53. Distribution of rocks in House 1.

are consistently associated with the structural remains. Functional classes are defined by the uses to which the morphological classes were put and are identified by the locations of these remains in the Ozette houses, the features in which they were involved, and historic data on traditional Makah dwellings.

Some morphological classes are generalized and their attributes cannot be related to specific functions. Poles provide examples of a non-specific morphology and one would be hard pressed to distinguish rafter poles, wall poles, and cross-poles for fish-drying frames on strictly morphological grounds. This problem is compounded by the fragmentary nature of the Ozette structural remains.

Other morphological subclasses relate directly to function. In these cases, certain morphological attributes are required for particular functions. The lips on roof planks, the widths and thickness of bench planks, and the notches on rafter-support posts all are morphological prerequisites for those functional classes. Structural elements with these attributes were designed and manufactured specifically to fulfill certain functional requirements.

The structural elements in the Ozette dwellings involved three different materials: wood, rock, and whalebone. Through selection and manufacture, wood, in particular, was used to create a variety of morphological classes and subclasses of structural elements. While the materials and actual structural elements involved in Ozette dwellings were relatively few in number, the use of these elements demonstrates the ingenuity and sophistication of the protohistoric Ozettes in adapting a limited range of raw materials to their needs.

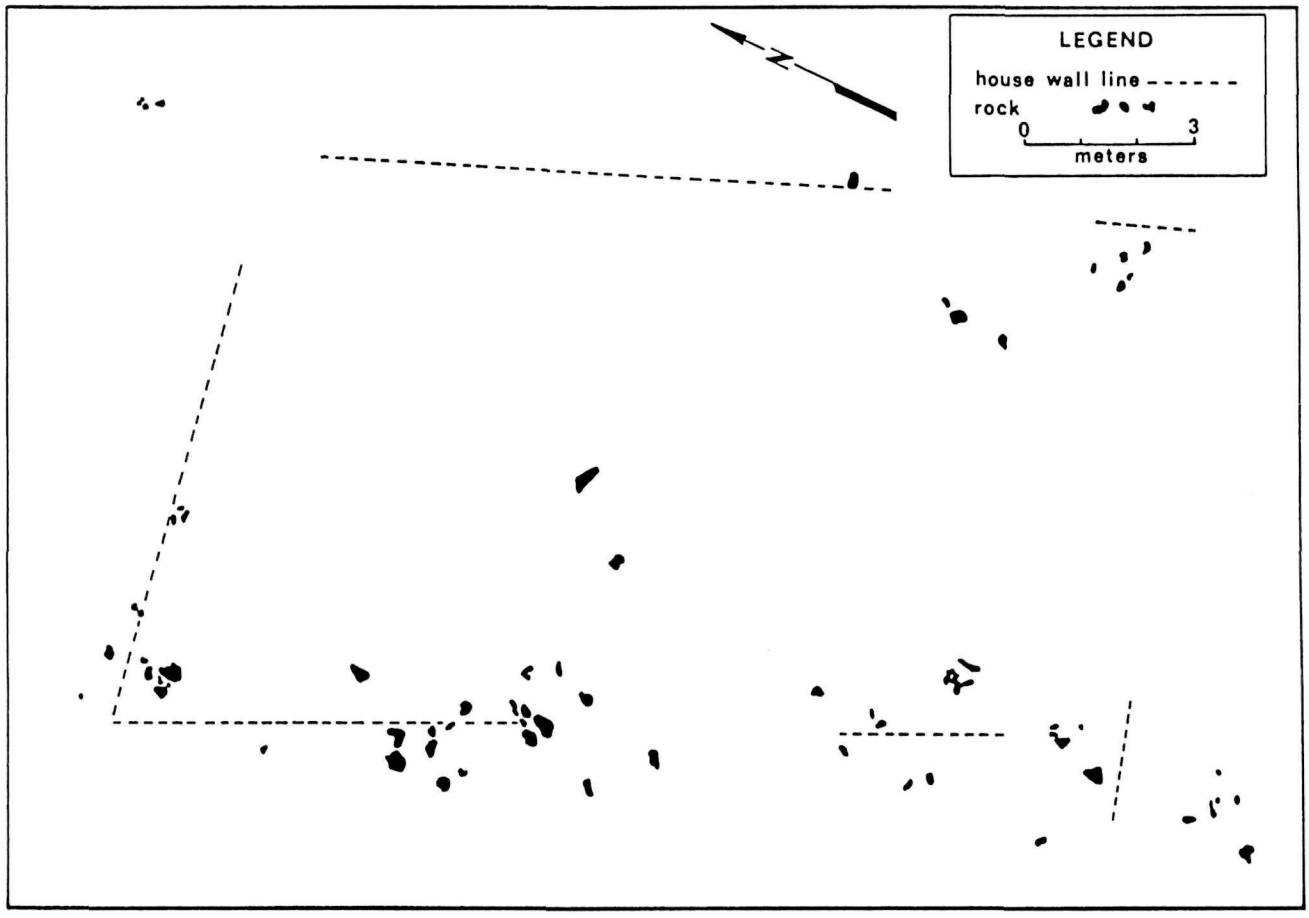


Figure 54. Distribution of rocks in House 2.

Figure 55. House 2 northwestern corner rafter-support post pit in cross-section, showing rock lining.

CHAPTER 5

OZETTE STRUCTURAL FEATURES

In this chapter, the structural features found in House 1 and House 2 are described. The presentation is arranged in what has been determined to be the probable construction sequence of the Ozette dwellings.

Ozette Village Pattern

The archaeological material from Unit IV and Unit V, the protohistoric components, allows some inferences as to the village pattern at Ozette before the historic period. All of the houses located thus far were close together (Figure 18), probably reflecting certain advantages of the locale to the protohistoric inhabitants as well as the limited level space available above the high tides. These advantages included: (1) the reef in front of the village which allowed safe canoe landings except during the most severe winter storms and highest tides; (2) the easy access to Tskawahyah Island which was used as a lookout and had been fortified at one time (Swan 1870:51); and (3) the shelter from winter wind provided by Ozette Island. In addition, the proximity of the houses to each other may have provided some mutual shelter from wind.

In the limited sample of houses excavated in the protohistoric component, no clear preference was indicated for the orientation of the long axes of the houses. Houses 1, 2, and 5 were situated with their long axes parallel to the ocean shore. From the limited excavation data on the locations of rafter-support posts in relation to wall lines in the House 3 and House 4 areas, it appears that the long axes of these dwellings were located at right angles to the shore.

There is no indication of the absolute size of Ozette village from the Unit IV and Unit V remains recovered at the site. The thick midden deposits thin out rapidly south of the field camp, however, and it is unlikely that occupation was very intense south of Area B70. Whether the 15 houses listed in James Swan's (1870:6) census of the village are indicative of the size of the protohistoric village also is conjectural. It is probable that during this earlier phase, the village was larger and the effects of introduced diseases and the population shift to Neah Bay had already reduced the village by Swan's time.

The two historic photographs of Ozette village (Figures 24 and 25) in the late nineteenth century show the houses in a linear arrangement. This probably was dictated to some degree by the topographic situation: a narrow strip of habitable land bounded on the west by the shore and on the east by a steep hill. Although some buildings are set farther back from the shore than others, only a single row of houses is apparent. In these photographs the greatest density of houses is in Area B70 and further to the north.

Historic Makah Village Patterns

The earliest detailed description of a Makah village is George Gibbs' account of Deah at the west end of Neah Bay (Gibbs 1970:174). At the time of his visit in 1855, he reports that there were two "blocks" of houses, one of which was partially surrounded by a stockade. An ink wash drawing of Deah village by Gibbs (Figure 22) shows a cluster of shed-roof houses, some of which are surrounded by a stockade that is open to the water. Apparently these houses represent the whole of Deah village at the time of Gibbs's visit. While blocks are not apparent in the drawing, houses within the stockade can be distinguished from houses outside the structure. Gibbs does not

elaborate on the nature of the blocks of houses. It may be possible, however, that they represent separate communities of Deah and Baada people since the Baada village site had been abandoned some years before. At Archawat and Warmhouse, two of the Makah summer villages, a linear arrangement was dictated by the local topography. Both villages were situated on narrow strips of land at the bases of steep slopes. Historic photographs of the summer camp in a cove on Tatoosh Island such as Figure 19 yield little data on preferred village patterns since the limited space for housing left little choice in the matter.

Ozette House Construction

The first step in the construction of the shed-roof houses at Ozette must have been the clearing and leveling of the intended house areas. Swan (1870:5) notes that the Makahs cleared a space for a house of rubbish and stones and then leveled it. He does not, however, provide any information on the method by which this was accomplished. At Ozette, at least, House 1 was constructed in an area that originally had a slight slope. Before construction of the dwelling, the northeast quadrant of the intended floor area was leveled by excavation into what is identified in the archaeological excavations as Unit VI clay (Figure 56). The back dirt from this excavation was deposited in the southwest quadrant of the intended house-floor area to bring it up to grade. During the archaeological excavation of this portion of the House 1 floor midden, disturbed clay was found overlying a buried organic horizon. This organic horizon represents the original ground surface in House 1 before it was brought up to level with the clay excavated from the northeast quadrant.

Construction Sequence

At the beginning of house construction, preparation of the house materials must have been well along. Used materials from dismantled structures also may have been available. Swan (1870:5) reports that erection of a house was initiated only "when a sufficient number of boards is procured." It is likely that rafter beams and rafter-support posts also had been fabricated as their numbers and dimensions directly controlled the length, width, and height of a house in which they were employed. It is probable, therefore, that at the initiation of house construction, the dimensions of the house had been determined and the bulk of the house materials had been fabricated or gathered. The dimensions of House 1 at Ozette are approximately 12 m by 19 m while House 2 measures roughly nine meters by 16 m. Swan (1870:5–6) provides a detailed account of Makah house raising. Care must be exercised in using his account because he includes variations in the typical shed-roof house form. In reference to the raising of the rafter beams, he states that they were set up "either parallel with the length of the house (in which case only one great timber extends along it), or else across the width, when three or four are used" (Swan 1870:5). Clearly, the latter part of this statement is in reference to a shed-roof house. The first part of the statement likely is in reference to building a gabled structure or possibly a shed-roof house variation using a large tie or eave beam.

According to the construction sequence detailed by Swan, rafter-support posts were first set up. Next, the rafter beams were raised into place atop the rafter-support posts. Then "Other posts are next set in the ground, which serve to form the frame for the sides and ends. Smaller timbers are fixed on these posts parallel with the large one" (Swan 1870:5). The second sentence in this quote suggests that Swan is referring to the construction of a gabled-roof dwelling. The "smaller timbers" must have been eave beams while the "large one" was the ridge or gable beam. The posts mentioned in the first sentence are the support posts for the eave beams.

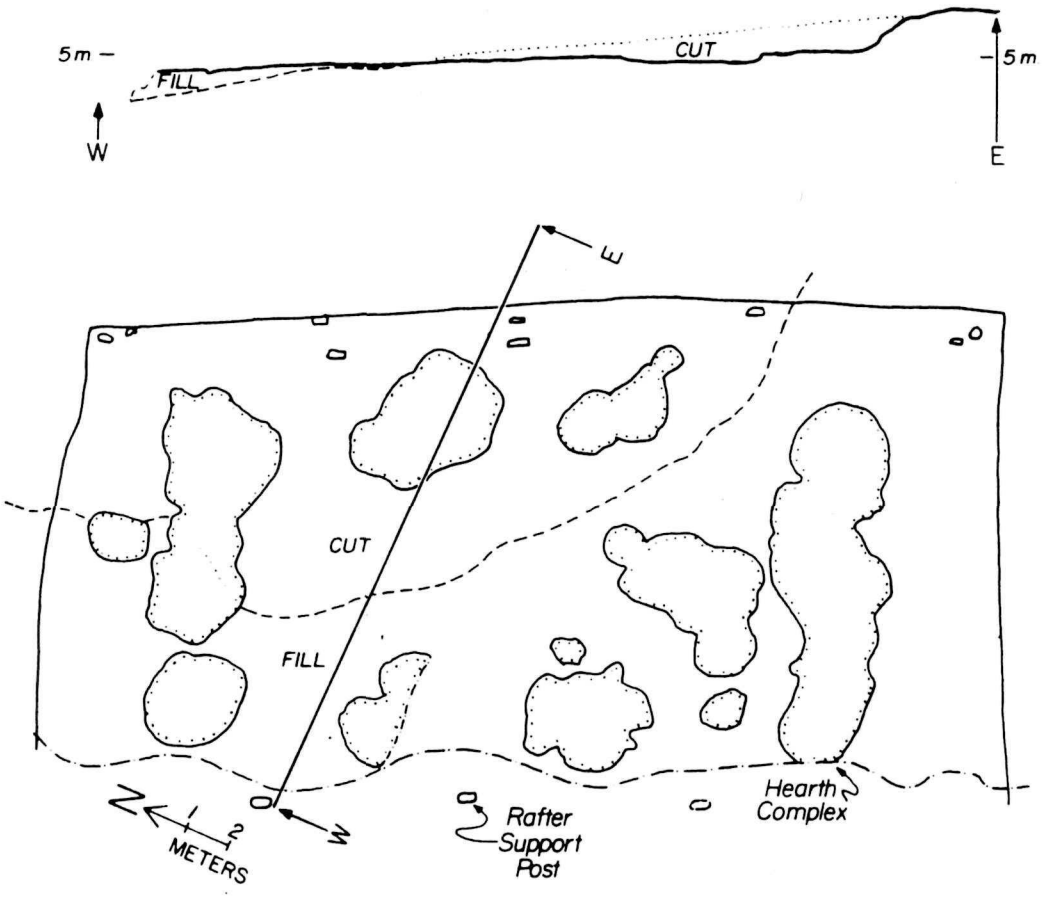


Figure 56. House 1 ground leveling map.

Following the erection of the rafter-support posts and rafter beams, Swan's account indicates that the rafter poles were then set in place to be followed by the roof planks. Once the roof-support system and roof planks were constructed, the walls were built by placing wall poles and then laying and fastening the wall planks. With the walls and roof of the structure erected, the only remaining construction activities involved placing the benches and other interior furnishings such as partitions.

Roof System

As noted previously, the roofs of shed-roof houses were structurally independent of the walls. At Ozette, the roof systems of the protohistoric dwellings involved two components: the roof-support frame and the roof itself. The roof-support frame consisted of rafter-support posts, linings for the rafter-support post holes, rafter beams, and rafter poles. The roof was composed of roof planks and weights (Figure 57).

With the exception of rafter-support post fragments found in place, few portions of the roof structures of Houses 1 and 2 were recovered. The probable explanation for the lack of roof elements is that the mudslide collapsed the walls and flowed under the roof. The roofs and rafter beams, which simply rested on the rafter-support posts, floated onto the beach and/or were salvaged after the slide. Although a number of lipped roof planks and a few possible rafter pole fragments were

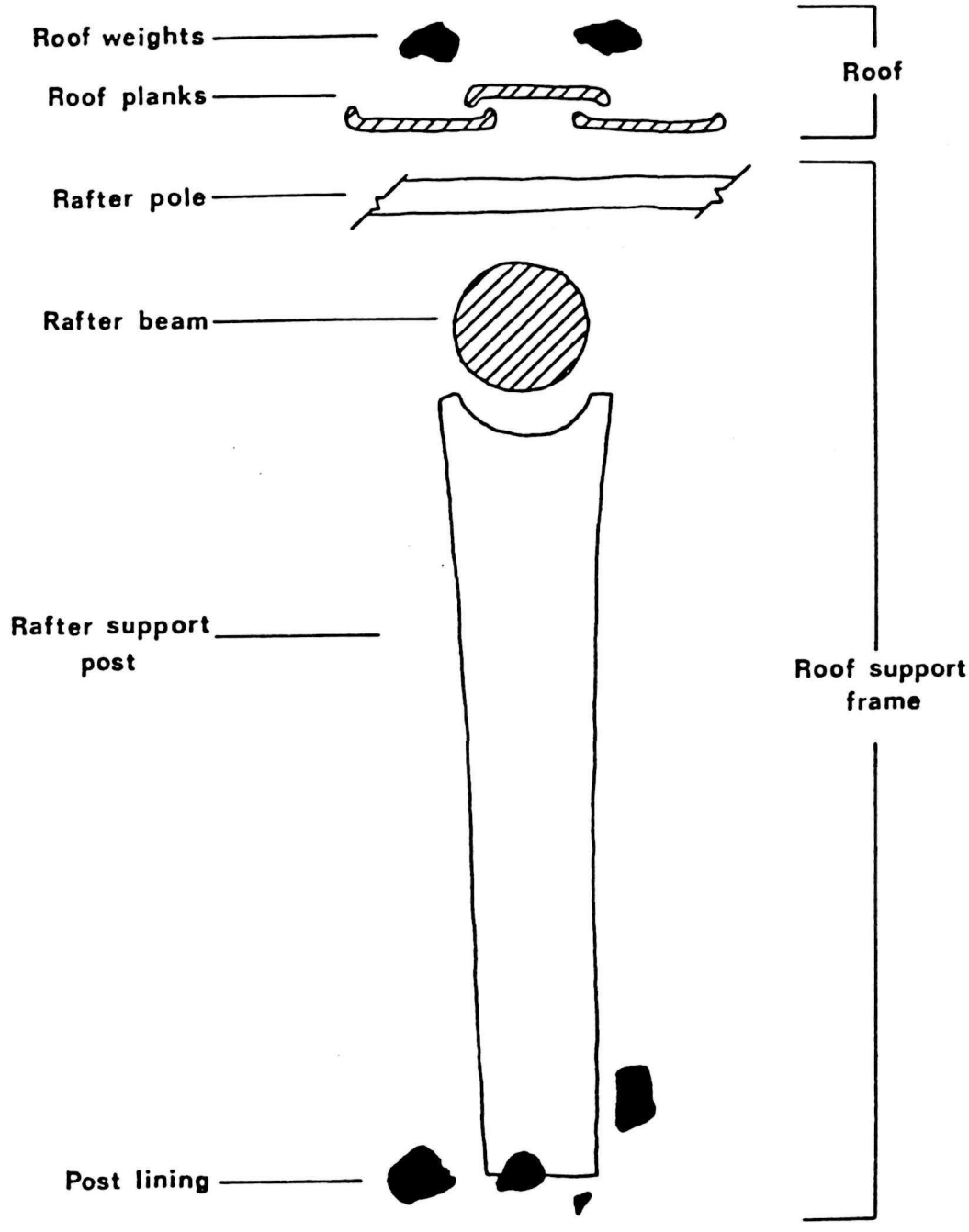


Figure 57. Roof-support system components.

located, no rafter beams were found in either House 1 or House 2. Since these roof elements recovered fit the general ethnographic model of Makah shed-roof houses, there is a high probability that the construction of the Ozette houses followed the same pattern.

Rafter-Support Posts. The placing of rafter-support posts in the Ozette dwellings was critical because their locations determined the length and width of the houses, their orientation, and interior arrangements. The height of the rafter-support posts determined the height of the houses and the slopes of their roofs.

Five pairs of rafter-support posts were involved in the construction of House 1. The distance between the posts along the east wall of this dwelling ranged between 4 and 5.2 m. One pair of rafter-support posts in House 1 was separated by a distance of 10.4 m across the width of the dwelling. Four pairs of rafter-support posts were used in the construction of House 2. The posts along the east wall of the structure ranged between 4 and 6.4 m apart.

Placement of the rafter-support posts may have been measured but the surveying must have been done by eye because pairs of rafter-support posts were not always exactly opposite each other. Nor, for that matter, were the structures exactly rectangular. In part, the skewed nature of House 1 was due to wall rebuilding that occurred later in the history of the dwelling.

Within a sample of five complete rafter-support posts recovered from the protohistoric components of Ozette, length varies between 3.92 and 5.07 m (Table 7). In part, this range may be attributed to the fact that the posts are from different structures and that some belonged to low walls while others were associated with high walls.

Two rafter-support posts (75/IV/16 and 40/IV/26) were recovered from the east wall of House 1. These posts were snapped off by the Unit IV mudslide at floor level and their bases were recovered in place. In the case of 75/IV/16, the lower end of the post was 1.31 m long, while the lower end of 40/IV/26 was 1.26 m in length. The approximate heights of these two posts above the floor was obtained by subtracting the lengths of the lower ends from the total lengths of the posts. Doing so indicates that 75/IV/16 reached 2.80 m above the floor at the time of the Unit IV mudslide, while 40/IV/26 stood 2.66 m high. Allowing for the thickness of the rafter beams and the rafter poles, the interior height of the east wall of House 1 must have been approximately three meters. There is, however, no direct evidence at Ozette as to whether the east wall of House 1 was the high or low wall of the structure since no rafter-support posts were recovered from the west wall. Regarding the orientation of pitched roofs, Waterman and Greiner (1921:22) make a significant statement in discussing houses with gambrel roofs, the central portion of which is pitched in the manner of shed-roof houses. These dwellings always were situated with the slope of their roofs away from the weather; otherwise, the wind would drive rain into the houses. It is likely that the same rule also applied to shed-roof structures.

Shed-roof houses shown in the historic photographs of Ozette village (Figures 24 and 25) are oriented with their long axes perpendicular to the shore and their roofs sloping to the north. This fits the observation that roof slope is away from the wind; at Ozette, the winter storms generally are from the southwest. If this principle held true in the past, the slope of the roofs of Houses 1, 2, and 5 must have been to the east, while the roofs of Houses 3 and 4 sloped to the north. The east wall of House 1 must have been a low wall and the height of the west wall of the structure must have been something over three meters above the floor.

Swan provides no information on the process by which the Makahs erected the rafter-support posts for their houses. The posts from Ozette are not so large, however, that this would have been a complicated process.

Rafter-support post stubs found in place in Unit V often were surrounded by large cobbles. These must have been put in after the posts were in place and either before or during the filling of the pits. These rocks apparently acted as wedges to hold the posts in place (Figure 55).

Rafter Beams. James Swan (1870:5) describes the Makah technique for raising rafter beams. One end was lifted and blocked up. Cross-poles, lashed together, were then employed to lift the end further until it could be placed in the notch of a rafter-support post. The opposite end was then lifted and placed in a similar manner.

Swan also notes that once the rafter beams were in place, support posts were placed under their centers. There is no evidence at Ozette of the use of center supports for the rafter beams of the houses. If they were employed, they were not so large as to leave impressions in the floor midden. The historic photograph of the interior of a Makah shed-roof house (Figure 26) does not show the use of center supports. If such supports were employed at Ozette and in Makah houses, their use probably was expedient rather than as part of the original plan.

The drawing by George Gibbs (Figure 22) shows, in addition to complete houses, what apparently is the frame of a house under construction. Four rafter-support posts are visible, forming a rectangle with the long axis at a right angle to the shore. Two long beams, parallel with the long axis of the rectangle, connect each pair of rafter-support posts. At one end, a shorter beam, at a right angle to the long axis of the rectangle, connects and rests upon the long beams. The roof slope is not discernible and, as a consequence, this house frame may be interpreted in several different ways. The interpretation of this author is that the frame is only one unit of a house under construction whose long axis was to be parallel with the shore. Since only two pairs of rafter-support posts had been raised, the apparent width is greater than the intended length of the dwelling. The raising of additional rafter-support posts and rafter beams would reverse this relationship. The short beam either may be an eave beam or a rafter pole, exaggerated in size by the artist.

Since any interpretation of the house frame in the Gibbs drawing must be based upon the artist's conception of what he actually saw, a definitive statement cannot be made. As illustrated, the house frame does represent a divergence from the Ozette-Makah model; whether this divergence is the product of the artist's interpretation, cultural change, or simple innovation cannot be demonstrated.

Rafter Poles. Rafter poles rested upon and spanned the rafter beams of shed-roof houses. These poles formed the direct support for the roof planks of these dwellings. In the photograph of the historic house ruins at Archawat (Figure 23) and the interior of the Makah dwelling (Figure 26), the rafter poles are of substantial size and are square or rectangular in cross-section.

In Unit IV and Unit V at Ozette poles were not found in an association where they could be positively identified as rafter poles. While diameters are not mentioned in the ethnographic literature, such poles must have been fairly substantial considering the weight of the roof planks and the activities that took place on them. Squared pole fragments were not found in the protohistoric components of Ozette and it is probable that the poles were round. The whole concept of squared poles seems foreign to the Ozette woodworking patterns as known from the archaeological material and it is likely that the occurrence of such structural elements in the historic photographs cited above is a late phenomena in the evolution of these dwellings.

Roof Planks. James Swan (1870:5) describes roof planks on Makah houses as being concave on one side and convex on the other. These planks were laid alternately so as to overlap in the fashion of roof tiles. Gibbs (1887:174) also describes roof planks at Deah as being guttered and overlapping.

Historic photographs of the summer dwellings on Tatoosh Island (Figure 19) indicate that all roof planks may not have been guttered. Lips are not discernible when the eaves of these houses are examined closely.

A number of bilaterally lipped planks were found associated with Unit IV and Unit V house remains at Ozette. There can be little question that these were roof remains, despite the fact that some bilaterally lipped planks were found associated with house walls. The presence of the latter

might be the product of surplus or recycling, where roof planks that were unusable, perhaps due to splitting or lateral breakage, were cycled into a wall feature.

Roof planks were laid in such a manner that they overlapped both at their sides and at their ends. The long axes of roof planks were at right angles to the long axis of a house; that is, they paralleled the width of a dwelling. There are no data available at Ozette regarding the number of courses of planks required to cover a roof from the upper eave to the lower eave. The fact that bilaterally lipped planks in the Ozette sample averaged longer than either dressed or split planks may be significant: the fewer courses of planks involved in a roof the less chance for rainwater to leak into a dwelling.

Roof Weights. Francis Densmore (1939:6) reports that the Makahs used three poles to hold the roof planks of their dwellings in place. When the occupants of a house were going to be absent, these poles were lashed to the rafter beams of the dwelling. In the photographs of the Tatoosh Island dwellings (Figure 19) both poles and rocks are visible on the roofs of the houses. Although some of the rocks found on the floor middens at Ozette probably were roof weights, poles were not found that can be positively identified as roof weights.

According to the construction sequence for shed-roof houses outlined by Swan for the Makahs, the roof system was constructed before the raising of the walls of a house and the furnishing of its interior. The Ozette data, coupled with those of Swan, indicate that the roof systems of Ozette-Makah shed-roof houses were composed of a number of discrete construction elements. These include rafter-support posts, rafter beams, rafter poles, roof planks, and roof weights. Rocks were used both as roof weights and linings in rafter-support post pits.

In the case of some construction elements, such as rafter-support posts, the morphological and technological attributes are distinctly related to function and are readily discernible to the archaeologist. With other elements, such as roof and rafter poles, the functional classes of structural elements are not distinguishable on the basis of morphological and technological criteria.

The roofs of the Ozette dwellings are particularly important to the archaeologist as they distinguish these and all shed-roof dwellings from other house types on the Northwest coast. To the occupants of the Ozette houses, the roofs provided more than shelter. Roof planks were movable to allow light to enter and smoke to escape. James Swan (1870:6–7) notes that the roofs of Makah houses were used for drying halibut. Furthermore, he suggests that the whole rationale for the flat roofs of these houses, at least among the Makahs, was to provide a platform for the air- and sun-drying of fish.

Wall System

Although the Unit IV mudslide fragmented the house remains and scattered them about, some portions of the house walls, particularly in House 1, survived intact. Standing portions of the southern part of the east wall and the south wall of House 1 (Figure 58A) were located during the archaeological excavations. These walls had been protected against the slide by exterior midden that had accumulated against them during the occupation of the house. In other areas of the house, particularly along the north wall, portions of the walls were collapsed inward but still preserved intact (Figure 58B).

In construction, the walls of House 1 and House 2 were identical to the techniques described by James Swan for the Makahs in the 1860s (Figure 59):

> First, double rows of poles are set up perpendicularly all around the house, at distances of four or five feet from each other, the rows themselves being about four inches apart. A board is then placed between these rows of poles, with one of its edges resting on the ground. Withes made of twisted cedar twigs are passed round the poles, and on these withes another board is laid, with its lower edge overlapping the

Figure 58. House 1 *in situ* wall remnants: A - South wall (at left), from southeast corner facing west; B - north wall, from north of House 1 facing south.

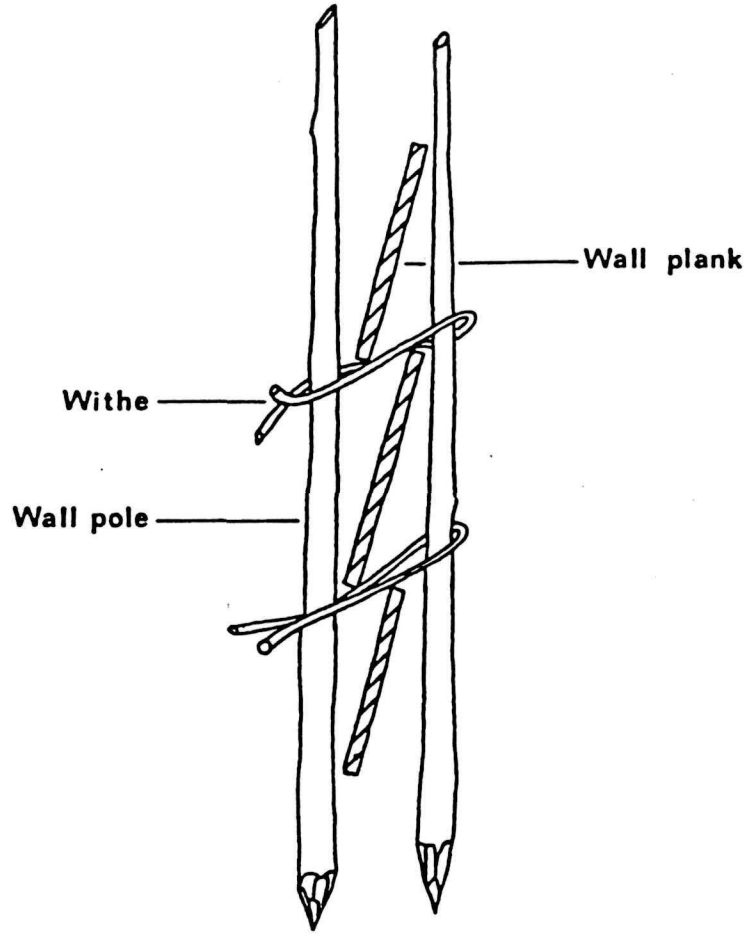


Figure 59. Withe-slung wall construction.

one beneath; this process is repeated till the sides and ends are complete. Moss and dry seaweed are then stuffed into all the seams, and the house is considered habitable (Swan 1870:5).

George Gibbs (1877:174) describes wall construction techniques at Deah in much the same terms.

Wall Poles. According to Swan's account of wall construction, wall poles were erected first. The wall poles recovered at Ozette have sharpened lower ends and battering on some upper ends of the poles, which does suggest that they were pounded or driven into the ground.

Preparation of the wall poles for the Ozette structures involved trimming the branches close to the trunk, sharpening one end of the poles, and trimming the opposite ends to length. The sharpened ends of the wall poles were always the thicker ends.

Spacing of wall poles depended upon the length of the planks used in a wall. In withe-slung wall construction, each plank in every course of planks had to be supported near both ends by a pair of wall poles. If planks were of standard lengths, the spacing of the poles would be regular. Standard plank lengths are not apparent in the Ozette house remains. Gibbs (1877:174) states that the poles of the Deah houses were a few feet apart and in his drawing of the village (Figure 22), the spacing of the wall poles appears quite regular. Swan (1870:5) notes that wall poles were four to five feet apart. His figures seem to fit fairly well with the Ozette data.

Post molds and wall pole stubs located along the wall lines of the Ozette houses provide little information on wall pole spacing (Figures 48 and 49). The molds show that poles were placed

and replaced throughout the history of the house structures. With occasional dismantling of the houses, repair and rebuilding, the archaeological evidence accumulates a larger number of poles than actually related to a standing wall at any one time. Even taking these factors into consideration, a great many more poles seem to have been involved than generally are illustrated in the early drawings and photographs of this house type.

To hold the upper wall boards in place, at least some of the wall poles had to be long enough to reach the eaves of the houses. The remains of the Ozette houses suggest that many did not reach the eaves; in fact, the lengths of the wall poles recovered vary considerably (Figure 52). In some cases the poles on one side of a house wall were in pairs, with members of unequal lengths.

Wall poles of unequal heights may be explained on the basis that not every pole related to every course of wall planks. There is some indication that the Ozette walls were built up in stages, with successively higher wall poles relating to the higher courses of wall planks. This would help explain the high frequency of wall poles and post molds along the wall lines of the Ozette houses, the occurrence of wall poles of varying heights, and the occurrence of tall and short poles immediately adjacent to each other.

Wall Planks. Wall planks on the Ozette houses were horizontal, the one above overlapping the one below (Figure 59) to prevent rain from leaking into the interiors of the dwellings. The ends of adjacent planks in a single course of planks also overlapped, making a more weatherproof wall than would have been the case by simply butting them together.

The lowermost portions of the Ozette house walls extended below the ground surface, due in part to the accumulation of floor midden inside and exterior midden outside the houses (Figure 60). Also, the first course or so of planks was actually placed below the existing ground surface during the initial construction of a house.

When approaching the eaves of the end walls, planks probably were gradually tilted to meet the slope of the roofs of the Ozette houses. Although there is no direct evidence of this technique at Ozette, historic photographs of the village (Figures 24 and 25) and the Tatoosh Island houses (Figure 19) show that this was the most common method of matching the upper edges of the walls to the roof slopes.

Corners. Although nearly all the corners of Houses 1 and 2 were thoroughly demolished by the mudslide, the junction of the south and east walls of House 1 demonstrated the manner of joining walls. In this area, the side wall simply butted against the end wall of the structure (see Figure 47). This technique also is seen on the Tatoosh Island houses (Figure 19). It appears that the two walls remained independent of each other and rafter-support posts and corner posts were not related structurally to the walls. Both types of posts were placed too far out from the actual house corners to be structurally involved.

Windows. Evidence of windows was not found in the house remains at Ozette. There is little question that most interior illumination in these dwellings was provided by shifting roof planks, as illustrated in the photograph of the interior of a Makah dwelling (Figure 26). Windows, if they existed, probably were little more than gaps between wall planks in a single course and therefore difficult to identify in the structural debris at the site.

Wall Chinking. James Swan (1870:5) reports that the Makahs stuffed the cracks between wall planks with moss and dried seaweed. Chinking material was not found in the intact portions of the house walls at Ozette. This absence, however, may result from difficulty in recognizing the material in its weathered state.

Figure 60. Detail photograph of House 1 south wall, showing wall planks *in situ*.

Entrances. James Swan (1870:6) reports that Makah dwellings had one main entrance and another small opening at the rear of the house for convenience in bringing in wood and water. Direct evidence of entrances was not found in the Ozette houses. The stratigraphy of the floor midden in House 1, however, suggests that the entrance to that structure was near the middle of the west wall of the house. This area apparently was used as an entrance throughout the history of the dwelling because the pattern of hearth features and pebble layers observed in the stratigraphy (see part III). Stratigraphic evidence for House 2 suggest the entrance(s) also were along the west wall and/or along the north wall at various times during the history of the dwelling.

Benches

Relatively few data are available on benches in traditional Makah dwellings. Swan (1870:5–6) reports that bed platforms were placed next to the house walls and raised about 18 in off the floor. Gibbs (1877:174) mentions a raised platform running around Makah houses. Densmore (1939:25) reports a wide shelf on one side of upper class houses that may have been a bench. This shelf was raised four feet above the floor and was used for secluding girls during puberty.

Benches may be seen in the photograph of a Makah house interior (Figure 26). The back benches are raised fairly high while the front benches appear to be only slightly elevated. In addition, planks can be seen on the floor; these apparently also served as benches. Fronts are visible on the raised benches. These fronts, however, are separate from the benches and probably were held upright by stakes and pegs.

A number of planks recovered from Ozette are identified as benches (Table 6). These planks are either unilaterally lipped or plain (without lips). Other than locational criteria, bench planks are identified on the basis of size, particularly width and thickness. While some of the benches apparently were displaced from their original locations by the Unit IV slide, this movement generally was not significant. This probably is due to the fact that benches were near the floor and the mudslide flowed over them.

Benches were not found along the west wall of House 1. Any that were in this area probably were pushed onto the beach and salvaged, or were later eroded out along the sea bank. Bench planks were found, however, near the other three walls of the house (Figures 61, 62, and 63). Some of the benches in the north wall area of House 1 probably originated from House 3. The benches that were in House 1 were concentrated along the north and south walls of the structure while the middle of the east wall was largely free of benches. Whether their absence there was caused by the mudslide cannot be stated with certainty, but it seems likely that they were absent from the area at the time of the slide.

The distribution of benches in House 2 is even more speculative than in House 1 (Figure 63). Benches in this house were found concentrated in the northern part of the west wall of the structure. At least one of these benches may have been displaced from the north wall by the mudslide. One or two of the benches also may have been placed at right angles to the west wall. Benches are absent from the east and south walls of this structure. Any benches in the south area of House 2 may have been salvaged after the slide since Unit IV was quite thin in this area. The absence of benches along the east wall, however, is more difficult to explain. Although it is possible that some of the House 2 benches were pushed into House 1 by the Unit IV mudslide, none in the latter area can be singled out as having definitely originated from House 2.

It is apparent that benches in Houses 1 and 2 were elevated on stakes driven into the house floors. The benches nearer the walls seem to have been raised higher than those closer to the centers of the houses. Rear benches were elevated some nine inches to a foot above the surface of the house floor. None of the many stakes and pegs located in the bench areas of the houses can be isolated as having raised front benches as described by Swan (1870:6). Considering their numbers it is probable that some were involved in such a function. Benches may have been raised for a variety of reasons. Deterioration of the wood may have been hastened by contact with the damp floors of the houses. Also, benches may have been raised to keep them above the floor midden, which continuously accumulated during the occupation of the houses.

The function of the unilateral lips on many of the benches is unknown. As mentioned earlier, they may have prevented raised benches from sliding off their support stakes when the fronts were used as back rests. Bench fronts in the photograph of the interior of a Makah house (Figure 26) are separate planks; bench fronts in the form of exaggerated lips as found at Ozette are not mentioned in the historic literature. Separate fronts may have been employed at Ozette but are difficult to

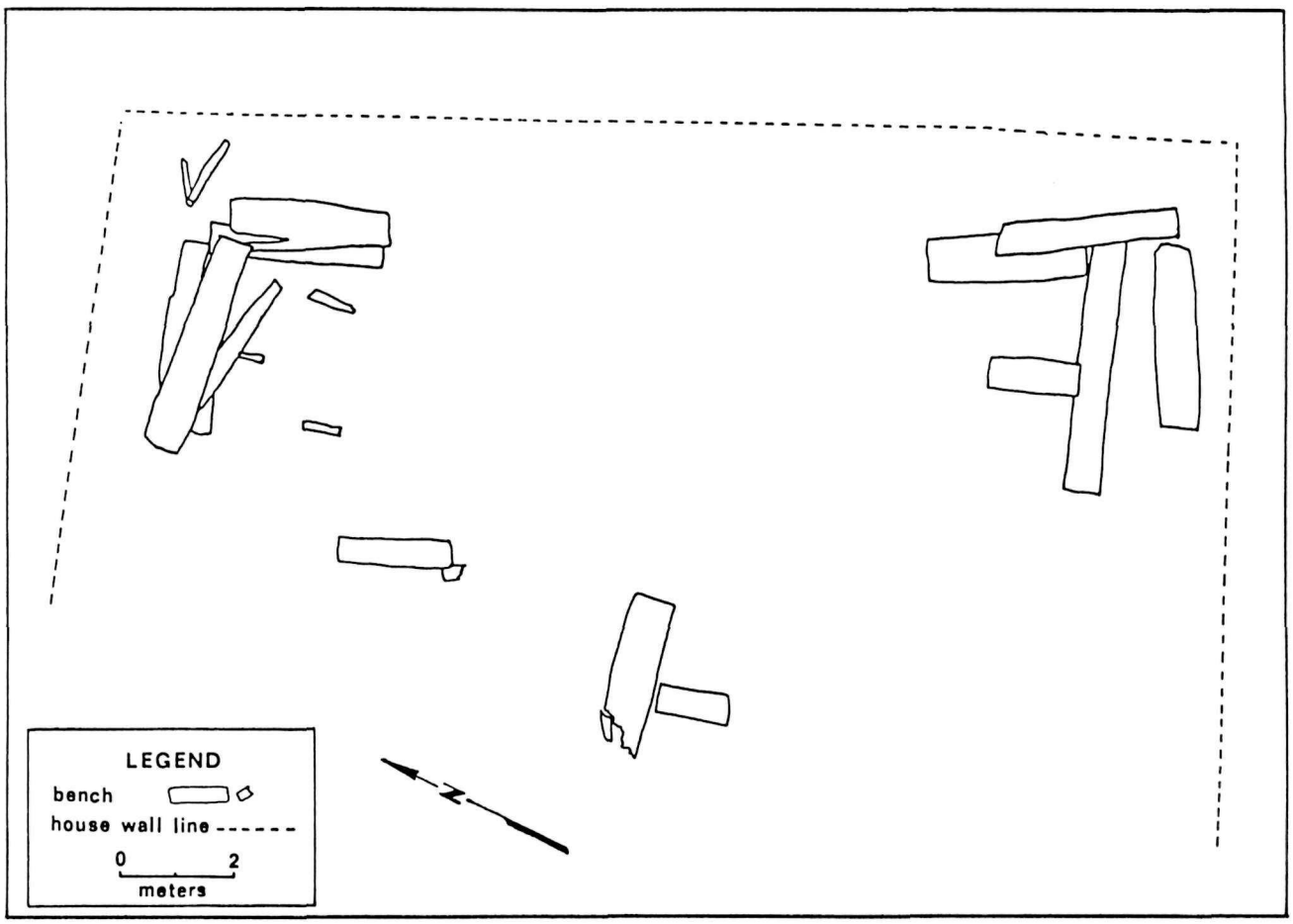


Figure 61. Distribution of benches in House 1.

identify with certainty. If they were used, they were of a simple morphology and are easily confused with old baseboards or other planks buried in the floor middens.

In summary, benches were the major furnishings in the Ozette houses. They were located adjacent to the house walls and their distribution was discontinuous; that is, large gaps occurred between them (see Figures 61 and 63). This appears contrary to the reported historic data on bench distribution although the placement of the Ozette benches at the time of the Unit IV slide may reflect purely local circumstances rather than the preferred cultural pattern.

The bench-support systems in the Ozette houses involved unilaterally lipped and plain planks, support stakes and, perhaps, separate bench fronts. Both the support stakes and the separate fronts had simple morphologies and are difficult to distinguish from similar structural elements such as planks and stakes. Their functions did not require distinctive morphological attributes. The benches themselves are generally identifiable on locational criteria, unilateral lips, and unusual widths and thicknesses.

Benches were employed for a variety of purposes. They are often referred to in the historic literature as "sleeping platforms." At Ozette some benches were found with sleeping mats upon them. The front, lower, benches apparently were used in the performance of daily or household tasks. Cuts, punctures, and scratches on the Ozette benches suggest that they also served as work benches and platforms.

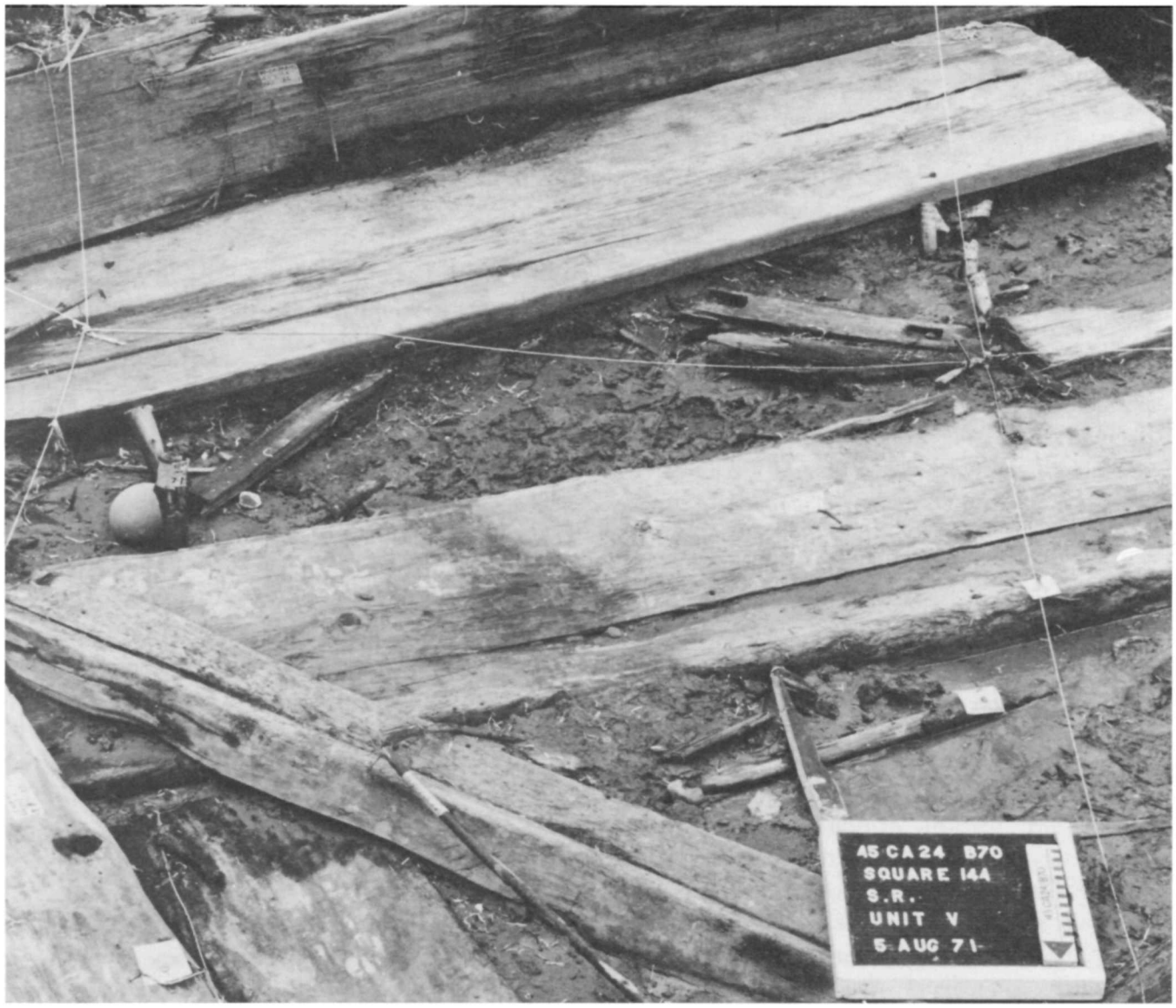


Figure 62. Benches in the southeast portion of House 1.

Carved Panels

Three large carved panels were recovered from House 1. The largest of these (29/IV/21) has a whale carved on one of its faces (the panel is shown on the cover of this part, and the carving is the cover illustration for this series). The carved lines defining the design are channeled; that is, in cross-section the lines have a "U" form. Traces of red pigment are preserved on the background of the design. Both sides of the panel are smooth and no dressing scars are apparent. The plank was found adjacent to the northern portion of the east wall of House 1 with the decorated side facing downward and the top of the design toward the center of the house.

A second decorated plank (129/IV/7) was recovered adjacent to the south wall of House 1. This plank is decorated with designs representing two thunderbirds and two fork-tailed wolves or dogs (a portion of this panel is shown *in situ* as the cover photograph of part III). Again, the design

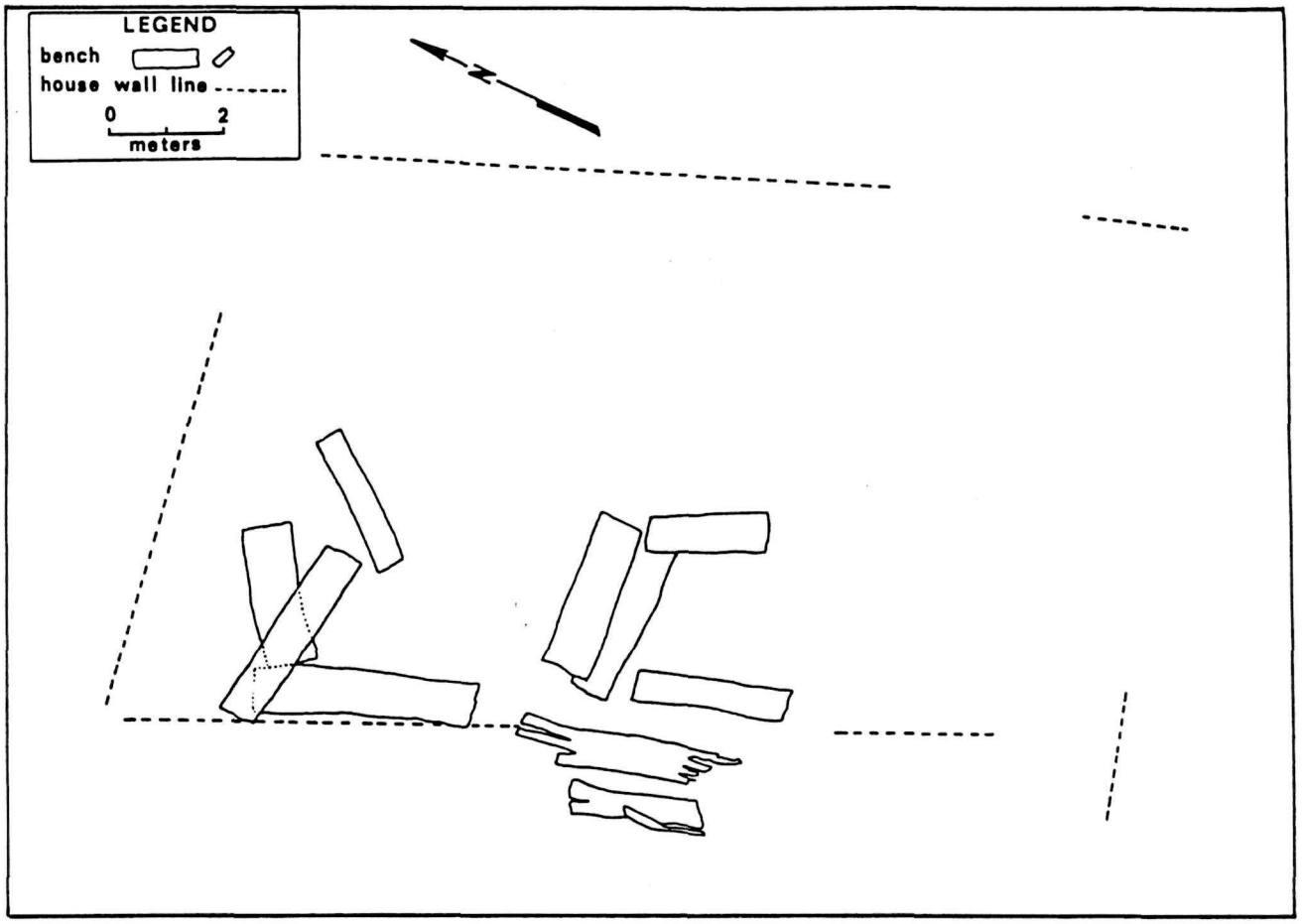


Figure 63. Distribution of benches in House 2.

is channeled and traces of red pigment are preserved on the plank. In addition to the channeled lines, punctures are employed as a decorative element. The panel is extensively mended and six square holes are cut through one end and two through the other. Fine dressing scars occur on the decorated side. One edge of the panel is a separate piece, lipped and sewn on. The panel is very fragmented and was found with the design elements facing upward. It apparently was displaced by the mudslide and originally may well have been in House 2.

A third panel (129/IV/43) was found in the southern area of House 1. This plank also is carved with a design representing a whale but the head is truncated. This truncation was caused by cutting the plank rather than its being broken. As with the other carved planks, the design on this plank was channeled. No painting is visible on its surface. Both edges are missing although one edge is curved as if it had been strongly lipped at one time.

It is unlikely that the truncated whale plank was in use as a decorated plank at the time of the Unit IV mudslide. There is clear evidence that the plank was displaced by the slide but there is no clue as to its original location. Of the three carved panels, only the long whale plank was definitely near its original location.

The method of fastening the planks is not clear from the Ozette data. The location of the long whale plank suggests that they were located near or against the wall of a house. If not

fastened directly to the wall, they may have been fastened between light poles in the manner of wall construction.

James Swan (1870:7) mentioned that large boards or planks frequently were displayed in Makah lodges. These were painted with various designs and mostly represented "the private totem or tamanous of individuals." The term "tamanous" was used by Swan in the sense of a guardian spirit (Swan 1870:61). Swan assigns no function to the tamanous planks other than being of decorative or supernatural significance. Local informants indicate that these planks were used during puberty seclusion. They suggest the term **/ci-tak-sat/** → 'the back portion' for the panels.

Swan also states that the tamanous planks of the Makahs were obtained from the Nitinahts and varied in length from 10 (3.05 m) to 20 ft (6.1 m). While there is no evidence at Ozette for a distant origin for the carved panels found there, they all fall within the size range stated by Swan; the shortest plank (129/IV/43) is 3.99 m in length while the longest (29/IV/21) is 5.25 m long.

Decoration

In any discussion of dwellings within the context of traditional life at Ozette village, the decoration of certain structural features should be noted. In addition to the large carved panels, decoration occurs on other structural remains, particularly planks. This decoration is characterized here as "formal" or "informal" depending upon its planning, execution, and probable social significance.

Formal decoration apparently was well planned in advance. Technologically, it is distinguished by carving and inlaying. Painting also might be added as a characteristic of formal decoration although it survived rather poorly at Ozette.

Carving on the formally decorated structural remains in the Ozette collection is generally deep and deliberate. Other than the carved panels found in House 1, formally decorated structural remains are limited but include a bench lip with a dog or wolf head, another possible bench fragment with a geometric design, and inlaid planks. Of the decorated Ozette structural remains, the inlaid specimens are the most spectacular. Inlaying was accomplished by carving or drilling holes into which the inlay material was set. Inlay material generally consists of Red Turban snail opercula, although a piece of quartz was found along with the opercula on one specimen. One double lipped bench front is extensively inlaid (Figure 64). In addition, a plank was recovered that is inlaid with opercula along the longitudinal half of one side; the other half was painted with red pigment. This plank was found along the east wall of House 1 between the wall and a rafter-support post. Whether this was the original position of the plank before the Unit IV mudslide is not known. Opercula inlay and inlay holes are found on at least five small fragments of structural remains of unknown function.

Decoration of rafter-support posts and rafter beams is unknown at Ozette. Densmore (1939:6) reports an historic shed-roof house at Tsoo-yes that had carved eagles on the tops of the wall poles. Evidence of such carving on wall poles was not found at Ozette and the example at Tsoo-yes likely is a late manifestation among the Makahs.

Informal decoration of the Ozette structural remains is characterized by being lightly cut or scratched into the surface of a plank. Little deliberation or forethought seems to have been involved in its production. Seventeen planks in the collection display such decoration (Figure 65). Generally the motifs are symbolic rather than anthropomorphic and are predominately vulvaforms. Geometric forms occur in only two cases. To all appearances, the informal decoration on the planks in the Ozette collection is analogous to graffiti in contemporary culture, and is of particular interest in that it generally is not included in discussions of Northwest Coast art. Although much has been made of the formal aspects of this art and its relation to society, little mention has been made of the more casual, informal art.

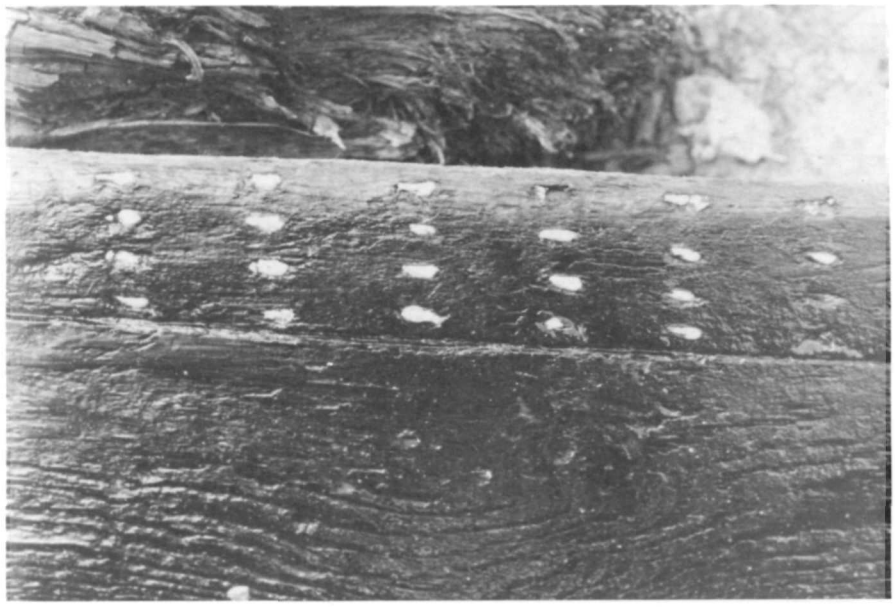


Figure 64. Detail photograph of a bench front, showing opercula inlay.

The formal and informal art displayed on the Ozette structural remains is not limited to structural remains of houses. Numerous examples in the artifact collection are decorated in one form or another; formal and informal art may be distinguished and generally display the same style as that found on the structural remains.

As is the case with much of the decorated material from traditional Northwest Coast societies, the decoration of the Ozette structural remains probably was closely associated with social aspects of the society. Decoration of the structural elements and tools in the houses may have been an indicator of wealth and an advertisement of social rank. In the Ozette houses, the formally decorated structural features, particularly the inlaid material, may have marked higher ranked locations within the dwellings.

Accessory Features

Accessory features are defined here as those architectural features that did not contribute directly to the structural integrity of the Ozette dwellings. This is not to deny any relationship, however, and accessory features often may be seen as contributing to the houses in terms of maintenance or comfort.

Partitions

The historic data available on the Makahs strongly suggest the use of partitions within a dwelling to subdivide space. Gibbs (1855:176) reports that Makah houses were occupied by several families whose areas were separated by partitions two or three feet high. Swan (1870:7) also mentions that families were separated by partitions consisting of single boards set on edge. The photograph

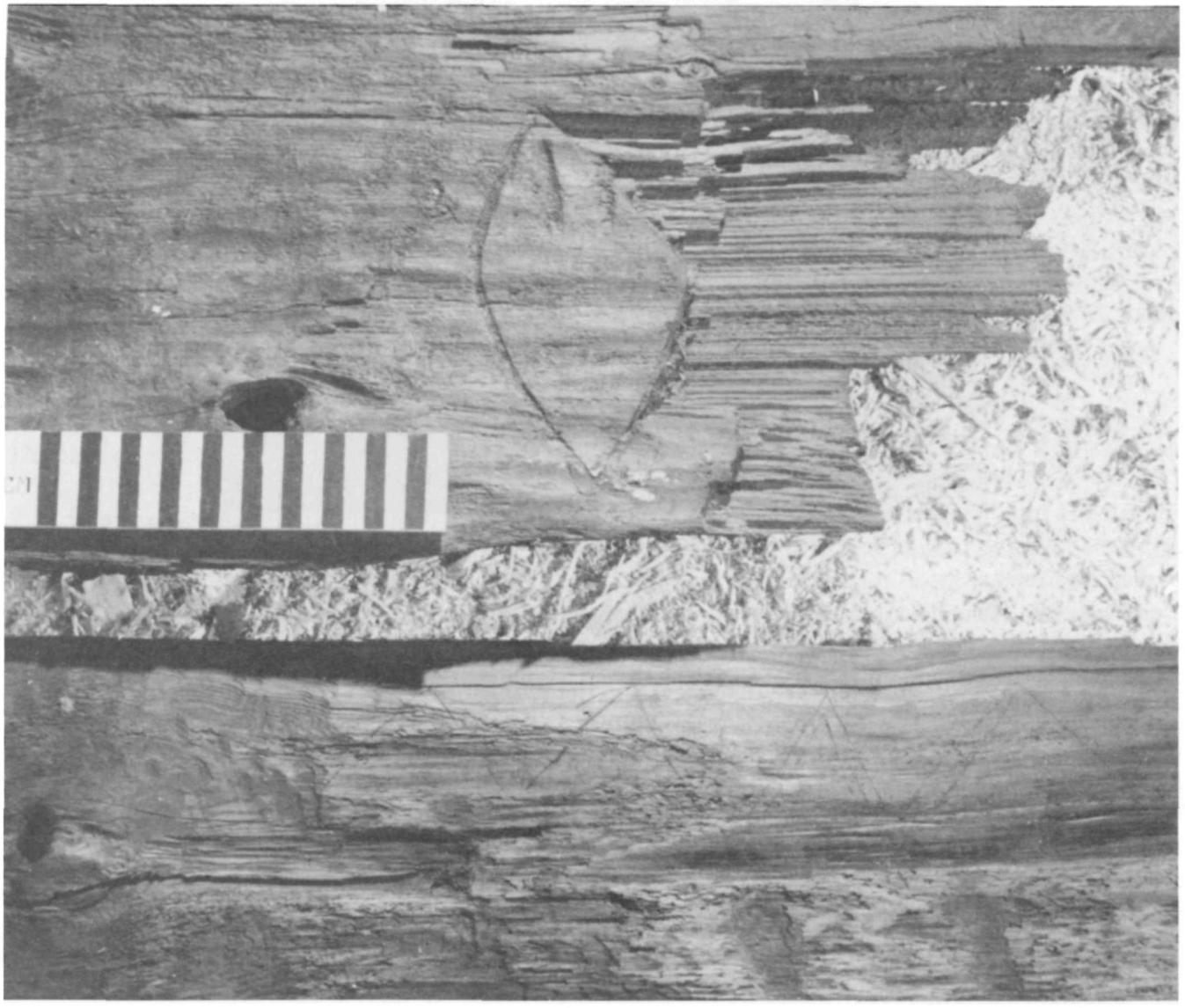


Figure 65. Informally decorated planks.

of the Makah house interior (Figure 26) shows a low single plank partition, possibly another higher one behind the first, and either a mat wall-hanging or partition at the far end of the house.

From the historic data, partitions might be expected in the Ozette houses but none could be found. Their absence may be attributed to several causes. They may have existed but cannot be identified in the debris. From the accounts of Gibbs and Swan, partitions apparently were simply planks and would be difficult to identify in the Ozette houses if they had been displaced by the mudslide. The use of partitions possibly was related to particular seasons and might not have been in use at the time of the Unit IV slide. Finally, partitions might have been used at Ozette but not in Houses 1, 2 or 5.

Floors

The floors of the Ozette houses consisted of midden that accumulated gradually as the houses were occupied. There was no evidence of floor planking of any sort in the house debris. In House 1, the floor midden ranged between 20 and 40 cm in depth. Constituents of this floor midden include animal bones, plank remains, wood chips, fire-cracked rocks, stakes and post molds, hearths, and features such as rock and pebble concentrations. These midden elements are the products of many activities, ranging from food preparation to tool fabrication.

The thickness of the floor middens contrasts drastically with the midden found outside the houses. Exterior midden often was two or more meters thick. In part, the exterior midden may have been the result of outside activities but the bulk of it was composed of debris from household activities that had been transported and deposited around the houses. One local informant indicates that the floors of the "old style" houses, without floor planks, were regularly swept with cedar boughs. Concentrations of single elements in the exterior midden, such as clam or periwinkle shells, suggests that these materials were transported out of the houses soon after use and before they had a chance to become mixed with general floor debris. Disposal of midden debris probably was accomplished with baskets.

Perhaps one of the more significant contributions of the Ozette excavations is the discovery that floor midden can be distinguished from exterior house midden even in the absence of house walls. The distinguishing attributes of these two midden types have been detailed by Samuels (part III) and are only summarized here.

The floor midden encountered in the central part of the Ozette houses exhibited fine laminations possibly caused by the compaction associated with walking on the deposits. These laminae were not found under the benches. In contrast, the exterior midden associated with the Ozette houses was much less compact, and stake and postmold frequencies were much lower than in the houses. On the other hand, concentrations of bone, shell, and wood debris were encountered in exterior midden with much greater frequency than in floor middens. Exterior midden also contained a higher frequency of shell concentrations of a single species, and the size range of shell and bone fragments was greater. Finally, the floor middens at Ozette were characterized by internal features such as hearths, pits, and rock and pebble concentrations that generally were lacking outside the walls of the houses. Analysis of these features is presented in part III.

The predictive value of this model of the floor/exterior midden differences has been demonstrated on a number of occasions during the Ozette excavations. The existence and location of the houses south of House 1 rests largely on evidence generated by distinctions between the two midden types. During the excavation of a test trench north of the major excavation area, the nature of the midden deposit was such that it became obvious the trench was intersecting a house floor (House 4) before the wall line actually was discovered. With or without preserved structural remains, the model of floor/exterior midden distinctions should have real value in delineating house areas, both in other areas of Ozette and in other archaeological sites on the Northwest Coast.

Storage

Because of seasonality of Makah resources and the specialized technologies developed for their harvest, some tools in traditional Makah culture were in use during only a part of the year. These were stored in the houses when not needed. Many items of hunting gear, particularly the whaling and sealing harpoons, fishing gear, and bows and arrows were found stored in Houses 1 and 2 at the time of the Unit IV slide. These types of implements contrast with items such as cooking boxes, sleeping mats, and looms that probably were in daily use within a house. In addition to storing

this equipment the harvested resources themselves must have been kept for extended periods of time within the dwellings. Dried fish and meat, berries, whale and seal oil, and roots and shoots all may have been stored for processing or later consumption. In addition to foodstuffs, certain raw materials such as cedar bark, cedar limbs, and spruce roots, all found within the buried houses, were kept for eventual modification and use.

Given the complexity of the material culture, the variety of food resources and raw materials, and the space available within the Ozette dwellings, it might be expected that certain features of the architectural system related at least in a secondary way to the storage of materials. (A secondary relationship would be one in which the storage function would be an added function, not the primary function, of an architectural feature.) An example of this is the house walls where the primary function was to enclose a house and provide shelter yet withe-slung wall construction offered many opportunities for storage. The whaling harpoons recovered in House 1 seem to have been fastened to a house wall and an arrow was found tucked behind an interior wall pole in the east wall of House 1. The areas behind the benches were utilized for storing many items, ranging from canoe paddles to loom gear.

Some areas of the Ozette houses were used primarily for storage at the time of the Unit IV slide. In House 1, for example, the eastern corners of the structure appear to have been used for storage of loom gear and other materials. To facilitate this, benches along either adjoining wall did not abut in the corners and appear to have been purposefully placed out from the house walls to provide storage space.

There also is ample historic data to indicate that certain architectural features existed in Makah dwellings specifically for storage. Gibbs (1877:174) reports that the Makahs had overhead storage shelves and poles on which property was stored. Swan (1870:6) notes that baskets of provisions were stored over the beds in Makah houses. Neither observer, however, mentions the actual method of construction for these storage features.

The photograph of the interior of a Makah dwelling (Figure 26) provides some data as to the possible construction of overhead storage facilities. In this illustration, a loft composed of poles fastened at right angles to the long axis of the house is visible. These poles support other poles from which a canoe sail (?), seal skin pokes (filled with oil?), and other articles are suspended. In one section, the ends of planks forming an overhead platform may be seen. Unfortunately, the ends of the cross poles are not visible so there is no direct evidence as to how they were supported. Two taut vertical ropes are visible, however, suggesting that at least one end of these poles may have been suspended. A ladder, seen in the background of the photograph, provides access to the storage platform. In addition, light poles from which fish are hanging span the rafter beams above the platform or loft.

The photograph of the house ruins at Archawat (Figure 23) shows smaller vertical posts adjacent to the rafter-support posts of the dwelling. The function of these posts is not indicated in the photograph but they may be related to overhead storage features.

At Ozette there is no evidence of overhead storage features in either of the buried houses. Considering the historic evidence, however, it is likely that they were employed but are not identifiable. The round posts located in the corners of the houses may have supported overhead storage facilities or lofts but no additional evidence of such features has been recovered. The structural elements that probably would have been involved in such features (poles, planks, and withes or ropes), cannot be distinguished from elements of other structural features in the houses.

Fish-Drying Frames

James Swan (1870:7) reports that fish-drying frames were attached directly to Makah houses. These frames consisted of horizontal poles fastened across the ends of wall poles that extended above the roofs of the houses. George Gibbs does not mention such racks but does illustrate wall poles extending above the roof lines of the houses in his sketch of Deah village (Figure 22). Drying frames similar to those described by Swan can be seen on the summer dwellings on Tatoosh Island (Figure 19).

In the Ozette excavations, a number of long poles were recovered lying on top of the pile of planks and poles that formed the east wall of House 1 (Figure 50). These poles originally were located along the west wall of the dwelling and seem to have been associated with that house rather than House 2. The poles had been sharpened on their thicker ends, set vertically in the ground, and apparently attached to the wall of the house with withes. The longest of these poles is over seven meters in length. No cross poles were found in association with the vertical support poles for the fish-drying racks. The relationship between the two may have been destroyed by the Unit IV mudslide.

A question relating to attached fish-drying frames is whether the upright poles were simply long wall poles or whether they were accessory features, not directly contributing to the structural integrity of the house. Although not entirely clear, the Ozette data suggest the latter, especially considering the fact that their use probably was seasonal.

Drainage Features

The Northwest Coast of North America is distinguished from other areas of the western United States and Canada by its high annual precipitation. One of the primary functions of any dwellings in this area, whether traditional or contemporary, is to shelter the inhabitants from the frequently adverse weather. This was no less true at Cape Alava than for other areas of the coast. The situation here, in fact, is worsened by local topographic and geologic conditions.

The steep gradient of the bluff east of Ozette village resulted in a great deal of surface runoff. Since the village was situated at the foot of the bluff (Figure 8), much of this water flowed into the house areas. In addition, the deposits exposed by the slides contributed a great deal of moisture from water that percolates through the lenses in the clay. As a result, the village was subject to much ground water flowing off the hill during the wet winters and even during the other, relatively drier, seasons.

Within the Ozette village area, water drained both through the permeable midden and along the surface. Rain shed from the roofs of the houses added to this water during bad weather. Around Houses 1 and 2, where the roofs sloped to the east, this water was deposited upslope from the structures and drained back into the dwellings. Thin lenses of clay, apparently deposited as a slurry, were found in areas of the floor midden of House 1, indicating that in the protohistoric Ozette village seepage into the houses was a major problem.

Excavations in Units IV and V revealed a number of architectural features related to drainage. These features were both directly and indirectly associated with House 1 and House 2, and represent major efforts by the villagers to direct surface runoff from among the houses to the beach. These efforts resulted in several distinctive features of whalebones, planks, stakes and pegs, as well as trenches dug into the underlying clay or midden. The following discussion reflects the extent of excavations conducted through 1976. See the discussion of bank-stabilization and water-diversion features in part III for further information and final maps (including excavation conducted through 1981).

South Whalebone Feature. The south whalebone feature, the first drainage feature found associated with the houses at Ozette, functioned to channel runoff that accumulated between Houses 1 and 2, and houses to the south. This feature is represented by a complex series of constructional features and depositional episodes which span the history of occupation in this area. The excavation of this feature has been detailed throughout the interim reports of the Ozette Archaeological Project (these are cited in part I), and is only summarized here.

The first episode in the evolution of the south whalebone feature involved the excavation of several trenches into Unit VI clay. The slope of the trenches proved insufficient to carry sediments onto the beach and the trenches filled with silt and sands and overflowed their banks. This initiated a long series of constructional episodes to control the drainage in this area. Whalebones seem to have been used in lieu of logs to divert or channel the runoff waters, with ribs, mandibles, and even segments of vertebrae, scapulae, and skulls employed in aligned configurations for this purpose (Figure 66). Planks placed on edge and held upright by stakes also were employed at various times. The accumulation of natural and cultural deposits that comprise the south whalebone feature was finally terminated by the Unit IV mudslide.

The south whalebone feature represents a response to a highly localized problem. Since the deposit represents a substantial period of time, is composed of a number of discrete constructional episodes, and since these features were similar in techniques and materials, this response may be considered part of the architectural system operative at Ozette in protohistoric times.

East Whalebone Feature. Another constructional feature located between House 1 and House 2 also involved the extensive use of whalebone as a material. Originally, a clay bank existed in the area between House 2, located about two meters higher, and House 1, lower as well as further west. In part, this bank was formed by leveling of the floor of House 1 during its construction (see Figure 56). Occupation of House 5, followed by the construction and occupation of House 2, resulted in the accumulation of midden and large quantities of whalebones paralleling the walls of the dwellings.

The east whalebone feature, unlike the south whalebone feature, consisted primarily of whalebones. Toward the southern end of the feature, rocks which may have been a constructional element of the feature were found imbedded in the bank. In addition, two 10.5 m long logs were found buried in the accumulated midden (Figure 67).

It is likely that a number of discrete construction episodes also were involved in the development of this feature, the purpose of which is less clear than in the case of its neighbor to the south. It is clear that the east whalebone feature did not function to control surface runoff as did the south feature. The steep slope between House 1 and the higher dwelling, House 2 or House 5, probably precluded the diversion of water perpendicular to the slope. The most reasonable suggestion is that the logs and whalebones were placed on the bank to stabilize the slope between the higher structures and House 1.

Virtually all areas of the village outside the houses were dumps for midden. Refuse deposited on the slope would have crept or slumped downslope and accumulated against the east wall of House 1. This must have been undesirable for its occupants, as it resulted in pressure against the east wall of the structure, and the chemical environment would have hastened deterioration of the lower wall planks. In addition, any exposed clay faces on the slope between these structures would have been prone to slumping which, if not controlled, would undercut the west walls of House 5 and later, House 2.

Figure 66. Photograph of the upper level of the south whalebone feature, facing north. The south wall of House 1 is just beyond the whalebones, with the southeast corner at the right.

Retaining Walls. Low retaining walls, paralleling the east wall of House 1 and possibly the north wall of the structure were located during the excavation of the house. As with the east whalebone feature, they did not relate directly to drainage of the site area; rather, they were in response to geomorphic processes accelerated by the surface and subsurface drainage of the village site.

A low retaining wall was excavated along the northern portion of the east wall of House 1. Structurally, the retaining wall seems to have been quite simple; single planks were laid on edge and supported by stakes. The function of this retaining wall seems to have been to prevent midden from accumulating against the house for the same reasons mentioned in the preceding discussion of the east whalebone feature. This wall was found collapsed and buried under a pile of stratified midden.

Figure 67. Photograph of the east whalebone feature, facing east.

A second retaining wall may have paralleled the north wall of House 1. The existence of this wall is uncertain because of the difficulty in separating its components from buried boards associated with the construction of the house wall. Considering the depth of accumulation of the floor and exterior middens immediately to the north of House 1, it is likely that some efforts were made toward preventing the collapse of the bank against the wall of the dwelling.

Interior Drainage Features. Drainage features were found within all three completely excavated floors. The purpose of these features was to channel surface drainage out of the houses. Their construction involved planks placed adjacent to the house walls and plank-lined or covered ditches dug into the floor midden and underlying clay.

Excavation of the lower portions of certain walls in House 1 revealed a number of boards paralleling the walls but structurally independent of them (Figure 68). These boards had been placed on edge, sometimes into Unit VI clay, and buried by the accumulating floor midden. The purpose of these "baseboards" is not entirely clear. They were not found along every wall line but were concentrated along the east wall of House 1. There is some evidence that they also were placed along the east wall of House 2 (Figure 69).

The function of baseboards in the Ozette dwellings is not clear. It is apparent, however, that they were not part of wall construction since they do not occur along every wall nor are they physically related to the walls. It is hypothesized here that these boards represent attempts to block seepage under the walls of the houses. Baseboards may have been set into the floor of the

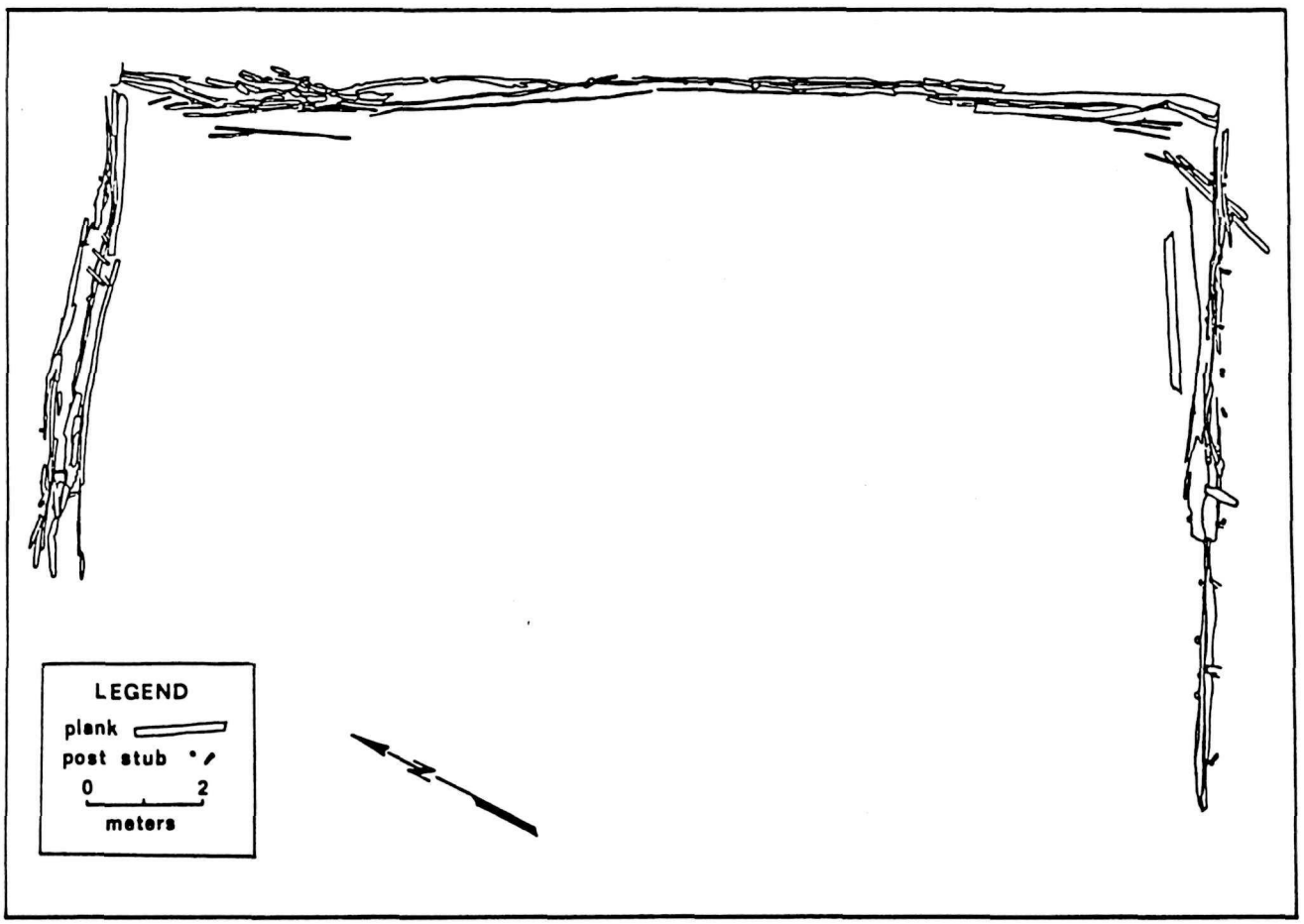


Figure 68. House 1 baseboards and lower wall boards.

midden, adjacent to the walls of the houses, to divert the seepage laterally or to force it deep enough so as not to be a problem in the houses.

In the southern area of House 1, a shallow channel was found leading under the south wall (Figure 70). This ditch, less than three meters long, was lined with boards held in place by pegs. The interior end of the ditch was close to the ends of baseboards along the east wall of House 1. This drainage feature appears to have functioned as an exit for seepage diverted laterally by the baseboards.

A much larger and more complex ditch system was found in House 2 (Figure 71). Excavation of the floor midden revealed a trench that had been dug across the width of the dwelling. Another ditch intersection the first near the east wall and extended to the north wall. A portion of the northern segment of the ditch system was lined with boards set on edge. The whole of the system was spanned with stakes on which planks were placed as a cover. The northern end of the north segment also was associated with whalebones. Despite the fact that midden had accumulated over the planks, the system was functional at the time of the Unit IV slide and the ditch was still clear of debris when excavated. Photographs of this ditch system are presented in part III.

Both the northern and eastern ends of the House 2 drainage system were closely associated with the walls of the house. These two points apparently were located in major seepage areas where water could not be diverted around the dwelling. The occupants of House 2 therefore chose to construct the ditch system and channel the water flow through the house. This ditch exited near

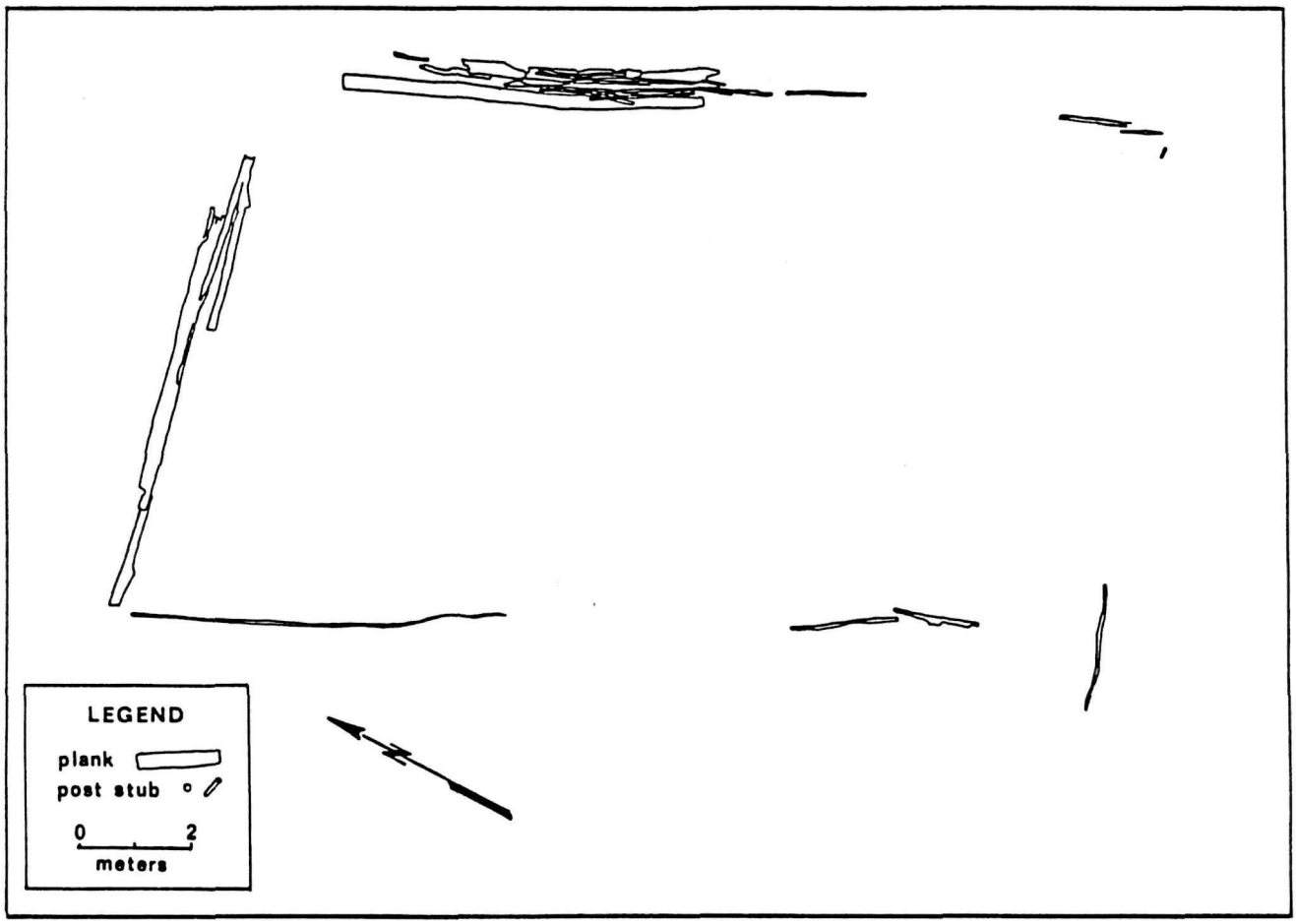


Figure 69. House 2 baseboards and lower wall boards.

the middle of the west wall of House 2 and doubtlessly added to the drainage problems in the area between House 1 and House 2.

A patterned and systematic approach to the problem of drainage in the village was revealed by the excavations in Area B70. Drainage features, both inside and outside of the houses, functioned to control surface and subsurface runoff and to control related problems such as slumping and creep of the midden. While construction of these features, particularly the interior ones, probably related to the comfort of the occupants of the houses, practical considerations such as slowing the weathering and deterioration of components of the houses also may have been involved.

Repair and Maintenance

Houses on the Northwest Coast of North America tended to be long lived. During use, many of the original structural elements probably were replaced as they deteriorated or were damaged. Withe-slung wall construction and loose roof planking allowed replacing wall poles and planks as well as roof planks and rafter poles with relative ease. Only rafter-support posts and rafter beams would have been difficult to replace because of their size and weight.

Western red cedar, the primary wood in the Ozette houses, is well known for its resistance to decay. Deterioration of the lower portions of the walls, posts, and poles in the Ozette structures

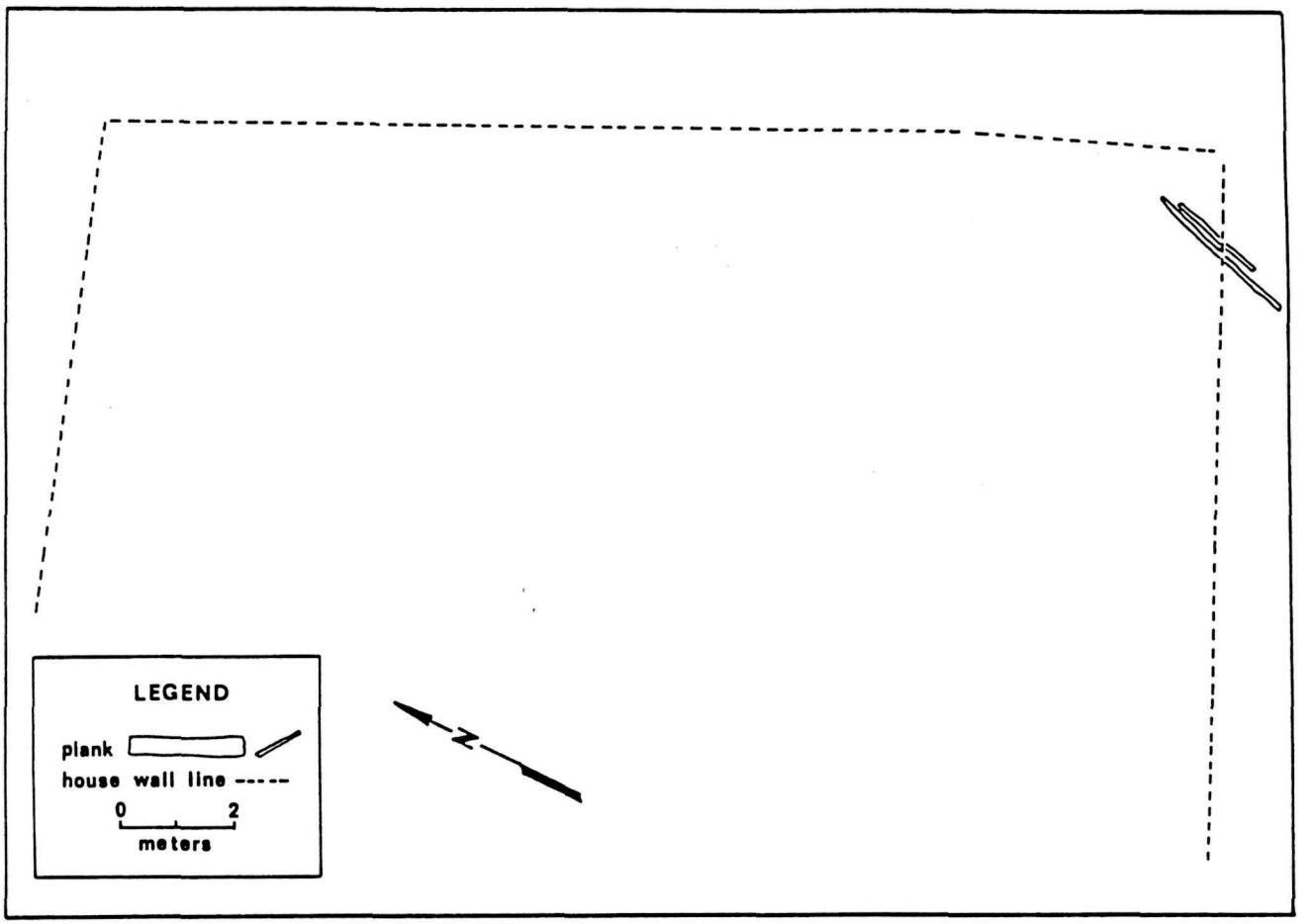


Figure 70. House 1 drainage features.

may have been accelerated, however, because they were in contact with moisture and the chemical environment of the midden. Some damage to various structural elements probably occurred during seasonal dismantling, transportation, and reassembling of the houses. In addition, activities connected with the dwellings, such as walking on the roofs of the houses while drying fish, also were likely to cause some damage.

Part of the maintenance of shed-roof houses in Ozette village involved replacing and recycling deteriorated elements. This resulted in bilaterally lipped planks in walls, canoe fragments as planks, and use of broken wedges and harpoon shaft fragments as stakes and pegs. There also is ample evidence of attempts to repair damage, especially to planks. Repair of longitudinal splits and checks by sewing is common.

Repair and replacement of structural elements constituted relatively minor maintenance in terms of entire houses. In Unit V evidence was found of a major repair involving the northern portion of the east wall of House 1. This portion of the wall was moved inward a short distance, leaving the lowermost portions of the wall still in place. The reasons for this rebuilding are not completely clear. The absence of charcoal indicates that fire was not a factor. Most likely, the rebuilding was required because of wall deterioration from moisture and midden accumulation. Whatever the reasons, the rafter-support posts also were affected. During the excavation of the east wall of House 1, the first indications of reconstruction were pairs of rafter-support post stubs

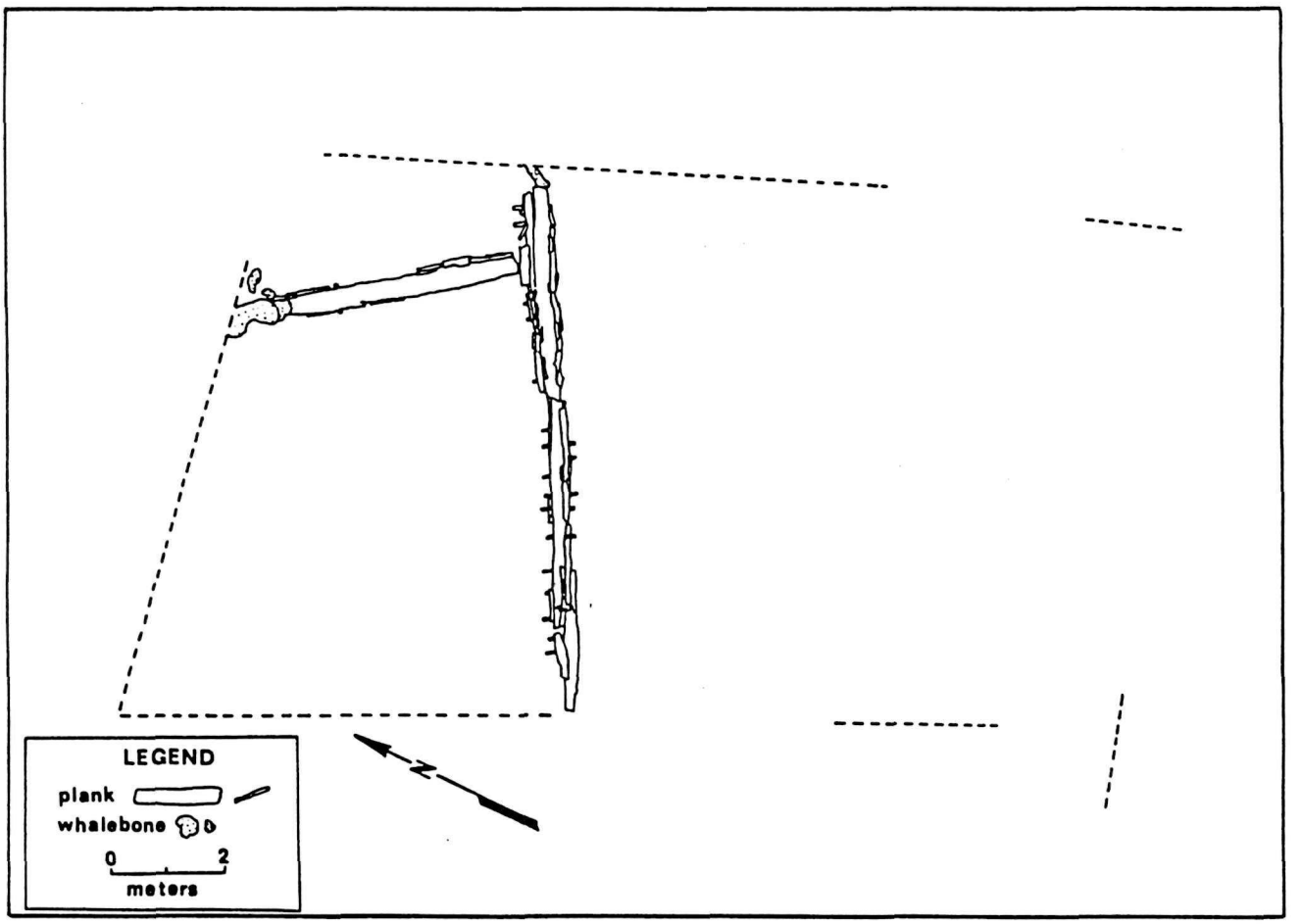


Figure 71. House 2 drainage features.

found in two stations along the line (Figure 42). The members of each pair were aligned so that one was inward of the other. In addition, many baseboards, stakes and pegs, and postmolds were found in an area wider than would have been required for the wall (Figure 72). The excavation of the rafter-support post stubs revealed that the pits for the interior member of each pair were not lined with rocks. Elsewhere in the Ozette houses, lining these pits with rocks was a common technique (see Figure 55).

Probably as a result of the exterior midden accumulating against the wall, the northern portion of the east wall of House 1 deteriorated to the point that rebuilding was required. As a result, the standing, above-ground portions of the wall were dismantled and the rafter-support posts were cut or snapped off at floor level. The stubs of these posts, as well as the lower portions of the wall and the associated baseboards and stakes, were left in place. The wall was then rebuilt inward from its original location. The former position of the wall may not have been used due to the structural remains left in place and possibly because the midden behind the wall would have required excavation. The rebuilding of the wall appears to have been hasty since the pits for the new rafter-support posts were not rock lined. The Unit IV mudslide snapped off the newer rafter-support posts at ground level, resulting in the pairs of rafter-support post stubs encountered during the excavation of the wall.

Figure 72. Photograph of baseboards along the east wall of House 1.

Another feature of interest is a series of short poles found immediately adjacent to the interior side of the southern portion of the east wall of House 1. The poles involved in this feature are all relatively thick and stood less than one meter above the surface of the floor at the time of the Unit IV mudslide. These poles were not wall poles because: (1) they were spaced more closely than wall poles; (2) they were all of the same height and relatively short; and (3) they did not have opposite members outside the walls. These poles are interpreted here as buttresses to keep the wall from collapsing because of pressure caused by midden accumulating against the outside of the wall.

Summary

This chapter defined and described the structural features identified in House 1 and House 2 at Ozette. These features were in turn built of the structural elements discussed in the preceding chapter.

Reference has been made to the Ozette architectural "systems." One definition of a system is "any intercommunicating network of attributes or entities forming a complex whole" (Clarke 1968:44). In reference to the Ozette data, two points should be made regarding systems. The first is that most systems "can be acted upon by various external conditions and can themselves act upon such conditions" (Clarke 1968:45). The second point is that systems may exist in different states of equilibrium or stability. One of these states is defined as follows:

> A system is said to be in unstable equilibrium if a small displacement from the equilibrium state gives rise to accumulatively greater displacement from that specific state—usually towards some alternative or fresh equilibrium state (Clarke 1968:49).

The architecture of the Ozette houses formed a system and the houses, as manifestations of this architectural system, were in a state of unstable equilibrium.

Given this definition of a system, the structural features discussed in this chapter can be considered "intercommunicating entities." Major changes in one feature were very likely to affect other features in the houses. Moving the north portion of the east wall of House 1, for example, required replacing at least two rafter-support posts and must have displaced any benches adjacent to the wall.

If the Ozette houses represent an architectural system, then drainage and seepage problems were external conditions acting upon the system, threatening or upsetting its equilibrium. If unchecked, the accumulation of midden against House 1 and the constant contact of the walls with surface and subsurface moisture would have greatly accelerated the deterioration of the wood and threatened the structural integrity of the house. The responses to these problems found during the excavation of the houses—baseboards, retaining walls, whalebone features, and bank and wall buttressing—all are examples of the architectural system responding to, or acting upon, external conditions.

While each repair technique or maintenance structure represented an attempt to maintain the stability of the Ozette houses as subsystems, their cumulative effects resulted in the houses being shifted to new or alternative equilibrium states. If House 1 or House 2 had been buried by a mudslide immediately after it had been first erected, it is likely that many of the repaired elements and maintenance features would not have been found upon excavation. The physical accumulation of repairs and maintenance features in the Ozette houses greatly altered the appearance and structure of the houses during their histories.

In summary, the Ozette architectural system was comprised of the interrelated structural features and elements discussed in this and the preceding chapter, and the repair and maintenance techniques that contributed to the structural integrity of the houses. This architectural system, however, was but a local expression of a broader architectural system, that of the shed-roof house type. The structural elements and features discussed so far are only those in evidence at Ozette or reported in the historic material on traditional Makah dwellings. The next two chapters examine similar dwellings documented in coastal areas of what is now northern Washington State and southern British Columbia. The purpose of this survey is to place the Ozette houses within the total range of the shed-roof house type in the Pacific Northwest.

CHAPTER 6

SHED-ROOF HOUSES IN THE PACIFIC NORTHWEST

Introduction

The primary house form of the Northwest Coast of North America was a large, rectangular, plank dwelling. A key feature of these houses is that they were constructed of split planks. This was possible because of the availability throughout the area of woods with low cleavability, allowing a longitudinal split to be initiated with minimum force. In the northern portion of the Northwest Coast, Alaska yellow cedar was employed for planks. Farther south, western red cedar was available, and along the southernmost Northwest Coast, Port Orford cedar and redwood were employed. All these woods cleave easily, are straight grained and occur as large trees. These characteristics allowed many square feet of planks to be obtained from a single log. From these woods the people of the Northwest Coast manufactured planks in a variety of sizes for use in house construction as well as certain artifact classes.

Northwest Coast House Types

Although the plank houses of the Northwest Coast are generally similar, particularly when compared with dwellings outside the area, a number of geographical variants existed. Philip Drucker (1963:67–71; 1965:25–27) classifies these variants into five house types, the distinguishing attributes of which are discussed below. Two of these, the shed-roof and Wakashan types, are of particular interest here and are discussed in detail. The other three types are briefly mentioned for comparative purposes.

Northern House Type

The Northern house type was found among the Tlingit, Haida, Tsimshian, and Haisla or northern Kwakiutls (Figure 73). Houses of this type were nearly square with a low-pitched, gabled roof. Ridge poles were supported by front and rear posts. Slotted horizontal upper and lower plates held vertical wall planking in place. A door faced the beach at one gabled end and often was a round or oval opening cut through a center post. Occasionally, there was a deep central pit, sometimes in tiers. Plank-walled sleeping compartments were built on the benches between the house walls and the central pit.

Chinook-Oregon Coast House Type

Structures of this type were found along the coast of Oregon and the southern coast of Washington. Gabled roofs were supported on a frame of ridge poles and eave beams raised on upright posts. Dwellings of this type were semisubterranean with a deep pit lined with vertical planks. The eaves were so low that only the roof and part of the gable were above ground. Shelves and beds consisted of raised planks and the doors were at the gabled ends of the houses.

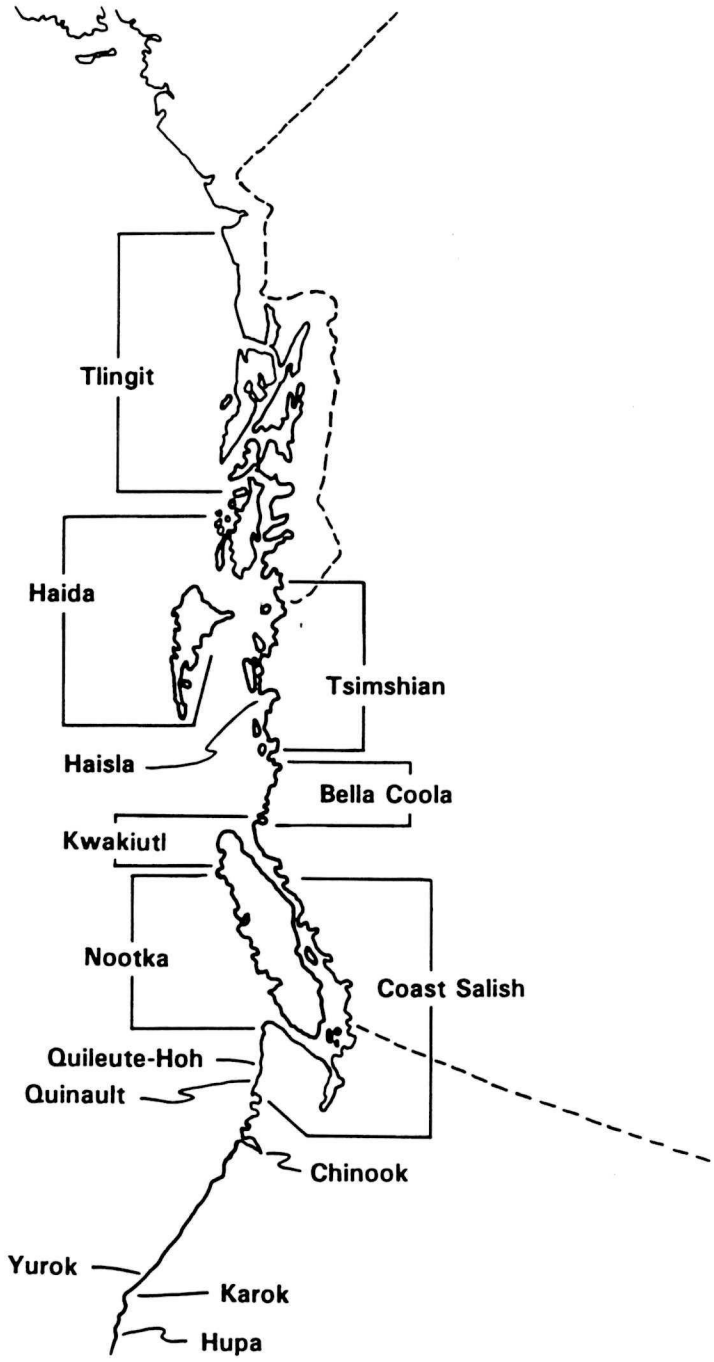


Figure 73. Major Northwest Coast native groups.

Lower Klamath House Type

This house type was found among the Karok, Yurok, and Hupa around the lower Klamath River (Figure 73). These structures were gabled, sometimes with triple-pitched roofs, and semisubterranean with the walls set back from a deep pit leaving a shelf or bench. Double front walls formed an anteroom and the door was cut through a plank set at one side of a gabled end.

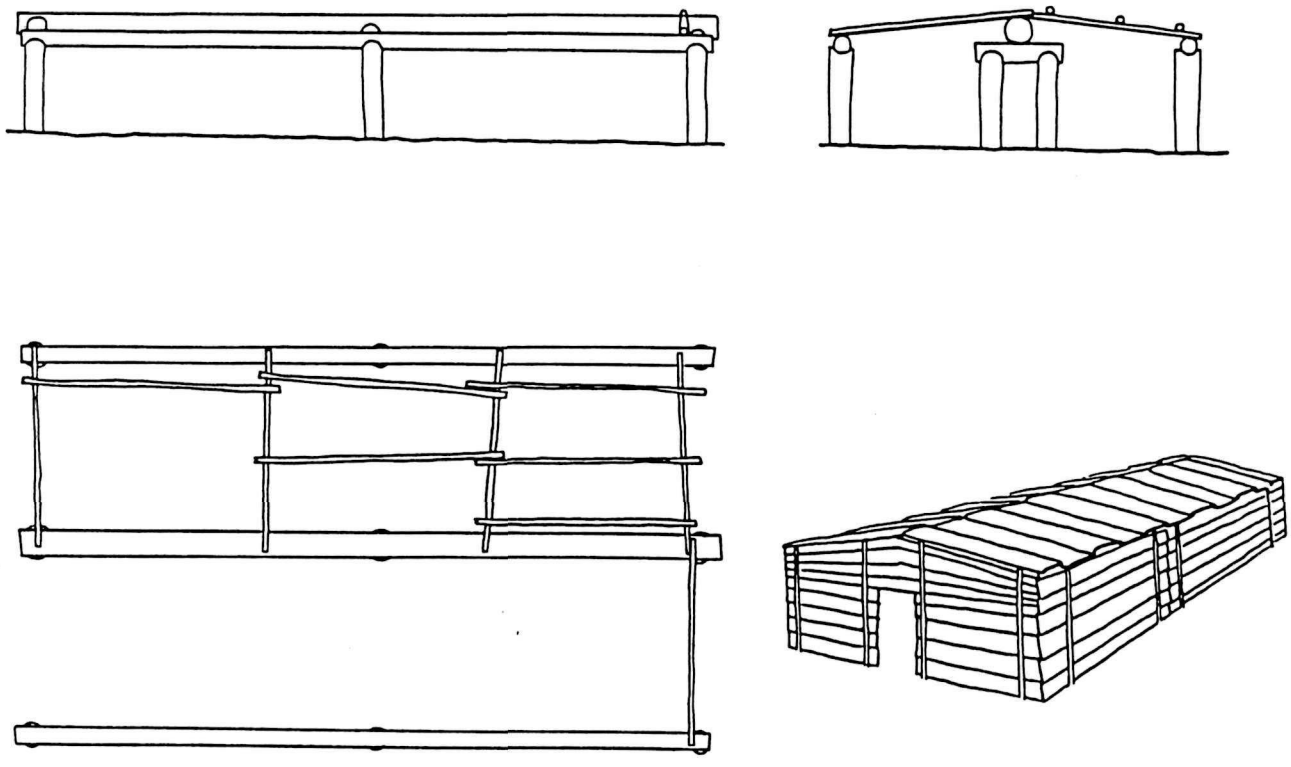


Figure 74. Wakashan house and house frame. For clarity many of the rafter poles are not illustrated.

Wakashan House Type

Wakashan houses were found among the Kwakiutl (except the Haisla), the Bella Coola, and the Northern and Central Nootkas (Figure 73). This house type had a low-pitched gabled roof supported by ridge and eave beams raised on vertical posts (Figure 74). In plan, Wakashan dwellings were rectangular and long relative to their width. House walls were of horizontal planks slung between wall poles and secured with withe ties. The walls were completely independent of the roof and roof-support frame. The Kwakiutl divisions using this house type occasionally had plank-walled sleeping compartments, a characteristic which Drucker feels was borrowed from the northern tribes.

Shed-Roof House Type

Shed-roof houses were used by many of the Coast Salish groups around the Gulf of Georgia and the Strait of Juan de Fuca, by the southern Nootkas and by many tribes in northwestern Washington. These structures were characterized by a flat, single-pitch roof with a low slope (Figure 27). In plan, they were rectangular and were generally narrower relative to their length than gabled dwellings to the north. Walls were constructed in the same manner as the Wakashan house type. Wide benches for sleeping and storage lined the walls.

In common with other Northwest Coast house types, shed-roof houses were rectangular, constructed with split planks, and had benches around their walls. Roofs were supported by horizontal beams raised on vertical poles. The roof form of shed-roof houses most distinguishes them from other Northwest Coast dwellings.

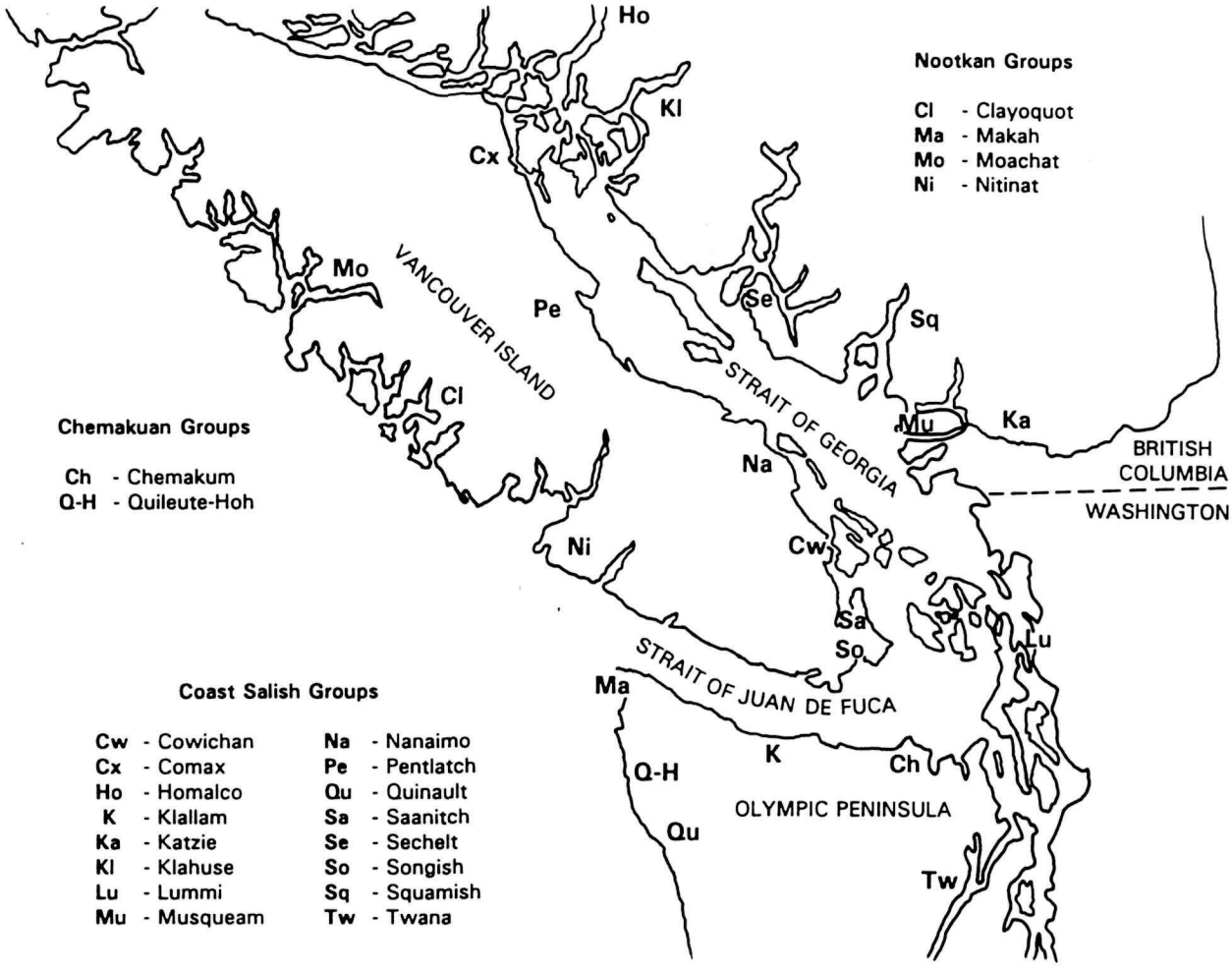


Figure 75. Locations of native groups in the shed-roof house area.

While shed-roof houses differed from Wakashan dwellings in roof form, the two house types had several features in common. These included withe-slung wall construction, a feature that distinguished both these house types from other Northwest Coast houses. In addition, they were not associated with house pits as were southern Northwest Coast houses and occasional Northern dwellings. In these shared features and in their geographic proximity, shed-roof houses seem more closely related to Wakashan houses than to any other house type.

On occasion, shed-roof houses were found outside the area defined by Drucker. Generally, however, these were specialized structures such as burial houses. They are not included in the discussion here.

A survey of the historic and ethnographic data available on shed-roof houses is presented below. For convenience, the data are presented by geographic area. Location of native groups mentioned in this survey are shown in Figure 75. Since Wakashan and shed-roof houses share certain features distinguishing them from other Northwest Coast house types and since the two sometimes were undifferentiated or confused by early observers, both house types are discussed here.

The West Coast of Vancouver Island

The west coast of Vancouver Island is penetrated by several major sounds containing many islands, bays, and inlets. These sounds offered advantages to the native inhabitants, including sheltered waters and a variety of harvestable resources. Much early exploration and commercial activity in these sounds resulted from the sheltered anchorages they offered and their concentrations of native populations.

Nootka Sound. Of all the sounds on the west coast of Vancouver Island, Nootka Sound had the most influential role in the exploration of the Northwest Coast. Since its apparent discovery in 1774 by Juan Perez, it served as the base of operations for many of the early traders and explorers as well as a political center during the conflicting claims between England and Spain for sovereignty over the area. For these reasons, some of the best descriptions of traditional Northwest Coast Indian life, customs, and material culture were written about the natives of this area.

The earliest detailed accounts of Nootkan dwellings are from the journals of James Cook's third voyage. Having sighted Cape Flattery on his voyage north, Cook missed the entrance to the Strait of Juan de Fuca and arrived at Nootka Sound in March, 1778. Visiting the Moachat village of Yuquot in Friendly Cove, Cook recorded many observations regarding the houses (Beaglehole 1967:317–318). The largest of these were 150 ft (45.7 m) long and between 24 (7.3 m) and 30 ft (9.1 m) wide. Regarding the construction of the houses, Cook reports:

> They first fix firm in the ground three rows of large posts, on there are fixed longitudinally [sic] large trees the whole length of the building, a cross [sic] these they lay the boards that serve for the covering, and those of the sides are fastened to the posts (Beaglehole 1967:317).

Some houses apparently were built on a slope with log floors supported by posts. These floors extended beyond the front of the houses, leaving a four foot wide platform which was ascended by steps. Entrances to the houses were on the water sides and were adjacent to passages that crossed half the widths of the dwellings. In wider houses, these passages joined others that paralleled the lengths of the houses. "Apartments" were arranged on either side of such passages.

The apartments that Cook describes were about 12 ft (3.7 m) wide and 16 (4.9 m) to 18 ft (5.5 m) long and were enclosed on one side and end by partitions against which benches were placed. Benches were raised six inches (15 cm) above the floor and occasionally there were two rows of benches, one rising behind the other. These served as seats and beds for the families that occupied the apartments. Each family had a fire in the center of their area. Cook also notes that some houses had windows in the form of round holes in their walls but that most light was admitted and smoke let out by shifting the loose roof planks.

Clerke, one of Cook's officers, also reports some observations of the Nootka Sound dwellings (Beaglehole 1967:1327–1328). He cites some houses as 100 ft (30.5 m) in length and 12 (3.7 m) to 14 ft (4.3 m) high. Posts were at each end of the houses on which rested large "trees" that supported the roofs. Roofs were flat "tho' somewhat shelving" (Beaglehole 1967:1327). Clerke also notes that the walls of the houses were planked and the roof planks could be moved at will. Each dwelling sheltered a number of families with their own fire. Fish were hung from poles fixed close to the roof for that purpose.

Finally, King (Beaglehole 1967:1408–1409), another member of Cook's expedition, reports that the Yuquot houses were in three rows. The largest of the houses was 140 ft (42.7 m) long and between 30 (9.1 m) to 40 ft (12.2 m) wide. Regarding construction, King says:

> the frame of the building consists of three rows of rough upright posts with large trees laid upon them the whole length of the building, on these are laid loose boards which serve for the roof.... The boards making the sides and ends were fixed to the upright posts (Beaglehole 1967:1408).

King says that the doors were placed at one corner of the houses but describes interior passages in much the same terms as Cook. Partitions were three (91 cm) to four feet (1.2 m) high. Four families occupied larger houses while smaller dwellings sheltered two families. King also mentions raised benches and occasional double benches.

The journals from Cook's expedition are notable in their detail and in their general agreement. Cook, Clerke, and King all report that the house dimensions they cite were of the larger dwellings in the village; only King describes the average-sized dwellings as roughly half the length for the bigger structures.

Both Cook and King describe the support poles for the roofs as consisting of three rows of upright posts. These supported longitudinal beams, paralleling the lengths of the buildings. Both Cook and King describe the roofs as flat although King mentions that they were shelving (i.e., sloping). A view of the village drawn by John Webber (Beaglehole 1967: plate 35), artist on the Cook expedition, also shows the houses with flat roofs. Additionally, Webber drew two views of the interiors of the Nootka Sound houses (Bushnell 1928: plates 2, 3) which are in agreement with the descriptions cited above.

The next important historical account of the houses in Nootka Sound is that of José Mozino, naturalist on the Bodega y Quadra expedition to the area in 1792. Mozino spent four months in the sound area and recorded numerous observations on the material culture of the natives. Of their dwellings, he writes:

> In order to construct them, they place some thick pine trunks vertically in the ground with notches upward. Upon these is placed an enormous round beam of the same wood, which, resting horizontally, serves as the base for the roof. The supports in the middle are higher so that the roof is pitched toward the sides; the walls are composed of planks of extraordinary size placed parallel and on edge overlapping each other and fastened to the supports with cords made from the bark of the same tree or from the cedar (Mozino 1970:17).

Summarizing the rest of his account (Mozino 1970:17–19), doors of the houses were made where the wall planks best permitted and were closed with mats. Roof planks were loose and movable, although care was taken to see that the edges of the upper planks rested exactly over the two lower ones. The houses were divided into compartments separated by partitions little more than a "yard" high.

It is of particular interest that Mozino clearly described gabled roof construction with ridge beams higher than the eave beams. This is an apparent contradiction to the descriptions of Cook, King, and Clerke who described the roofs as flat and apparently of shed form, and also differs from the Webber drawing of the village.

The illustrations accompanying a recent edition of Mozino' s Noticias de Nutkas (1970: plates 7, 11) also show flat, single-pitched roofs. Although the artist is not cited in this edition, the drawings apparently are those of Atanasiao Echeverria y Godoy. These illustrations appear to be highly stylized, probably due to the fact that they were finished by 14 Mexican artists upon Echeverria's return to Mexico (Cutter 1963:156). Another account of traditional Nootka Sound dwellings is in a journal kept by an anonymous member of the crew of the Chatam (Meany 1957b), one of the two vessels on George Vancouver's expedition to the Northwest Coast in 1792. The following description is of a dwelling at Tashees, a winter village of the Moachat:

> The frame ... was amazingly large but only the habitable part of it was roofed, this part was thirty yards long and eighteen broad. The roof was about 10 or 12 feet distant from the ground, and composed of large planks of Fir the ends of which were laid on Beams and were movable at pleasure.... In this house were three of these beams that run along the whole house, one along each side and the other in the middle. They were of an equal length and thickness. We measured one of them, and the dimensions were, in length, sixteen fathoms (or 32 feet) [sic] and in circumference twelve feet. They were supported at each extremity by Trees of much the same size (Meany 1957b:20).

This account also mentions that benches for sleeping and sitting were raised about one foot (30 cm) off the ground. These were about one "yard" wide and paralleled one side and the ends of the house.

Another important account of Nootkan house architecture is that of John Jewitt. Jewitt was the armorer on the trading vessel Boston which was captured and burned in Nootka Sound in 1803. He and one other crew member survived and were held captive by the natives until their escape in 1805. Although a reluctant participant in the daily activities of the Indians of Nootka Sound, the journal and narrative of Jewitt provide an important account of the activities of his captors. His description of house construction and architecture (Jewitt 1967:51–54) is lengthy and the most detailed thus far.

There were twenty houses in Friendly Cove at the time of Jewitt's stay there. These houses normally were 36 (11 m) to 40 ft (12.2 m) wide and ranged from 40 (12.2 m) to 150 ft (45.7 m) in length. The house of the chief was the largest and the tallest:

> Their method of building, is as follows, they erect in the ground two very large posts at such a distance apart as is intended for the length of the house. On these, which are of equal height, and hollowed out at the upper end, they lay a large spar for the ridgepole of the building, or if the length of the house requires it, two or more, supporting their ends by similar posts; these spars are some times of a almost incredible size, having myself measured one in Maquinna's house which I found to be one hundred feet long and eight feet four inches in circumference. At an equal distance from these two posts two others are placed on each side, to form the width of the building; these are rather shorter than the first, and on them are laid in like manner spars, but of a smaller size, having the upper part hewed flat, with a narrow ridge on the outer side to support the ends of [roof] planks (Jewitt 1967:52–53).

The roofs of the houses that Jewitt saw were covered with overlapping planks weighted down with stones. Wall planks were 10 ft (3 m) long and four (1.2 m) to five feet (1.5 m) wide and held between pairs of wall poles. Doors were at the ends of the houses, although sometimes they were in the middle. A passage ran through the center of the dwellings and families occupied spaces between it and the house walls. Jewitt notes that there were no partitions to mark family areas. Floors were dirt and the heights of the houses from floor to gable were generally 10 ft (3 m) while Maquinna's was nearly 14 ft (4.3 m).

Enough details of Jewitt's account are supported by earlier or later descriptions to suggest that it is largely accurate, despite the fact that it was ghost-written (Jewitt 1967:ii). His account of house sizes agrees well with those given by the members of Cook's expedition and is particularly useful in that he cites the extremes in length of the houses in the village. Jewitt, like Mozino, clearly describes gabled houses. The engravings accompanying Jewitt's narrative probably bear little resemblance to anything seen by Jewitt during his stay in Nootka Sound.

The early historical accounts of traditional Nootka Sound material culture present a fair impression of the architecture at that time. In most respects the accounts and accompanying illustrations are in general agreement, and usually complement, rather than contradict, each other. The apparent disparity in the accounts of roof form is of particular interest to this study. The question of gabled versus flat, or shed, roofs among traditional Nootka Sound dwellings is not resolved in later writings. Curtis (1916:178) states that Nootka houses had single-pitched roofs with the rafter beams running with the slope of the roof. While admitting to the existence of gabled houses, he feels that they were an innovation from the east coast of Vancouver Island. Waterman and collaborators (1921:23) assert that both the Nootkas and Coast Salish had shed-roof houses and Waterman and Greiner (1921:14) state that shed-roof houses were used over the entire west coast of Vancouver Island. Goddard (1925:14) also implies that the Nootka houses were similar to those on the east coast of the island in both construction and roof form. Drucker, however, in the major ethnographic work on the Northern and Central Nootka, states that the Nootka Sound house type was gabled and

that shed-roof houses were built only in temporary summer camps (Drucker 1951:75). He considers the traditional Northern and Central Nootka house type to be of his "Wakashan" type.

The crux of the problem appears to lie in the fact that the gables of Wakashan-style houses were quite low. Drucker, emphasizing this fact, states that they were so low that "some early sources described the houses as flat roofed" (Drucker 1963:69). The early sources to which Drucker refers are probably the accounts and drawings from the Cook expedition to Nootka Sound. These accounts also must have been the sources on which Waterman, Curtis, and Goodard base their assertions as the other historic accounts, those of Mozino and Jewitt, clearly described gabled houses. The question, then, is what house type Cook's party actually saw and described at Nootka Sound.

A key feature of Wakashan, as opposed to shed-roof, houses is that only three rafter beams are involved in their construction: one ridge beam and two eave beams (Figure 74). These beams parallel the length of the houses while beams in shed-roof houses are at right angles to the length (Figure 27). Cook and King both mention that the rafter beams were longitudinal with the houses while Clerke implies the same by noting that rafter-support posts were at each end of the dwellings. Structurally, then, there can be little question that Cook's party was describing Wakashan style, gabled dwellings. As Drucker states, their attribution of flat roofs to these dwellings was due to the low gables that characterized Wakashan houses.

The illustrations portraying Nootka Sound dwellings as flat roofed may be understood by considering the circumstances under which the drawings were made. In the case of the artist Webber, his drawings were made on the spot, in a relatively short time and in a totally alien situation. Also, since the long axes of the houses paralleled the shore, the view from a ship anchored offshore would have been limited to only one side of a gabled roof; the other side would have been hidden by the gable. Consequently, the roofs would have appeared flat or "slightly shelving" at best. Regarding the plates accompanying Noticias de Nutkas (Mozino 1970), reworked by 14 Mexican artists, little more need be said as to their probable accuracy.

While it seems certain that the Nootka Sound houses described by Cook's party were Wakashan dwellings, and that the permanent house type in Nootka Sound was gabled, this does not mean that shed-roof houses were unknown to the Moachat. A Maynard photograph (Sendey 1977:22) of Yuquot village in 1874 shows Wakashan house frames above the beach and smaller, planked shed-roof houses on a lower terrace. These dwellings apparently were small, temporary shelters rather than permanent dwellings.

Clayoquot Sound. Clayoquot Sound lies on the west coast of Vancouver Island, immediately south of Nootka Sound. It, too, was a focus for exploration and trading activities in the late eighteenth century. In June, 1778, John Meares visited Clayoquot Sound and described the house of Wickananish, leader of the Clayoquots (Meares 1790:138–139). This house was large, square, and 20 ft (6.1 m) high. The rafters consisted of three carved and painted "trees" supported at their ends and middles by carved posts. The door to the house was through a portal in a carved post. To enter the dwelling, one ascended steps on the outside, passed through the portal and descended into the house. Inside, the walls were lined with benches, raised two feet (61 cm) off the floor. Families occupied assigned spaces and that of Wickananish was at the end of the dwelling on a small raised platform.

Clayoquot Sound served as the base of operations for the American traders, Kendrick and Gray, and several accounts of traditional native culture in the area were written by members of their crews. John Boit describes Wickananish's houses as 80 ft (24.2 m) long and 40 ft (12.2 m) wide with a flat roof (Boit 1919:238–239). He, too, mentions that the place of the "king" was elevated and adds that it contained an overhead canopy, inlaid with animal teeth.

Robert Haswell (1880:714–715) describes a house at Clayoquot as being flat roofed and nearly 100 ft (30.5 m) long. One ridgepole was 12 ft (3.7 m) in circumference while "the sidepoles slightly slanting are not so large" (Haswell 1880:714). The houses generally were 30 ft (9.1 m) wide and

from 20 (6.1 m) to 100 ft (30.5 m) in length. They were divided into small apartments for different families by a single three-foot wide board. He notes that a long passage extended from the door through the house to the far end where the chief lived. Occupants of the houses sat on boards raised six inches (15 cm) off the floor.

Judging from these accounts, the dwellings in Clayoquot Sound also were of the Wakashan type. This is especially indicated by Boit's mentioning of a ridge pole and two smaller poles, apparently eave beams. Again, Haswell's description of the roofs as flat may be attributed to the low gable of the Wakashan house type and the vantage from which they were viewed. One notable feature of the Clayoquot houses, not shared by the dwellings in Nootka Sound, is the carved entrance post and portal which greatly impressed the early writers.

The construction of Clayoquot houses is described in detail in an ethnography by V. A. Koppert (1930:2–20). Koppert makes no reference to earlier accounts and gathered his information from informants. Gabled roofs with ridge and eave beams are clearly described and there is no question that the houses were of the Wakashan type.

Barclay Sound. Barclay is the next major sound south of Clayoquot Sound. The southern edge of this waterway marks the boundary between the Northern and Central Nootkas and the Southern Nootka (Drucker 1951: Map 1). Gilbert Sproat spent the years 1860 to 1865 in this area and recorded many observations on the traditional native culture there. Of particular interest to this study are his comments on house architecture (Sproat 1868:40–43). Regarding house construction, he writes:

> A row of round posts, a foot thick, and from ten to twelve feet high, placed twenty feet apart and slightly hollowed out at the top, is driven firmly into the ground to form the framework of the lodge. These posts are connected by strong cross-pieces, over which, lengthwise, the roof-tree is placed—a stick sometimes of twenty inches diameter and eighty or ninety feet long, hewn neatly round by the mussel adze, and often to be seen blackened by the smoke of several generations.... Heavy timbers cap the side-posts, and across from these to the roof-tree smaller cross-poles are laid, which support the roof (Sproat 1868:40).

Sproat's description is not completely clear and may be open to different interpretations. He seems to be describing, however, a variant of the Wakashan house type (Figure 76). This variant may be the product of architectural change that was already occurring in the area due to non-traditional influences, or the variant may represent a transitional form between shed-roof and Wakashan houses. The apparent gable suggests the Wakashan house type while the beams crossing the widths of the houses is indicative of shed-roof dwellings.

Whatever form the supporting frames of the Barclay Sound houses took, Sproat is less ambiguous as to their other architectural details. Roofs were built of cedar planks, sometimes five feet (1.5 m) wide and two inches (5 cm) thick. The roof was not flat but had "a slight pitch from the back part" (Sproat 1868:41). This suggests a shed-roof form but is confusing in terms of the description of the house frames. Perhaps the "back part" refers to the gable of the roofs. Walls were constructed of withe-slung planks. Sproat notes that the floors of the houses were excavated to a depth of one foot (30 cm) and not planked. Windows were lacking and the doors were generally at one end of the houses. Four foot (1.2 m) high partitions divided the houses into family divisions with nine inch (23 cm) benches and central fireplaces. Partitions were sometimes removed for "great occasions."

Sproat also provides one of the better accounts of interior storage frames:

> a sort of duplicate [of the house frame] inside the building is made by driving into the ground, close to the exterior upright posts, smaller posts shorter by about two feet. Small trees are tied to these shorter inside posts, one end of each tree being fastened to an inside post, and the other end tied in a similar manner to the opposite short post on the other side of the house. At right angles to these small trees, slender poles are laid, on which the natives stow all sorts of things (Sproat 1868:41).

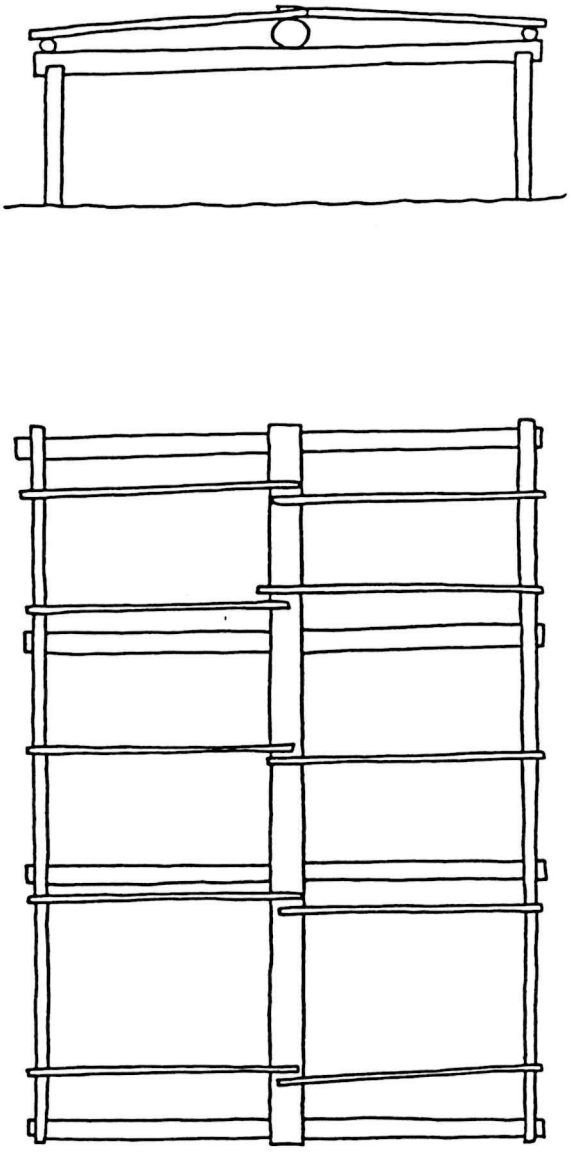


Figure 76. Barclay Sound house frame as interpreted from the account of Gilbert Sproat (1868:40–43).

Barclay Sound marked the beginning of the transition from Wakashan dwellings to shed-roof houses on the west coast of Vancouver Island. Not only is the house type described by Sproat ambiguous, he also is not specific as to which groups used it. Drucker (1950:178) lists Alberni Canal groups as using the shed-roof house type as well as the Nitinats. In the latter case, this is further verified by contemporary informants.

Before discussing the historic material on shed-roof houses in the Pacific Northwest, it might be useful to briefly reiterate the definitional criteria distinguishing shed-roof houses and Wakashan dwellings, particularly in view of the preceding data from the west coast of Vancouver Island. It is apparent from the early accounts that roof form cannot be the sole criterion for distinguishing the two. Because Wakashan houses had a very low gable, the roof form often was taken to be flat, thereby suggesting a shed-roof structure. The descriptions of the roof supporting frames, however, often resolve the confusion as they radically differ in form. Wakashan dwellings are characterized

by three beams, a ridge beam and two eave beams, paralleling the long axis (Figure 74) of the dwellings. As will be seen, shed-roof houses may have any number of beams, all of which are at right angles to the long axis of a house. In cases of apparent contradiction between roof form and supporting frame, as in the above account by Sproat, the house type indicated by the support frame is most likely the correct one.

The definitional precedence of supporting frame over roof form is particularly useful in dealing with historic photographs. Often the dwellings pictured are either partially dismantled or are deteriorated, and the angle from which the photographs are taken does not allow a clear view of the roof. Where the supporting frames are visible, as they often are in early photographs, there generally is little problem in distinguishing shed-roof from Wakashan houses.

Northwest Washington

Several culture groups speaking different languages inhabit the northern Pacific coast of Washington State. Among these are the Makahs, Quileute-Hohs and the Quinaults. The Makahs represent a Nootkan extension across the Strait of Juan de Fuca. The Quileute-Hohs are Chemakuan speakers who were related to a small band, the Chemakum, on the Strait of Juan de Fuca. South of the Quileute-Hohs were the Salish-speaking Quinault.

The Quileute-Hohs marked the southern boundary of the shed-roof house area. The Quinault, to the south, used gabled structures in historic times and apparently did so in the protohistoric period as well (Willoughby 1886:267; Olson 1967:61). The dwellings of the Quinault and the Queets, a small group closely related to the Quinault, although gabled, were unlike Wakashan structures. While the supporting frame for the roof was similar to some Wakashan variants, the long axes of the roof planks were parallel to the long axes of the houses rather than at right angles as in shed-roof and Wakashan houses. In addition, wall planks were vertical and fixed as in the gabled structures to the north of the shed-roof and Wakashan house area.

According to Edward Curtis (1913:147), Quileute houses were built over two-foot-deep excavations. Wall planks were horizontal and roofs were of a shed form with overlapping roof planks. A large structure measured 70 ft (21.3 m) by 40 ft (12.2 m) and housed around 20 people. Curtis indicates that the interior arrangements were similar to those of shed-roof houses throughout the area.

Additional data on Quileute houses are provided by Pettitt (1950:4–5) who cites two estimates of house dimensions; 40 ft (12.2 m) by 60 ft (18.3 m) and 50 ft (15.2 m) by 70 ft (21.3 m). Regarding house frames, Pettitt reports:

> The frame was formed by setting up four to six pillars, consisting of heavy logs, with one end sunk into the ground. Across the tops of these vertical supports other heavy logs were laid as longitudinal and lateral beams. The roof was formed by constructing a lighter framework on top of the main frame, with a slope from one side to the other like a shed (Pettitt 1950:4).

Pettitt's account is of interest as cross- and eave beams are clearly indicated. Roofs were covered with overlapping, dished out roof planks. Side walls were of horizontal, withe-slung planks but end walls were built of vertical planks lashed to horizontal stringers. Doors were rectangular and hinged by leather hinges, either at the top or side. Floors were not planked and were excavated to a depth of two or three feet. In the winter, skin tents or shelters were erected over and around the bed places to keep out the wind, rain, and snow. Houses were occupied by up to six families arranged on benches several feet wide that paralleled the side walls of the houses. A low wall-like structure ran down the middle of a house and served as a back rest for the families on either side of it.

From Pettitt's account, several features of Quileute-Hoh shed-roof houses differ from other shed-roof dwellings. These include the use of eave beams, the vertical planking of the end walls, the lack of benches on the end walls and the lack of partitions except for the back rest down the middle of a house. In part, these may be local variations, possibly influenced by the gabled house form used by the Quinault, their neighbors to the south. Since Pettitt was working with informants, the architectural details may also represent a temporal variation in the transition from traditional to contemporary housing.

The Strait of Juan de Fuca

The Strait of Juan de Fuca is an important waterway providing access from the Pacific Ocean to the inland waters of Puget Sound and the Strait of Georgia. The north shore of this strait is formed by the southwest side of Vancouver Island, inhabited by the Southern Nootkas. The south shore of the Strait of Juan de Fuca is formed by the northern shore of the Olympic Peninsula, inhabited by Salishan speakers, Chemakuan speakers, and the Nootkan-speaking Makahs.

Klallam. The Klallam Indians occupied a major portion of the south shore of the Strait of Juan de Fuca. Their traditional territory, at least in historic times, extended from near Clallam Bay on the west to Port Discovery on the east. Linguistically, they were Salishan speakers sandwiched between the Nootkan-speaking Makahs and the Chemakuan-speaking Chemakum.

Few early accounts of Klallam villages and houses are available. Vancouver mentions houses in what apparently was Klallam territory and notes that they were built along the Nootka pattern (Meany 1945:85, 91). By this, he apparently is indicating that they were similar to the houses in Nootka Sound which were Wakashan dwellings. As has been seen, however, these and shed-roof houses often were confused or not distinguished. It does not follow, then, that the houses to which Vancouver refers were necessarily gabled.

In 1847, Paul Kane, the Canadian artist, visited the village of "I-eh-nus" in the vicinity of the present city of Port Angeles and described it as follows:

> It was composed of a double row of strong pickets, the outer ones about twenty feet high, and the inner row about five feet, enclosing a space of 150 feet square. The whole of this inner space is roofed in, and divided into small compartments, or pens, for the use of each separate family. There were about 200 of the tribe in the fort at the time of my arrival (Kane 1925:159).

The size of the village cited by Kane must have been in reference to the length of one wall of the stockade rather than the square footage of the area. One hundred and fifty feet is only 10 ft (3 m) by 15 ft (4.6 m) and seems a very small area in which to fit 200 people. His account of the village being wholly roofed over also is questionable. It may have been that the houses were so close together as to give that impression. The illustrations resulting from his visit to the Klallams (Harper 1971: Figures 177 and 180) shed little light on the architecture of the houses within the stockade. Kane composed separate sketches into a painting depicting a raid on the village by the "Macaws" a few months before his visit (Kane 1925:159–161).

Another account of Klallam dwellings is that of George Gibbs who describes houses in Port Townsend, in what had been Chemakuan territory:

> Two or three [houses] are not less than thirty feet [9.1 m] long by sixteen [4.9 m] or eighteen [5.5 m] wide, built of heavy planks, supported on large posts and cross-beams, and lined with mats. The planks forming the roof run the whole length of the building, being guttered to carry off the water, and sloping slightly to one end. Low platforms are carried round the interior.... There are from two to four fires in each house (Gibbs 1967:36).

It should be noted that Gibbs describes the roof planks as running the lengths of the buildings and that they sloped slightly to one end. While there can be little question that he is referring to shed-roof houses, the slope of their roofs seems to have been parallel to the long axes of the houses rather than at right angles to them. While unusual, this arrangement is not unknown elsewhere in the shed-roof house area and will be discussed later.

Myron Eells states that the Klallams used shed-roof houses and that gabled forms were borrowed from the whites (Eells 1887:614). Erna Gunther's informants also agree that shed-roof dwellings were the traditional house form until they were supplanted by gabled houses in the early 1870s (Gunther 1927:92).

At Washington Harbor, the only ethnographic shed-roof dwelling on which Gunther was able to obtain data was a potlatch house. This dwelling was 50 ft (15.2 m) by 200 ft (61 m) with one side 25 ft (7.6 m) high and the other between 10 ft (3 m) and 15 ft (4.6 m) high (Gunther 1927:127).

It would appear that the traditional house type of the Klallams was a shed-roof form. The paucity of early historic data on this group and the early adoption of Euro-American inspired, gabled houses has resulted in relatively little data on traditional Klallam architecture. The dwellings described by Gibbs may represent variants while the potlatch structure described by Gunther was a special-purpose house and may not accurately represent the earlier dwellings of this group.

Chemakum. The Chemakum were a small group who inhabited the area from Hood Canal to Discovery Bay (Eells 1887:606). Their language was related to the Quileute-Hoh of the Pacific Coast and the geographical separation between the two groups is not completely understood. Wars, diseases, and assimilation by neighboring groups and Euro-Americans led to the extinction of the Chemakums in the historic period (Curtis 1913:141; Eells 1887: 606–607; Gibbs 1970:177–178). No useful data are available regarding their dwellings although they apparently were of the shed-roof type.

Songish. The southern end of Vancouver Island was inhabited by the Songish, Saanich, and Sooke, all Coast Salish-speaking groups. A typical Songish house is described by Boas and accompanied by schematic drawings of a house frame (Boas 1890:563–565). Notched cross-beams were fitted on the tops of rectangular uprights. One row of uprights (that facing the sea) was higher than the other row, thereby forming the roof slope. Rafters spanned the cross-beams and supported the roof planks. Walls were formed by planks laid horizontally between pairs of wall poles and fastened by withes passing through holes in the planks and around the wall poles. Doors were at one side and in larger houses, several doors were in the wall facing the water. Inside the houses, benches were built by driving posts into the floor, tying cross-pieces to them, and placing heavy planks on the frame. These benches were about one foot high and paralleled all four walls of the houses. Shelves sometimes suspended from the rafters so that they were seven (2.1 m) or eight (2.4 m) feet above the floor.

One point in which this account differs from other descriptions of shed-roof houses is in the method of fastening wall planks to poles. Except for Boas's acumen as an observer of material culture, this technique would be highly questionable. Paul Kane visited Fort Victoria in 1847. There he saw a "Cla-lum" village on the harbor and observed "The lodges are built of cedar, like the Chinook lodges, but much larger, some of them being sixty [18.3 m] or seventy feet [21.3 m] long" (Kane 1925:145).

One must presume that the lodges to which Kane refers were like Chinook lodges in material rather than form. Curtis (1913:19) suggests that this village was Sooke rather than Klallam. The issue is further confused by the fact that the Songish, not the Sooke, inhabited the Fort Victoria area (Duff 1969:28). In addition, a group of Klallams did move across the strait around the time of Kane's visit but settled in the Beecher Bay area (Duff 1969:28).

Whatever the bands with which he came in contact in the Fort Victoria area, it is clear from the Kane drawings that shed-roof houses were in use. One illustration shows the interior

of a "Clallam" lodge on Vancouver Island (Harper 1971: Figure 185); the roof is obviously single pitched. Additionally, two illustrations show houses in Esquimault harbour with shed roofs (Harper 1971: Figures 185 and 186). A third illustration showing shed-roof houses at Esquimault actually may be at Sooke (Harper 1971: Figure 184, p. 304).

Twana. The bands occupying the Hood Canal area are referred to collectively as the Twana (Curtis 1913:11). Beginning in 1874, the Reverend Myron Eells spent 33 years on the Skokomish reservation and recorded numerous observations on these bands as well as the Chemakums and the Klallams. Eells lists four main house types for these groups: large dwelling houses, flat roof (gambreled) houses, potlatch houses, and "houses with the roof wholly on one side"; that is, shed-roof houses (Eells 1887:624). Of the shed-roof type, he says little except that it once was the universal form, was intended for one or two families and the interior arrangements were similar to those of the large dwelling houses. Apparently the shed-roof house type had fallen into disuse by Eells' time and had been supplanted by gabled and gambreled forms. The large gabled houses had no flooring, doors were at each end or in the middle of one side, wind breaks were on either side of the door and double benches paralleled the walls (Eells 1887:22).

William Elmendorf (1960:151–165) also discusses Twana house types. Winter house frames stood year-round and occasionally planks were removed from them for use in summer lodges. Both gabled and shed-roof houses stood in a village with the gabled houses occupied by wealthier families. Shed-roof houses were generally smaller, more numerous and associated with lower classes. Occupants of gabled dwellings would build shed-roof houses for temporary summer quarters, however.

The gambrel houses adopted by the Twana bands were an apparent product of Euro-American influence. The gambrel-roofed houses consisted of a central flat portion with a slight pitch; adjoining each side of the central portion were steeply pitched segments. The sides of these houses included both vertical and horizontal wall planks (Eells 1887:624). A recent publication on Eells' notes and drawings includes a sketch of this house type (Ruby and Brown 1976:23). This form is unique in the area and was restricted to the Twana and the Puyallup-Nisqually (Smith 1940:281). It seems to be a transitional type involving elements of shed-roof houses in the central portion of the roof. Unfortunately, no data are available regarding the supporting frame for this house type.

Puget Sound

There are no very early accounts of houses in the Puget Sound area although George Gibbs offers some general comments on traditional native dwellings there (Gibbs 1970:214–215). There is little question that they were of the shed-roof type as he states that their roofs were single pitched. House planks were split from cedar and sometimes fir with elk antler or wood wedges driven by stone mauls. One large plank measured by Gibbs was 24 ft (7.3 m) long and 4.5 ft (1.4 m) wide. According to Gibbs, Puget Sound houses differed little from those of the Makahs except in size. He was particularly impressed with the large potlatch houses found in the area.

A Mr. Goldsborough (Gibbs 1970:215) measured a potlatch house at Port Madison which was 520 ft (158.5 m) long, 60 ft (18.3 m) wide, 15 ft (4.6 m) high in the front and 10 ft (3 m) high in the rear. There were 74 rafter-support posts in this dwelling between two feet (61 cm) and three feet (91 cm) wide and five inches (13 cm) to eight inches (20 cm) thick. These were spanned by 37 rafter beams, 60 ft (18.3 m) long, 12 in (30 cm) to 22 in (56 cm) in diameter, and of a round cross-section. Gibbs states that potlatch houses were erected for special occasions and dismantled afterwards.

The dwelling measured by Goldsborough was the famous structure known as "Old Man House." Several accounts of the structure exist as its size particularly impressed observers. In addition, the dwelling is significant as it has been the subject of archaeological testing (Snyder 1956; Gaston

and Jermann 1975) and the data derived from these investigations may be compared with historic accounts.

Carlson (1903:22–25) describes the structure as 900 ft (274.4 m) long and 60 ft (18.3 m) wide except at the ends where it was only 50 ft (15.2 m) wide. The front of the dwelling was 12 ft (3.7 m) high and the rear was between eight (2.4 m) and nine feet (2.7 m) high. The house contained 40 "apartments," each separated by plank partitions. Rafter-support posts were between two (61 cm) and four feet (1.2 m) wide and 10 (25 cm) to 12 in (30 cm) thick. These posts were placed with the bark side facing the interior of the house, suggesting that they were split logs, plano-convex in cross-section. Rafter beams were round cedar logs, 65 ft (19.8 m) in length, 12 in (30 cm) in diameter at the small ends and 24 in (61 cm) thick at the butts. Because of the lengths of these beams, central support posts also were used. The roof was covered with cedar planks that rested on boards spanning the rafter beams. Each apartment had several rooms which were subdivided by mats. Several of these rooms had raised cedar-plank "bunks" and doors were located at each end of the apartments. Carlson agrees with Gibbs that the structure was originally a potlatch house but states that it also was used as a residence for part of the year.

Another, somewhat romanticized, account of Old Man House was written by J. A. Costello (1895:19–21). This version gives the length of the house as over 1,000 ft (304.9 m), the width as 60 ft (18.3 m) and the height as 12 ft (3.7 m) in the front and eight feet (2.4 m) in the rear. Costello describes the rafter-support posts as spaced every 23 ft (7.6 m) apart, split and hollowed out to a concave-convex cross-section. One rafter beam was 12 in (30 cm) in diameter at the small end and 23 (58 cm) to 24 in (61 cm) thick at the butt. Costello quotes a William Deshaw as recalling that the house was between 384 (351.3 m) and 394 yd (360.4 m) in length.

Some of the figures cited for Old Man House are compared in Table 10. The Wilkes and Simons figures are other early estimates quoted in the archaeological reports on the site. It is apparent that Carlson's and Costello's figures generally agree but differ substantially from Goldsborough's estimates (cited by Gibbs). Waterman and Greiner (1921:16–17) feel that Costello's figures are "fanciful", although he is supported by Carlson.

The archaeological data recovered at the Old Man House site is particularly revealing. Excavations at the site located the stubs of many rafter-support posts. From these, it was found that the house narrowed in the middle rather than the ends from 60 (18.3 m) to 40 ft (12.2 m) (Snyder 1956:20). The length of the house was minimally 496 ft (151.2 m) and correcting that figure to account for several posts that are known to have been removed, Snyder (1956:20) suggests a length close to 530 ft (161.6 m) for the house. A number of rafter-support post stubs that were preserved because they were close to the water table were recovered. These poles were between 1.7 ft (52 cm) and 3.9 ft (1.2 m) in width and 0.3 (9 cm) to 0.75 ft (23 cm) in thickness, with the larger posts having been used in the wider portions of the house (Snyder 1956:21). When the posts were raised, rocks and dirt were packed into the pits.

Comparison of the archaeological data with the early estimates of the dimensions of Old Man House is instructive as it emphasizes the need for critical review when dealing with historic accounts. The Wilkes and Simons estimates cited in Table 10 are based upon first-hand observation of the house when it was still standing. All of the other accounts are based upon hearsay or surface examination of the site. Even with the two first-hand estimates within a 14-year period, the house increased in length by 353 ft (107.6 m). This may not reflect error on the part of the observers, however, since the dwelling may well have been lengthened in that time.

Another problem with Old Man House is that while Gibbs implies that the structure was temporary, both Costello and Carlson state that it was permanently occupied. In this case, the latter observers are supported by Waterman and Greiner (1921:24); they suggest that potlatch houses were dismantled during the seasons in which there were no festivals and the planks were

Table 10

House and Rafter-Support Dimensions Reported for Old Man House.

Length	Width	Thickness	Reference
House Size			
172 ft (52.4 m)	72 ft (22 m)	—	Wilkes *in* Gaston and Jermann 1975:11
525 ft (160 m)	—	—	Simmons *in* Gaston and Jermann 1975:12
520 ft (158 m)	60 ft (18.3 m)	—	Goldsborough *in* Gibbs 1887:215
714 ft (217.7 m)	54 ft (16.5 m); 39 ft (11.9m) at ends	—	Scammon *in* Snyder 1956:19
1152 ft (351 m) to 1182 ft (360.4 m)	—	—	Deshaw *in* Costello 1895:20
Over 1,000 ft (304.9 m)	60 ft (18.3m)	—	Costello 1895:19
900 ft (274.4 m)	60 ft (18.3 m) 50 ft (15.2 m) at ends	—	Carlson 1903:22–25
Rafter-support post size			
—	2 ft (61 cm) to 3 ft (91 cm)	5 in (13 cm) to 8 in (20 cm)	Gibbs 1887:215
—	—	10 in (25 cm) to 12 in (30 cm)	Costello 1895:19
—	2 ft (61 cm) to 4 ft (1.2 m)	10 in (25 cm) to 12 in (30 cm)	Carlson 1903:22–25

used for more temporary shelters. Eells (1887:652, 658) also reports that potlatch houses were built over a period of time for special occasions and dismantled afterwards.

Waterman and Greiner (1921:18–19) describe shed-roof houses in Puget Sound as being built with their long sides paralleling the water. The roofs of these houses were gently sloped and the fronts were between 10 (3 m) and 18 ft (5.5 m) high.

Ethnographic data on Puget Sound dwellings also are provided by Haeberlin and Gunther (1952), especially regarding the Snohomish, Snuqualmi, and Nisqually. They state that winter houses were between 100 (30.5 m) and 200 ft (61 m) long and refer to the accounts of Jewitt and Eells for construction details. Jewitt's account, however, is concerned with Wakashan houses and Eells lacks specific data on shed-roof houses.

Haeberlin and Gunther (1952:16) suggest that gabled houses existed traditionally among the Puget Sound groups although this is not supported by Gibbs or Eells. They do, however, describe

a shed-roof potlatch house at Tulalip that was 115 ft (35 m) in length and 43 ft (13.1 m) wide (Haeberlin and Gunther 1952:17–18). This house was spanned by five rafter beams. These beams were supported by carved posts, semicircular in cross-section, with round sides toward the interior. Mat partitions were employed to isolate family areas and doors were at each end of the house.

Marian Smith's informants mentioned gable, shed, and gambrel roofed houses for the Puyallup-Nisqually (Smith 1940:281). The shed and gabled forms were mutually exclusive in distribution while the gambreled forms occurred with both. Shed-roof structures were employed by the people of Gig Harbor and Carr Inlet; shed and gambreled forms were used by the Steilacoom and Squaxon groups (Smith 1940:281).

The Lummi are located in the northern area of Puget Sound, around Lummi Island, Lummi Bay, and the present city of Bellingham (Curtis 1913:25). There is some evidence that in the not-too-distant past, they were located mainly in the San Juan Islands (Curtis 1913:16). Stern (1934:31) states that the Lummi built shed-roof houses 60 ft (18.3 m) wide and of varying lengths composed of sections 60 ft long. The roofs slanted from 14 ft (4.3 m) to 10 ft (3 m). Stern also implies that gabled dwellings existed but does not speculate on their antiquity.

Paul Kane visited a village on Whidbey Island in Puget Sound (Kane 1925:158). A drawing of this village (Harper 1971: Figure 176) shows a shed-roof house among more temporary structures. The tribal affiliation of this village is uncertain as the island was inhabited by Snohomish, Skagits, and Klallams (Curtis 1913:174). Curtis (1913:157) characterizes the dwellings in the Puget Sound area as being single pitched with horizontal wall planing. He lists the average dimensions as 12 (3.7 m) to 16 ft (4.9 m) high in the front, seven (2.1 m) to eight feet (2.4 m) high in the rear, 40 (12.2 m) to 100 ft (30.5 m) long, and 20 (6.1 m) to 40 ft (12.2 m) wide.

To summarize, three house types are documented for the Puget Sound area; shed-, gabled-, and gambreled-roof houses. Of these, shed-roof dwellings seem to have been the most traditional form. Potlatch houses may have existed as special-purpose dwellings, whatever the roof form. It is possible, if not probable, that they also were used as winter houses. Gambrel-roof houses probably represent an historic innovation, combining elements of both shed and gabled forms. Gabled-roof styles also may be the consequence of historic developments although Haeberlin and Gunther, at least, feel that they may have been traditional.

Strait of Georgia

The Strait of Georgia lies immediately northwest of Puget Sound and is bordered by the east coast of Vancouver Island and the mainland of the United States and Canada. This area was inhabited by a number of Coast Salish-speaking tribes and bands.

Hill-Tout (1907:51–53) provides a general description of the houses found in the Gulf of Georgia region. Of particular interest are the house sizes he cites: the lengths of the dwellings varied according to the terrain and the number of inhabitants but could reach 600 ft (192.9 m) in length. In one instance, a dwelling was over 1000 ft (306.9 m) long. Generally, houses were 48 ft (14.6 m) wide and occasionally wider. The roof pitches, whether the houses were gabled or shed-roofed, were very low. Inside, shelves were suspended from the rafters and partitions were formed by removable mats.

Barnett (1955) reports on many of the villages and dwellings among groups in the Strait of Georgia area. Both shed-roof and gabled structures occurred with shed-roof houses dominating the southern part of the region and gabled structures the northern part. In the north, gabled dwellings seems to have conferred a social distinction with wealthier families using shed-roof structures only as summer dwellings.

Gabled houses (Barnett 1955:35–36) were constructed by placing four posts at the corners of an intended house and connecting them with eave beams. The central ridge beam was supported at each end by a single post or by two posts joined by a cross-beam. Extra support posts sometimes were placed in the middle of the ridge beams.

The walls of both shed- and gable-roofed houses were constructed in the same manner (Barnett 1955:36). Planks, occasionally three or four feet wide, were lashed horizontally between support poles. They also were lashed to the rafter-support posts. The wall planks were overlapped and moss and old mat fragments were used for chinking.

Barnett (1955:36–37) describes the construction of shed-roof houses in the Strait of Georgia region as fairly simple. Four posts were set in the ground with the posts in front slightly higher than those in the rear. Rafter beams joined each pair of the tall and short posts and sometimes additional posts were set under them if the span was great. Poles were lashed to the rafter beams and planks were laid on the poles to form the roof.

A curious feature in Barnett's account of the construction of shed-roof houses is that the rafter beams paralleled the length (usually 60 [18.3 m] or 70 ft [21.3 m]) of a house. The general pattern elsewhere is that the slope of the roof was with the width of the structure. Only in the account of Gibbs, quoted earlier for the houses in Port Townsend, is roof slope oriented in the manner described by Barnett. Duff (1953:43) quotes a Captain Wilson that Cowichan dwellings as well as shed-roof houses on the lower Fraser River followed the general model of shed-roof houses for roof slope. Barnett's data are unusually detailed but it is difficult to reconcile his account with that quoted by Duff and the general pattern of shed-roof houses in the Pacific Northwest.

Barnett states that single-unit dwellings among the Strait of Georgia groups were generally 60 (18.3 m) to 70 ft (21.3 m) "long"; that is, from the high side to the low side of the structures. Among the Squamish, houses were 20 ft (6.1 m) by 60 ft (18.3 m) with the first measurement being the distance from the high side to the low side. Wilson's account listed houses as large as 70 ft (21.3 m) by 20 ft (6.1 m) with the high and low sides being the longer sides (Duff 1953:48).

According to Suttles (1974:256–259) the Coast Salish of the Haro and Rosario Straits usually used shed-roof houses between 30 (9.1 m) and 50 ft (15.2 m) wide and from 50 (15.2 m) to 200 ft (61 m) in length or longer. There was a platform around the walls for sleeping, and storage both on and beneath the platform. Storage shelves hung above the bed platforms. In the winter, at least, walls were hung with mats and partitions were put up between family sections, at least during periods of cold weather. Doors often were at the ends of houses near a corner or in the center of a wall. Plank walls often extended into the houses from the doors and other devices were commonly used to impede entrance by intruders. Floors were not planked and were swept daily with hemlock boughs and sprinkled with water.

Among the Musquiam, a slight variation occurred on the general Strait of Georgia pattern for shed-roof houses (Barnett 1955:53–54). Tie beams were used, linking the posts along each of the long walls of a dwelling. Rafter beams rested upon these tie beams and crossed the width of the houses. This pattern seems similar to the account by Pettitt mentioned earlier citing "longitudinal" beams used among the Quileutes.

Barnett notes that the Cowichan, Nanaimo, Squamish, and Musquiam utilized very long shed-roof structures. One Squamish house was reported as 60 ft (18.3 m) deep and 120 ft (36.6 m) long (Barnett 1955:52). According to Barnett, these "segmented" structures were constructed by placing a number of single-unit houses end to end. The segmented houses noted by Barnett, however, do not approach the length quoted earlier from Hill-Tout.

Fraser River

Shed-roof dwellings also were found among the Salish-speaking groups on the Fraser River. The earliest account of these dwellings is that of Simon Fraser (1889:193). Near the present town of Yale, Fraser saw a house with a slanting roof, 46 ft (14 m) long and 36 ft (11 m) wide. The walls of this dwelling were 11 ft (3.4 m) high. Farther down the river he saw a large structure, 640 ft (195.1 m) long and 60 ft (18.3 m) wide (Fraser 1889:197). The front of this house was 18 ft (5.5 m) high and the roof was slanting. Partitions divided the house into smaller units.

Shed-roof houses were used by the Katzie (Jenness 1955:7) and one of Duff's (1953:47) informants mentioned a "big time" house that measured 30 (9.1 m) by 100 ft (30.5 m). Another of his informants indicated that shed-roof structures were used throughout the Tait area (Duff 1953:47). These were as small as 25 ft (7.6 m) square and were used as summer dwellings. Pithouses of the interior pattern were employed as winter houses. Shed-roof structures also were used among the lower Lilooet, Chilliwack and Nooksack usually in conjunction with pithouses (Smith 1947:157). On the Sauk and upper Skagit Rivers, small shed-roof houses were the only type (Smith 1947:158).

Discussion

The continuity in distribution of gabled dwellings with vertical wall planking along the Northwest Coast of North America was disrupted by the occurrence of shed-roof and Wakashan houses around the Strait of Juan de Fuca and adjacent inland waters. Wakashan dwellings, while having a gabled roof, shared similar interior arrangements and wall construction techniques with shed-roof houses. Shed-roof dwellings, in roof form and roof-support frame, differed substantially from house types to the north and south.

From the preceding survey, it is apparent that shed-roof houses were continuously distributed along the northern coast of Washington State, on both sides of the Strait of Juan de Fuca, throughout Puget Sound and the Gulf of Georgia, and up the Fraser River. This distribution involved speakers of Nootkan, Chemakuan, and Coast Salish languages. Not all speakers of these languages used this house type, however.

Determining the traditional house type for many groups in this area is often a difficult matter. The superficial similarity between shed-roof and Wakashan houses confused early observers and illustrators and writers; ethnographers and informants do not always distinguish between traditional and historic forms. In special circumstances, shed and gabled forms sometimes coexisted. This is especially true in the Strait of Georgia region where the northern groups relegated shed-roof houses to summer dwellings and "cheap" housing. In a diachronic sense, the two house types also mixed as gabled forms supplanted shed-roof houses in historic times.

Even on a broad regional level, variations in the construction of shed-roof dwellings are apparent (Figure 77). The use of tie or eave beams (Figure 77C) occurred only among the Musquiam and Quileute. This constructional variation is of interest in that shed-roof houses are sometimes viewed as essentially one half of a gabled dwelling. In this case, the tie beams of Quileute and Musquiam houses are analogs to the ridge and eave beams on gabled houses. Both of the groups for whom tie beams are reported were adjacent to tribes using gabled structures and the technique may have been borrowed from them.

Considerable variation in the size of shed-roof structures occurred. These houses ranged from single extended family dwellings to exceedingly long structures housing entire communities. Duff (1953:47) recognizes two variations of the large dwellings: larger versions of the single-unit houses and "segmented dwellings," often housing entire communities. Identifying these two variations is difficult, however, as the difference seems to be largely a matter of degree and related to length.

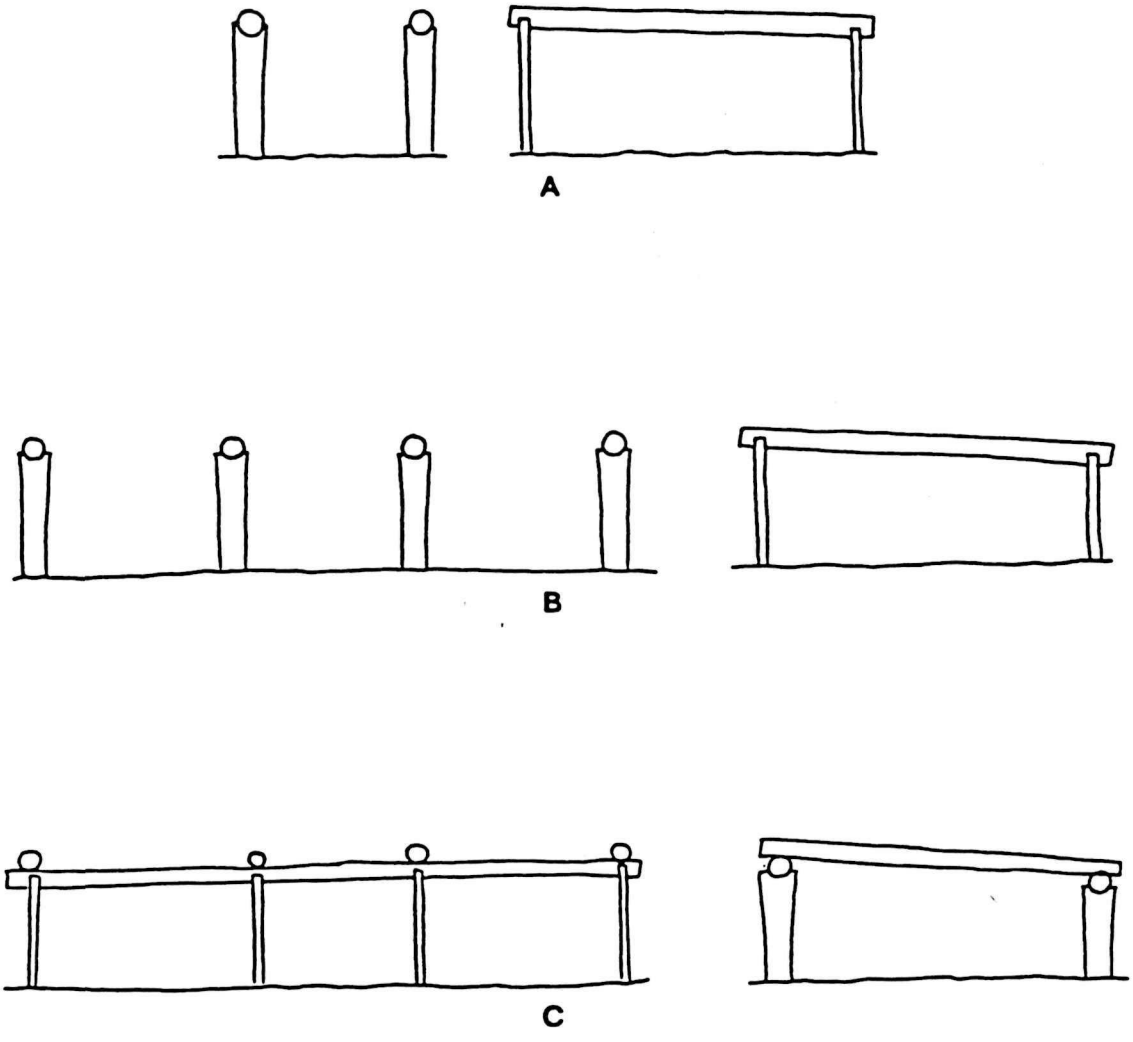


Figure 77. Shed-roof house frame variations: A - single-unit structure; B - multiple-unit structure; C - multiple-unit structure with tie-beam construction.

No firm criteria are available for distinguishing, for example, a large single-unit type from a short segmented structure.

The existence of partitions in large structures might be considered an attribute of segmented dwellings. Barnett (1955:52–53) asserts that segmented structures were physically partitioned except in certain circumstances. Duff (1953:48), however, states that shared walls between adjacent single-unit houses were sometimes left out or only indicated by suspended mats. Hill-Tout (1907:53) claims that partitions always were removed among the lower Fraser delta and coast tribes during the winter dancing season; among the upper delta tribes, where the winter dance season did not prevail, partitions were permanent. Jenness (1955:7) reports that his Katzie informants asserted that their dwellings lacked partitions altogether. Jenness also suggests, however, that mat partitions may have been employed on occasion.

There can be little question that partitions existed conceptually, if not physically, in large house structures. The occasional lack of partitions may have been the function of several factors, including an economy of lumber as well as the need for large open areas for winter ceremonials. None of the above writers distinguishes between low partitions functioning as boundary markers

for subgroups in the house social unit and actual shared walls, physically dividing the house. Only in the latter case could a structure be considered a series of one-unit dwellings in a physical sense.

Large dwellings, segmented or otherwise, seem to have occurred mainly in the Strait of Georgia-Fraser River area. In the Puget Sound area, an argument can be made that potlatch houses, at least, were an historic elaboration, if not development. The occurrence of long, or segmented, shed-roof houses may have been a function of several factors. Among these may have been defense, economy of planks, topographic considerations and available space. Suttles (1974:173) suggests that segmented dwellings may have been a recent development, probably for defensive purposes.

The potlatch houses of Puget Sound seem generally to have been special-purpose temporary dwellings, although some may have functioned as winter residences. The degree to which potlatch houses were a product of historic change in the Puget Sound area is unknown. With the breakdown of the large extended-family units, potlatch houses may have gained in importance as a place to carry out winter ceremonials and feasts. Indeed, it might be postulated that potlatch houses, as a special class of structure, may not have existed in protohistoric times when large multifamily dwellings were available for gatherings. While Old Man House apparently was a potlatch house and a segmented dwelling, other potlatch houses seem to have been either large single-unit houses or segmented structures. The term "potlatch house" probably is best applied in a functional sense, carrying no implication as to its structural type or variation (Elmendorf 1960:153).

A final point to be discussed is the apparent variation in the slope of the roofs, relative to the long axes, of shed-roof dwellings. For purposes of this study, the space between two adjacent sets of rafter-support posts is termed a single "structural unit." Houses such as those found at Ozette are multiple structural-unit dwellings. In houses with multiple structural units, roof slope was with the axes of the rafter beams; that is, at right angles to the long axis of a house (Figure 77B). Both Gibbs and Barnett report houses in the Port Townsend and Strait of Georgia areas, respectively, in which the roof slopes paralleled the lengths of the houses. Rather than being a real structural variation, it is likely that the houses to which they refer only involved one or possibly two structural units. In single-unit dwellings, the long axis of the house is parallel to the rafter beams (Figure 77A) rather than at right angles to them as in multiple-unit houses. Because of this problem, it is also useful to define the "structural axis" of shed-roof houses. As used here, the structural axis is the axis at right angles to the rafter beams. In single-unit houses, the structural axes of such houses are at right angles to the long axes. In multiple-unit shed-roof houses, the structural axes are parallel to the long axes of the houses. The expansion from single-unit to multiple-unit shed-roof houses took place along the structural axis.

Shed-roof dwellings in the Pacific Northwest, while varying greatly in length, nonetheless displayed a basic structural homogeneity. The smallest of these houses, single-unit dwellings, involved only two sets of rafter-support posts and beams. In such structures, the actual long axes were at right angles to the structural long axes. Multiple-unit dwellings, such as those found at Ozette, and long "segmented" houses involved expansion along their structural long axes by the raising of additional sets of rafter-support posts and beams. In these cases, the actual and structural long axes of the houses paralleled each other. Widths of the houses also varied but this may have been related to natural factors, such as the lengths of timber available locally for rafter beams, rather than cultural factors.

The only real structural variation in shed-roof houses was in the use of tie beams linking adjacent sets of rafter-support posts (Figure 77C). This variation, however, is only found in two areas, both are adjacent to groups using gabled roof house construction. It is likely that the use of tie beams represents a borrowing from these groups.

Some variations also occurred in other architectural features, mainly in the size and function of partitions. In some areas, low partitions were employed seasonally to reduce drafts while elsewhere they occurred as full walls, isolating households within multiple-unit dwellings. Other variations,

such as the number and heights of benches seem minor and reflect local preferences. Shed-roof houses apparently were the traditional house type throughout the area with which this study is concerned. Historically, many groups developed or adapted transitional forms, often combining old architectural features, such as horizontal planking, with introduced features like gabled roofs. To a large degree, the adoption of gabled structures was Euro-American inspired, although this change may have been encouraged by the fact that many groups already were familiar with gabled structures through contact with neighbors using Wakashan-style houses.

Shed-roof dwellings are architecturally closer to Wakashan houses than to any other Northwest Coast house type. These two house types share certain features, particularly withe-slung wall planking and loose roof planks, as well as similar interior arrangements. These similarities may be as much the product of similar economic and residence patterns as reflecting any historical relationship. Many groups using shed-roof and Wakashan-style houses seasonally dismantled and moved their wall and roof planks, a practice in which withe-slung wall construction techniques and loose roof planks were a distinct advantage (Mauger 1977).

CHAPTER 7

INTERGROUP COMPARISONS

Introduction

Historic and ethnographic data have been presented regarding the traditional house type of the Makah Indians. This was followed by a description of the structural elements and features found to be involved in the buried houses uncovered at Ozette. The preceding chapter was concerned with surveying shed-roof houses in the Pacific Northwest and establishing their range of variation. In general, these variations were minimal; apparent differences, such as the lengths of ethnographically and historically reported houses, were found to be elaborations on the basic structural type.

This chapter is concerned with comparing the structural features reported for shed-roof houses in the Pacific Northwest with these recovered at Ozette. The purpose of this comparison will be to place the Ozette houses within the total range of shed-roof houses and assess the degree to which the Ozette houses were a typical manifestation of this architectural system.

Village Layout

Inferences as to the arrangement of Ozette village in protohistoric times have been discussed. Probably, the village was linearly arranged, paralleling the shore and situated so as to take advantage of the local geography. House orientations either were at right angles to the shore or paralleling it; roof slopes probably were to the north and east, depending upon the particular orientation of a structure. In these characteristics, Ozette village differed little from other villages on the Northwest Coast. Villages in the study area were typically linear and nearly always paralleled the shore, whether of a river or ocean. Sometimes two or more rows of houses ascended a hillside (Beaglehole 1967:317–318; Koppert 1930:9). Variations on the linear arrangement did occur as, for example, in a Katzie village cited by Jenness (1955:10) where a winter village was "U"-shaped with the open end facing the water, or among the Lummi for whom Stern (1934:31) reported an "L"-shaped village. As well as being dictated by topography, the linear arrangement was advantageous since shoreline and aquatic resources were heavily harvested and transportation was generally by water. Even when two or more rows of houses were involved, a linear pattern allowed everyone nearly equal access to water.

House Site Selection and Preparation

Seasonal village sites apparently were extensively reused, probably because they were situated for the exploitation of spatially stable and seasonally recurrent resources, such as salmon runs and sea mammal migrations. Probably house locations within a village were stable also over long periods of time. There is every indication that traditional Northwest Coast houses, or their frames at least, were long standing. Construction and reconstruction of dwellings must have occurred, however, and probably were bound by locations of adjacent structures. As has been seen at Ozette, houses were close together and there was little room for expanding or reorienting a structure. Within an existing village, then, there probably were few options available for house-site selection and this may have been a major factor in the accumulation of deep midden deposits on the coast.

While some Northwest Coast houses were associated with house excavations, particularly south of the Makah area, there is no evidence of house excavation at Ozette. As used here, the term is meant to imply a construction technique whereby the interior height of a dwelling is increased by building the structure over a large pit or excavation. Such excavations should be distinguished from ground leveling, as done for example in House 1 at Ozette.

The question of house excavations deserves some attention as they apparently were associated with some shed-roof structures. One of Pettitt's (1950:5) informants claimed that Quileute houses were built over pits two (61 cm) to three feet (91 cm) deep to protect the occupants from the wind. Sproat (1868:41) reports that the floors of houses in the Barclay Sound area were excavated one foot (30 cm) in depth. Waterman and Greiner (1921:19–20) make the strongest case for house excavations associated with shed-roof houses. They do not, however, distinguish between house excavations and fire pit complexes which, at least at Ozette, were often fairly extensive.

As evidence of house excavations associated with shed-roof houses, Waterman and Greiner cite house pits in abandoned village sites around Puget Sound. Such pits probably were the result of midden accumulating around the outside of houses rather than excavations relating to the house architecture. At Ozette, the floor of House 1 was generally less than 30 cm in thickness while the exterior midden, representing the same amount of time, was often over 1.5 m thick. This differential rate of accumulation between floor and exterior midden was the result of housekeeping practices in which the bulk of refuse was deposited outside of the dwellings, effectively raising the ground level relative to the floors of the houses. If the Ozette houses had been abandoned rather than being buried by the Unit IV slide, the topography might appear appear to have been due to house excavation.

Shallow excavations within houses are reported by Barnett for the Pentlatch, Comox, and Sechelt (Barnett 1955:43, 45, 51). These excavations often were associated with gabled houses, belonging to wealthier families and normally were not found among the southern Strait of Georgia groups. To summarize, while shallow house excavations were associated with some shed-roof houses, the association was not universal. In addition, a distinction must be made among: (1) firepit complexes, which do not relate to the houses architecturally; (2) house excavations which are related architecturally to the houses; and (3) topographic anomalies which result from differential rates of accumulation between floor and exterior midden.

Manufacture

Logging

The traditional logging practices of the Makah Indians have been discussed above (chapter four). Among the Quinault, south of the Makahs, felling of trees was accomplished with mauls, chisels, and wedges (Olson 1967:66). Two cuts were made around the tree trunk and the intervening wood was split out. Among the Quileute, fallen trees first were sought for plank manufacture; if none were available, trees with hollow stumps were felled by burning through the stump (Pettitt 1950:5).

Drucker (1951:79) describes an interesting logging practice among the Northern and Central Nootka tribes. Notches were cut in a standing tree at a distance apart equal to the length of the desired planks. A split was initiated from the upper notch and a cross pole was inserted in the split. The tree was then left for the wind and the weight of the cross pole to extend the split until a slab fell off. This slab, already the required length, was then used for manufacturing planks.

Among the Clayoquot (Koppert 1930:8–9), trees were felled by cutting through with stone chisels. The cutting was done above the swell of the trunk and once down, the tree was trimmed of

branches and bark for transportation. Among the Lummi (Stern 1934:95), canoe logs were downed with "sledges" and elk horn chisels.

There are virtually no data available from the Ozette site as to logging practices and any of these techniques, as well as those discussed in chapter four, may have been employed. The structural remains in the Ozette collection have been so modified that evidence of logging techniques no longer exists. However, about two miles northeast of Ozette, one tree was located which shows evidence of having planks removed some time ago, apparently using the method outlined above for Northern and Central Nootka tribes. Still standing, this cedar has continued to grow around the split-off portion, producing bulges of bark either side of the removed area (Figure 78). The slab removed from this tree was about three meters long.

Plank Splitting

Ethnographic data on plank splitting by the Makahs have been presented in chapter four. Planks were split by wood wedges driven by stone mauls; the mauls and wedges in the Ozette collection indicate that the protohistoric Ozettes split their planks in a similar fashion. Ozette woodworking technology has been the subject of a separate study by Paul Gleeson (1980b), to be included in a future volume in this series.

Among the Quileutes, planks also were wedge split. This process is described by Pettitt as follows:

> Logs were split into planks ... by driving wedges carved from the heartwood of spruce into the ends of the logs. These wedges were some sixteen inches long and two or three inches in diameter. The butt end of the wedge was strengthened by wrapping it tightly with strips of elk or deer hide. Generally, for this heavy work a large boulder, held with both hands, was used as a hammer (Pettitt 1950:5).

Plank splitting by the Quileute apparently was similar to the process inferred from the Ozette collection. Wedges from Ozette, however, are of yew and compression wood from spruce; worked, pestle-like mauls were used in addition to the possible use of boulders. Wedges in the Ozette collection are wrapped with withes rather than hide.

Drucker describes plank splitting among the Northern and Central Nootka in much the same manner as described by Pettitt and Swan earlier in this study. One additional feature, however, is that when two people were working together, one person used a stout pole to pry at the longitudinal side of a split. Olson (1967:66) describes a similar technique for the Quinault who used pry bars that were flattened at one end. One artifact class in the Ozette collection is described by a local informant as being used for this purpose. These artifacts are stout poles, between 93 cm and 1.25 m long, tapering to a conical point on one end and having a grip carved into the wood at the other end.

Boas (1909:329) describes a Kwakiutl method of controlling splits which hints at the sophistication of traditional woodworking techniques on the Northwest Coast. Splits that began to feather out prematurely or dive into a log were reversed by the application of pressure immediately ahead of the split. Again, there is no evidence of the use of this technique in the Ozette collection although it may have been known by the Makahs.

Dimensions of split planks were controlled largely during the manufacturing stage with trimming and dressing occurring afterwards. Dimensions of ethnographically reported planks are listed in Table 11. These dimensions may be compared with Tables 2, 3, and 4 of this study which list the dimensions of plank classes in the Ozette collection. Ozette planks are generally shorter, less wide, and less thick than those cited in the ethnographic literature for neighboring groups.

Figure 78. Standing western red cedar with slab removed. The vertical distance from the lower (base) to the upper cut is about three meters.

Dressing

As has been seen, a number of planks in the Ozette collection have been dressed to some degree. Plank dressing is mentioned for groups in the Puget Sound area by Eells (1887:626) and Gibbs (1970:215). Waterman and Greiner (1921:30) report that after dressing, Puget Sound Indians "scraped" the planks with mussel shells after they were split. It is not clear whether their reference is to shells used alone or hafted.

Table 11

Ethnographically Reported Plank Dimensions.

Ethnic Group of Geographic Area	Length	Width	Thickness	Source
Quinault	—	1 ft (30 cm) to 5 ft (1.5 m)	—	Willoughby 1886:267
	—	—	2 in (5 cm) to 3 in (7 cm)	Olson 1936:62
Makah	—	5 ft (1.5 m) or more	—	Swan 1869:5
	—	5 ft (1.5 m) or more	—	Waterman and Greiner 1921:26
Klallam	40 ft (12.2 m)	2.5 ft (76 cm)	—	Eells *in* Ruby and Brown 1976:23
Puget Sound	24 ft (7.3 m)	4.5 ft (1.4 m)	—	Gibbs 1887:215
Gulf of Georgia	—	3 ft (91 cm) to 4 ft (1.2 m)	—	Barnett 1955:36
Fraser River	—	—	3 in (7 cm) to 4 in (10 cm)	Fraser *in* Masson 1889:193
Upper Stalo	—	—	3 in (7 cm) to 4 in (10 cm)	Duff 1952:47
Nootka: Northern and Central	15 ft (4.6 m) to 24 ft (7.3m)	—	—	Drucker 1951:71
		1 ft (30 cm) to 5 ft (1.5 m)	—	Drucker 1965:148
	30 ft (9.1 m)	3 ft (91 cm) to 5 ft (1.5 m)	—	King *in* Beaglehole 1967:1408
Nootka: Southern	10 ft (9.1 m)	4 ft (1.2 m) to 5 ft (1.5 m)	—	Jewitt 1974:50
Clayoquot	—	8 in (20 cm) 10 in (25 cm) 15 in (38 cm)	—	Koppert 1930: 11, 15

Koppert (1930:11) states that the Clayoquot "smoothed" planks, presumably by dressing them. Drucker (1951:81) notes that the Northern and Central Nootka adzed planks at the village after splitting them in the forest. He also reports that up to one-third of their thickness was removed by dressing. Sanding of planks with dogfish skin is mentioned by Waterman and Greiner (1921:31) for Puget Sound groups.

Dressing of planks after splitting seems to have been quite common in the shed-roof and Wakashan house areas. Reasons for this rarely are stated although it probably was for purposes of truing the planks as the thickness could be closely controlled during splitting. Tools for dressing planks are seldom mentioned although adzing often is implied. Except for Waterman and Greiner's comment on sanding, this process rarely is mentioned and probably was not used frequently.

Repair

Plank repair is well documented in the Ozette structural remains and also is reported in the ethnographic literature. Among Northwest Coast groups, longitudinal splits often were repaired by sewing methods and Waterman and Greiner (1921:31) describe this technique for groups in the Puget Sound area. Perforations were made on either side of a crack or check which was filled with pitch. The crack was then drawn together by withes threaded through the perforations. Occasionally, cracks were filled with splinters to prevent the pitch from dripping through. While this technique is similar to the sewing techniques exhibited on repaired planks in the Ozette collection, the use of pitch and splinters is not evidenced in the latter material. Although pitch does not preserve well at Ozette traces of it often are seen on artifacts such as harpoon heads. The complete absence of even traces of pitch in the repaired examples of Ozette structural remains indicates that the pitch and splinter technique was not used by the protohistoric Ozettes.

The use of splints of wood driven between a mending tie and a plank to draw a crack together is exhibited on a few artifacts and structural remains from Ozette. A similar technique also is reported for the Kwakiutls by Boas (1909:335).

Among the Quileutes, rectangular holes were cut around a knothole or knot; these holes were plugged with a piece of wood cut to a similar shape (Pettitt 1950:5). In the Puget Sound area, knotholes were covered with clam shells filled with clay, which acted as a binding agent (Waterman and Greiner 1930:31). Neither of these techniques for repairing knotholes is found in the Ozette collection, although the clay and clamshell technique, if used, may not have been preserved during the archaeological excavation of the structural remains.

Construction Sequence

The construction sequence described by Swan for shed-roof houses among the Makahs is similar to a sequence reported by Waterman and Greiner (1921:27–28). The only detail added by the latter is that the taller rafter-support posts were erected before the shorter ones. To a certain degree, the construction sequence of both shed-roof and Wakashan houses must have been dictated by the nature of the structures. Roofs could not be constructed before the roof supporting frames. Since the walls enclose the rafter-support posts and rafter beams of both house types, it is likely that roof supporting frames were erected before the walls.

House Size

Historic estimates of Makah house sizes vary. George Wilson (1849–1857) reports the dimensions of Flattery Jack's house in Deah as 50 ft (15.2 m) by 30 ft (9.1 m). A Mr. Goldsborough, quoted by George Gibbs (1970:174) said the same dwelling was 100 ft (30.5 m) long. According to Gibbs (1970:174), Makah houses in Deah at the time of his visit were about 75 ft (22.9 m) by 40 ft (12.2 m) and 15 ft (4.6 m) high in front. In a later document, Gibbs reports that Makah dwellings were about 50 ft (15.2 m) wide and 100 ft (30.5 m) long (Gibbs 1967:35). James Swan says that some Makah houses were 60 ft (18.3 m) long, 30 ft (9.1 m) wide, and 10 ft (3 m) to 15 ft (4.6 m) high. In a letter to the Pioneer Democrat (October 14, 1858) Swan reports the length of Makah houses at between 80 (24.4 m) and 100 ft (30.5 m). In another letter to a newspaper, Swan gives the dimensions of Makah houses as 40 ft (12.1 m) by 60 ft (18.3 m) and 18 (5.5 m) to 20 ft (6.1 m) high (Costello 1895:118). Francis Densmore quotes Young Doctor that his father's house was 84 ft (25.6 m) long.

To summarize, the early reports of Makah house sizes range between 50 (15.2 m) and 100 ft (30.5 m) for length and between 30 (9.1 m) and 40 ft (12.2 m) for width. Heights varied from 10 (3 m) to 20 ft (6.1 m) although the difference in height between the front and back walls is never clear in the literature. In part, the range in house sizes must have been real as individual houses in a community probably varied in size according to the wealth of the owners and the number of inhabitants. On the other hand, the Goldsborough and Wilson reports indicate that observer's estimates were, at best, only estimates.

At Ozette, House 1 measured approximately 67 feet (20.5 m) long by 39 feet (12 m) wide, while House 2 was about 56 feet (17 m) long and 31 feet (9.5 m) wide. Both of these houses fall within the range of length and width reported for Makah dwellings. As has been seen in the preceding chapter, shed-roof dwellings in the Pacific Northwest varied greatly in size according to a number of factors including local preference. While the Makah (and Ozette) houses are not the smallest reported for the region, there is no indication of Makah houses comparable to the long, segmented dwellings reported for the Strait of Georgia and Fraser River areas.

Walls

Construction

Horizontal wall planks, slung between pairs of wall poles by withes, were universally used throughout the shed-roof and Wakashan house areas. Slight variations in this technique did occur, however. The use of vertical planks in the end walls of Quileute houses has already been mentioned. Among the Songish, Boas (1890:664) notes that withes were passed through holes in the wall boards. Gibbs (1970:174) mentions that Neah Bay dwellings had withes passing through "apertures" (probably spaces between individual planks). Boas's account suggests that the holes were drilled. If this were the case, it would seem that problems in the seasonal assembly and disassembly of the dwellings would be encountered. Drilled holes would require that the wall poles be maintained in a constant position relative to the planks. It is also possible that the houses Boas saw were permanent and not disassembled seasonally.

Barnett notes that planks were lashed to rafter-support posts, apparently in both the gabled and shed-roof structures of the Strait of Georgia Salish (Barnett 1955:36). This practice, if widespread, did not occur at Ozette. No evidence of withe lashing on the rafter-support posts was found in either Houses 1 or 2 and the posts generally were set inward, away from the house walls.

Wall construction of the Wakashan houses used by the southern Kwakiutl and the Northern and Central Nootka was identical to that of shed-roof houses (Drucker 1963:69). This may have contributed to the lumping together of Wakashan and shed-roof dwellings by some early observers. Except for the low gable of the Wakashan-style structures, the two house types must have presented a very similar outward appearance.

Wall Poles

While no specific data are available from Ozette on the method of setting wall poles into the ground, some of them probably had been driven in as evidenced by the battered ends on many of the poles. Koppert (1930:15) reports that among the Clayoquot wall poles were driven into the ground by someone standing on a cross beam using a piece of cord wood as a pile driver.

According to Gibbs (1970:174), wall poles were spaced "few feet apart" along the walls of Makah houses. James Swan says that they were four or five feet from each other (Swan 1870:5).

Spacing of wall poles in the Ozette dwellings appears to have been irregular; any regularity in their spacing probably a disappeared early in the histories of the houses as wall poles were replaced and others added. Some writers (Drucker 1951:69–70; Koppert 1930:15) report fairly standard lengths for wall planks and regular spacing of the wall poles as a consequence. Many illustrations, particularly those of Paul Kane, show even lengths of wall planks and regularly spaced wall poles. No such standardization is apparent in the planks in the Ozette collection. Some early illustrations, such as the drawing by Gibbs (Figure 22) and Paul Kane's illustrations (Harper 1971: Figure 186) show wall poles extending above the eaves of houses. Barnett (1955:48) reports that wall poles sometimes projected above the roofs of dwellings among the Klahuse and elsewhere. Also, in the illustration accompanying Boas's (1890:564) account of Songish dwellings, wall poles are shown extending above the eaves of the dwelling.

At Ozette, wall poles appear not to have extended above the roof lines whereas fish-drying racks did. It may well have been that the two were combined in some areas so that the upper ends of the wall poles functioned as the vertical supports for fish-drying racks. At least at Ozette the two seem to have been separate.

As noted earlier, wall poles of unequal heights were sometimes found at Ozette immediately adjacent to each other. Such a construction is illustrated in a Webber drawing of the interior of a house at Nootka Sound (Bushnell 1928: Plate 2). In the Gibbs drawing of Deah village (Figure 22), a curious feature is visible on one dwelling: logs or poles are leaned against the outside of two of the house walls. Each of these timbers has one end butted against the ground while the other is against the house. Similar leaning timbers occasionally are visible in other early illustrations and photographs; in one of Paul Kane's drawings (Harper 1971: Figure 184), for example, timbers can be seen leaning against a shed-roof house on Vancouver Island.

The functions of these timbers are unknown and they are not mentioned in the historic and ethnographic literature. Conceivably they may have had several purposes as wall braces, drying frames, or access to the roofs of the houses. No such timbers are apparent in the structural remains recovered at Ozette, although the relationship of such timbers to the walls of House 1 or House 2 would not have been preserved because of the impact of the Unit IV mudslide.

Wall Chinking

Chinking the gaps between individual wall planks in shed-roof houses occasionally is mentioned in the literature. Barnett (1955:36) reports the use of moss and mat-fiber for chinking among the Strait of Georgia Salish and Curtis (1913:45) notes that the Salish stuffed the interstices between wall planks with "grey moss." Chinking of the walls in Makah houses is reported by Swan (1870:5) who says that moss and dry seaweed were used. No evidence of chinking was recovered at Ozette although it is possible that the practice existed and the chinking material was not identifiable in the debris upon archaeological excavation.

Corners

There is no mention of corner construction in the historic and ethnographic literature on shed-roof houses. Close examination of sketches, however, suggests that they were constructed in the same manner as those at Ozette, with one wall butted against another.

Wall Mats

Among many groups in the shed-roof house area, woven mats are mentioned as components of the house walls. These wall coverings are recorded for the Songish (Boas 1890:564), Klallam (Gibbs 1967:36), Puget Sound groups (Eells 1887:626; Haeberlin and Gunther 1952:16; Waterman and Greiner 1921:37), Lummi (Stern 1934:31), Strait of Georgia Salish (Barnett 1955:37), Straits of Haro and Rosario Salish (Suttles 1974:157) and the Quinault (Willoughby 1886:267). Generally, these mats were employed to prevent drafts, especially in the winter. Pettitt (1950:5) mentions that the Quileute erected a kind of tent around their beds for protection against rain, wind, and snow.

A vertical mat is visible in the background of the photograph of the interior of a Makah dwelling (Figure 26). It is not clear whether this mat functioned as a partition or a wall covering. Considering the prevalence of wall mats among groups that used shed-roof houses, it might be expected that the practice would have been followed by the Makahs and Ozettes. Evidence of mat wall coverings at Ozette is however tenuous (see Croes 1977:454, 458). Their use may have been seasonal, thereby accounting for the lack of good evidence for use in the Ozette houses; the slide that collapsed the Ozette houses occurred in the late spring or early summer.

Entrances and Doors

The ethnographic writers dealing with shed-roof houses generally agree that normally there was one main door on the water side of the structures. Eells reports that in the Puget Sound area the older form of entrance was oval and notes its occurrence as far west as the Klallams (Ruby and Brown 1976:23). Paul Kane illustrates an entrance in a shed-roof dwelling on Vancouver Island that was arched on the top (Harper 1971: Figures 192 and 194). Photographs of the Makah summer dwellings on Tatoosh Island, shed-roof houses in Neah Bay, and the historic photographs of Ozette village all show rectangular entrances. The fact that these are framed entrances in the photographs indicates historic influences; their shape may not be indicative of the traditional pattern.

The journals from Cook's voyage to Nootka Sound mention that the houses there had no regular entrances and that they were formed by gaps between the ends of planks (as shown in a Webber illustration in Bushnell 1928: Plate 2) or through a space between end-lapping wall planks (Curtis 1916:12–13). The account by Mozino (1970:17) substantiates this description in stating that entrances were formed where spaces between planks best permitted.

Several writers mention swinging or hinged doors. According to Haeberlin and Gunther (1952:16) the entrances to Puget Sound houses were closed by a slab hinged on an upright pole and bolted by a horizontal log. Their informants avowed that this was an old practice. Among the Strait of Georgia Salish some doors were hinged from the top by withes while others were simply blocked by planks (Barnett 1955:37). Gunther (1927:187) reports that some Klallam doors were hinged by elk-hide strips. Among the Quileute it was claimed that doors were hung by leather hinges, some on the top and others on the sides of the entrances (Pettitt 1950:5).

The Webber drawing of a Nootka house interior (Bushnell 1928: Plate 2) shows two entrances, both of which seem to be associated with large mats. Mozino (1970:18) mentions that mat coverings were used in the Puget Sound area and that hinged doors were a recent innovation.

Although hinged slabs may have been employed traditionally as doors, the idea is so suggestive of foreign influences that it is difficult to assess the antiquity of the trait with any certainty. Without question, doors with frames were a postcontact innovation. Mat doors are the most likely candidate for the traditional pattern, although entrances may also been blocked with slabs at night. At Ozette, lacking any direct evidence, the most likely hypothesis would be entrances similar to those described by Cook and Mozino, possibly with mat doors.

Windbreaks

Windbreaks are constructional features associated with entrances rather than with house walls. These frequently are reported in the literature and have been noted for at least one Makah dwelling. A sketch accompanying an unpublished manuscript by Waterman (n.d.) shows short walls extending from the entrance into the interior of the house. Further details are not provided but the walls apparently functioned as windbreaks rather than partitions.

Cook (Beaglehole 1967:317) and King (Beaglehole 1967:409) both describe walls extending halfway into the interiors of Nootka Sound houses. Webber (Bushnell 1928: Plate 2) illustrates a low wall parallel to the entrance of a house. Paul Kane (Harper 1971: Figures 192 and 194) also illustrates an entrance flanked by low wall-like structures.

Haeberlin and Gunther (1952:34) state that small partitions were built on either side of the entrances to Puget Sound dwellings to serve as windbreaks. Waterman and Greiner (1921:34) report that Old Man House had a "maze" of staggered parallel walls with a pit in a dark area. Well built houses were supposed to have had "hallways." Stern (1934:31) reports that the Lummi had low "fences" extending into their houses from the waterside entrances. Other entrances in Lummi dwellings were obstructed by pits and stumps. Suttles (1974:259) reports Coast Salish houses with plank walls from the entrances into the houses.

From the ethnographic literature the main function of low, partition-like walls leading into houses from the entrances seems to have been as windbreaks. Elaborate variations, including obstructions placed in the way, also served a defense function to impede access into the houses. Windbreaks seem to have been widespread in the shed-roof and Wakashan house areas. While no such structures were found in the houses excavated at Ozette, their absence cannot be taken to indicate that they were not employed in traditional Makah dwellings. Waterman's notes suggest the contrary and Swan is silent on the matter. If windbreaks were used at Ozette, they may not have occurred in House 1 or House 2, or they may be undetectable in the debris.

Windows

Windows occasionally are reported for both Wakashan and shed-roof houses. Cook mentions round holes which served as windows in the dwellings at Nootka Sound (Beaglehole 1967:318) and square and round windows are illustrated in the drawings accompanying Noticia de Nutkas (Mozino 1970: Plates 7, 11). It is probable that the windows in the Spanish drawings are stylized and were to some degree the result of historic influences. Bodega y Quadra presented Macquinna with glass panes (Mozino 1970:56) and it may be presumed that details on their use accompanied the gift. Drucker (1950:70) notes that among the Nootka, spaces between wall planks functioned as windows in good weather. Jenness (1955:7) describes windows among the Katzie as gaps between wall boards which were closed with mats.

While windows may have existed protohistorically in shed-roof and Wakashan houses, they apparently were little more than spaces left between the ends of wall planks. Evidence of windows was not found at Ozette. There is little question that most of the interior illumination in these dwellings was provided by shifting roof planks as mentioned by many authors and illustrated by Webber (Bushnell 1928: Plates 2, 3), and Kane (Harper 1971: Figures 192 and 194), and as seen in the photograph of the interior of a Makah shed-roof dwelling (Figure 26). Windows, if they existed in the Ozette houses, probably were little more than gaps between wall planks in a single course of planks and hence difficult to identify in the structural debris at the site.

Decoration

Stern (1934:31) reports that the inside walls of Lummi houses often were painted with a serpent design. Olson (1967:66) notes that the walls of Quinault houses occasionally were decorated with a horizontal band of red and black. No evidence of wall decoration either in the form of carving or painting was recovered at Ozette.

Roof Systems

Rafter-Support Posts

Data on rafter-support posts in shed-roof houses in the Pacific Northwest are quite poor. Actual lengths are never given and widths, thickness, and cross-sectional data are seldom cited. As a consequence, dimensional and sectional data comparable to the rafter-support post data from Ozette (Table 7) are minimal.

Cross-sections of rafter-support posts varied from square to rectangular among the Songish (Boas 1890:563), Katzie (Jenness 1955:6), and the Salish of the Straits of Haro and Rosario (Suttles 1974:256) to round as among the Nitinaht (Sproat 1868:40) and the Klallam (Gunther 1927:187). As has been seen with the historic Ozette and Archawat data, cross-sections of rafter-support posts varied at least through time within Makah territory.

Widths of rafter-support posts ranged from two (61 cm) to four feet (1.2 m) and thicknesses varied from less than one (30 cm) to two-and-one-half feet (76 cm) in diameter (Waterman and Greiner 1921:26; Gunther 1927:187). Lengths of rafter-support posts might be implied from the heights cited for shed-roof houses except that a substantial portion of each post was buried in the ground. Also, the interior heights of dwellings decreased with occupation time as floor midden accumulated. Consequently, the actual length of rafter-support posts in older houses greatly exceeded the interior height of the houses.

The spacing of rafter-support posts in shed-roof houses is not well documented in the ethnographic and historic literature. According to Waterman and Greiner (1921:27), rafter-support posts in the Puget Sound area were set up between 12 (3.7 m) and 14 ft (4.3 m) apart. A shed-roof potlatch house at Washington Harbor in Klallam territory had rafter-support posts spaced every 10 ft (3 m) apart (Gunther 1927:187). At Ozette, rafter-support posts in Houses 1 and 2 were between four and five meters apart (Figures 42 and 43). Among the Clayoquots, holes for rafter-support posts were scooped out with the aid of clamshells (Koppert 1930:13). When raising a rafter-support post, both the Clayoquots (Koppert 1930:13) and the Northern and Central Nootka (Drucker 1951:73) placed a plank against the back side of the pit to prevent the post from digging into the pit wall as it was tilted upward. There is no evidence of the use of planks in rafter-support post pits at Ozette although they may well have been removed after the posts were raised. Drucker (1951:73) mentions that the Northern and Central Nootka filled pits for rafter-support posts with large stones and dirt once the posts were raised; rafter-support post pits in Old Man House also were filled with dirt and stones (Snyder 1956:21). This also was a common practice in the houses excavated at Ozette.

Koppert (1931:11) mentions that the Clayoquot equalized the heights of rafter-support posts of different lengths by burying them at different depths. As seen earlier in this study, adjacent rafter-support posts at Ozette varied in length and it is likely that this practice occurred there also.

Although no decoration is evidenced on the rafter-support posts excavated at Ozette, similar posts frequently were carved or painted throughout the shed-roof house area (Ruby and Brown 1976:63–64; Haeberlin and Gunther 1930:17; Gunther 1927:187). Densmore (1939:6) states that support posts in the corners and centers of dwellings in Neah Bay customarily were carved but not

painted. This was done by placing a slave against a plank, tracing his outline and then carving the figure in relief. Either the Ozettes did not participate in this carving complex or it was a late introduction into the Makah area. Boas (1890:564) states that the Songish acquired the custom through a Cowichan marriage.

Rafter Beams

Dimensional data on rafter beams in shed-roof houses are generally lacking in the literature. Their approximate lengths, however, can be derived from the widths cited for shed-roof houses. Rafter beams spanned the full widths of the houses and there is no indication that two or more were involved in a single span, that is, placed end to end, as were ridge and eave beams were on occasion in Wakashan houses.

The Makah technique for raising rafter beams described by James Swan, has been described in chapter five. Koppert (1930:14) reports that the Clayoquots rolled ridge and eave beams up a plank incline to the tops of the rafter-support posts of their houses. Later, when square beams came into fashion, the ends were raised by building cribworks under them. The Northern and Central Nootka likewise raised eave and ridge beams with cribworks (Drucker 1951:74).

As mentioned earlier, center supports for the rafter beams were not found at Ozette although Swan reports their use among the Makahs. They were commonly used in Wakashan houses, however (Drucker 1951:69; Koppert 1930:11). A drawing by John Webber of the interior of a Nootka Sound house shows slanted poles supporting a rafter beam or pole (Bushnell 1928: Plate 2) and a drawing and painting of a shed-roof structure on Vancouver Island by Paul Kane also shows the use of center supports (Harper 1971: Figures 192 and 194). Rafter beams in Wakashan houses often were carved and/or painted (Drucker 1951:69) as were some beams in shed-roof houses (Barnett 1955:52, 54). Lacking rafter beams, however, there is no evidence at Ozette of this practice.

Rafter Poles

Rafter poles are not well described in the literature. Barnett (1955:36) notes that they were lashed to the rafter beams of houses in the Strait of Georgia area. Waterman and Greiner state that the poles along the higher sides of shed-roof houses in the Puget Sound area were of a larger diameter than the others and had a different name (Waterman and Greiner 1921:29, 40). We lack positively identified rafter poles in the Ozette collection.

Roof Planks

The use of bilaterally lipped planks for roof planks is nearly universal in both the shed-roof and Wakashan house areas. On occasion, plain unlipped planks also were involved in roofs. Barnett (1955:41), for example, reports that houses at West Saanitch employed unlipped planks and the Klahue used both plain and lipped planks (ibid:47) on the roofs of their houses. The gabled houses at Comox also involved both plain and lipped planks with the lower layer lipped and the upper layer plain (Figure 79A).

While use of bilaterally lipped planks is well documented in the study area, their manufacture is rarely discussed. Waterman and Greiner (1921:29) state that groups in the Puget Sound area split their roof planks in such a way that the edges already were raised. While planks may be somewhat laterally curved due to splitting long growth rings, this is not the same as having raised

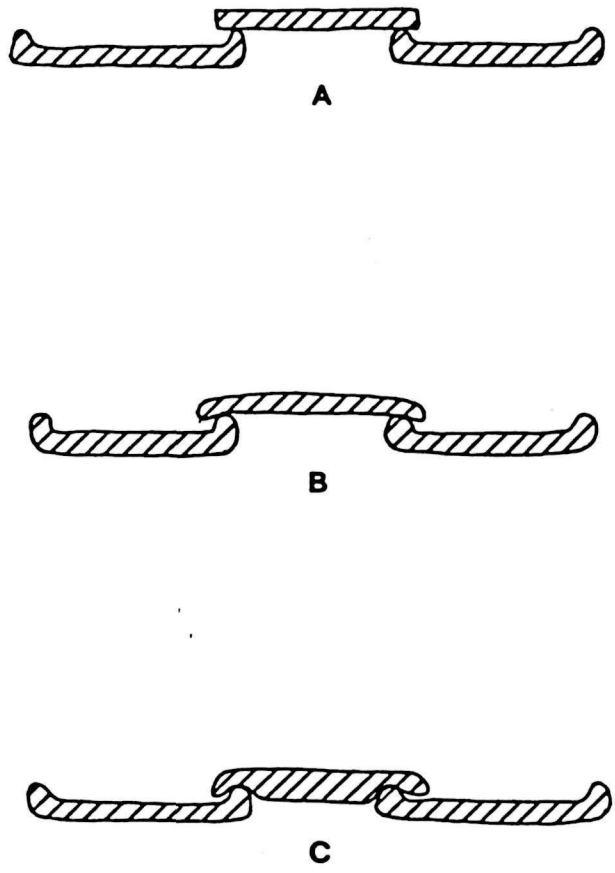


Figure 79. Methods of laying roof planks in cross-section: A - Comox and West Saanitch using plank and lipped planks; B - Puget Sound area using shallowly and deeply lipped planks; C - hypothetical technique at Ozette using guttered and troughed planks.

edges or lips. The fact that all of the lipped planks in the Ozette collection were fabricated by dressing suggests that the technique described by Waterman and Greiner was not used, at least at Ozette.

Waterman and Greiner (1921:29–30) also state that Puget Sound groups manufactured two types of roof planks: some had deep troughs with high lips on their edges while others had shallow troughs with low lips. The planks with deep troughs were used on the lower layer of roof planks while the shallower ones were used on the upper layer (Figure 79B). Morphologically, no such difference in the depths of the troughs or lips exists in the bilaterally lipped planks in the Ozette collection. In that sample, lip depths range between one and two centimeters with an average of 1.2 cm (N=40). These are, however, two morphological types of lipped planks in the Ozette material based upon their method of manufacture; troughed and guttered planks (Figure 33). It is possible, if not probable, that guttered planks formed the top layer of roof planks and troughed ones formed the bottom layer because of their greater capacity for carrying rainwater off the roofs of the Ozette houses (Figure 79C).

Roof planks on shed-roof and Wakashan-style houses almost never were fastened in place. The only exception is that mentioned by Waterman and Greiner (1921:30) for "better" houses in the Puget Sound area. In such houses, roof planks were held in place by longitudinal poles bound by withes passing through holes drilled in the roof planks and fastened to rafter poles. No such holes

are found on the bilaterally lipped planks in the Ozette collection and this technique appears not to have been employed. Densmore (1939:6) reports that when the occupants of Makah houses were absent for a period, poles on the roofs of their dwellings were lashed to the inside rafter beams to hold the roof boards in place. She makes no mention of holes drilled through the roof planks.

Weights often were placed on the roofs of shed-roof and Wakashan houses to hold the planks in place. Drucker (1965:148) notes that both rocks and poles were used as roof weights among the Northern and Central Nootka. Jewitt (1975:50) graphically describes the natives of Nootka Sound turning out during a storm to weight the roofs of their houses with large stones. Waterman and Greiner (1921:30) also report that stones were employed as roof weights in the Puget Sound area.

Gilbert Sproat (1868:69–70) describes a dance on the roofs of houses in Barclay Sound. Of particular interest is his mention that the roof planks on the houses were damaged by this activity and later replaced. This would probably lead to recycling of the damaged planks into other features in the houses as is evidenced in Houses 1 and 2 at Ozette. A photograph of Wakashan-style houses in Nootka Sound (Sendey 1977:20), for example, shows a bilaterally lipped plank incorporated into a house wall.

Waterman and Greiner (1930:31) mention a technique in which channels were carved around knotholes on roof planks to divert rainwater. Such carving is found on a number of planks of different classes in the Ozette collection (Figure 80). When they occur, the channels are around knotholes, never intact knots; in addition, the carving always is on one side of the planks and never on both sides.

Local informants have suggested that the carving around knotholes in the Ozette collection was to prevent checking in that area of the planks. No checking, however, has been observed in the collection around knotholes that were not carved. The fact that carving around knots was applied to plank classes other than bilaterally lipped planks indicates that either the phenomenon was not restricted to roof planks (in which case the explanation for their occurrence offered by Waterman and Greiner is not quite correct), or that various plank classes were used as roof planks.

House Interior

Floor

Floors throughout the shed-roof and Wakashan house areas were not planked except in special circumstances such as the floor leveling technique mentioned by Cook at Yuquot in Nootka Sound. While floor middens inevitably accumulated within these houses, their rates of accumulation were minimized by disposal and housekeeping practices. The deep exterior house middens in many Northwest Coast archaeological sites is evidence that much household debris was transported outside the dwellings. Suttles (1974:157) reports that the Coast Salish of the Haro and Rosario Straits regularly swept their floors with hemlock boughs and sprinkled them with water. The latter practice may have occurred at Ozette and contributed to the formation of distinctive floor middens as opposed to exterior midden.

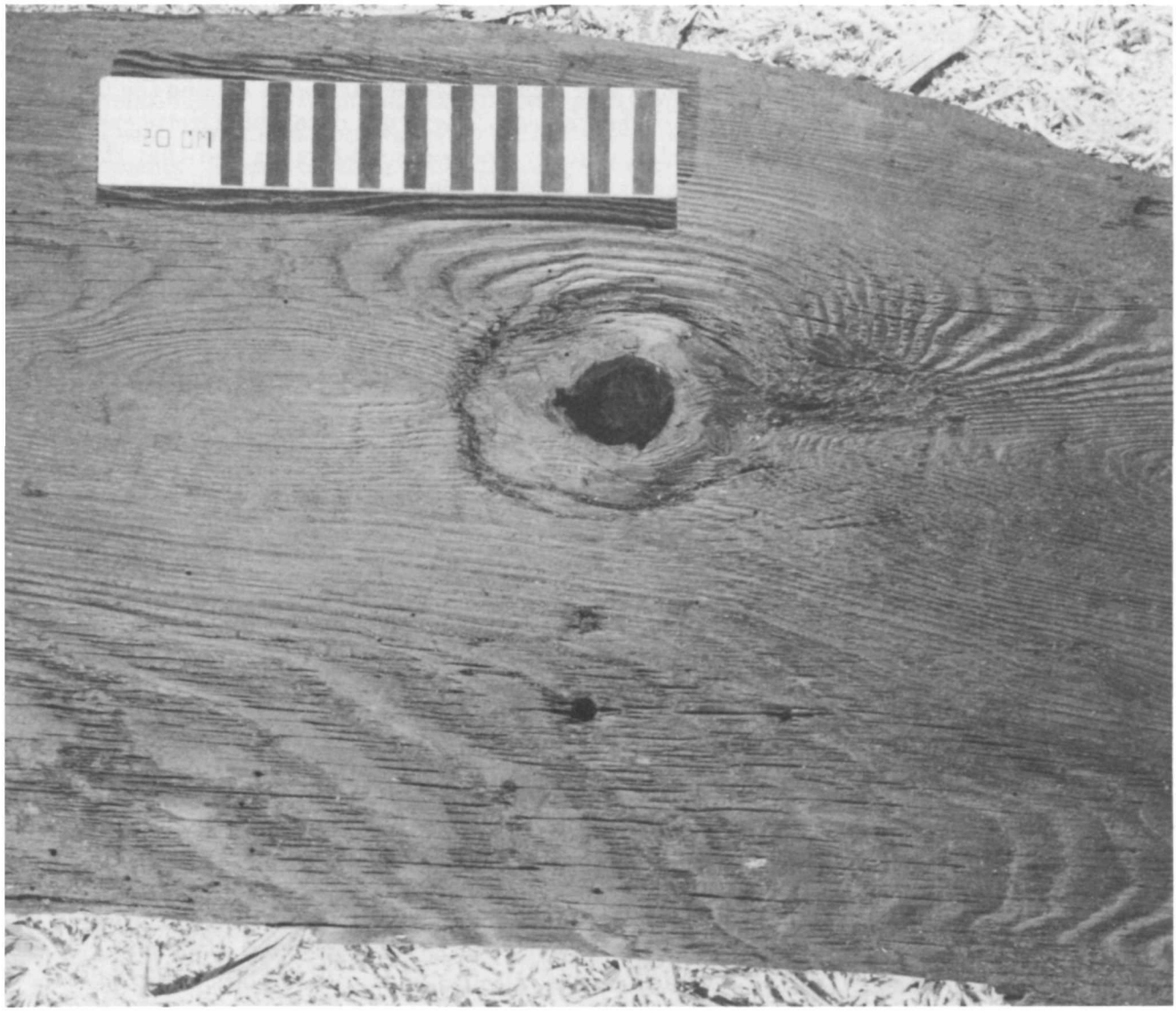


Figure 80. Carved knot on an Ozette plank.

Benches

Either one or two rows of benches paralleling the walls of houses was the common pattern in both shed-roof and Wakashan houses. The Strait of Georgia Salish (Barnett 1955:37), Lummi (Stern 1934:31), Klallam (Gunther 1927:186) and Nootka or Barclay Sound (Sproat 1868:42) are reported as using one row of benches in their dwellings.

One or two rows of benches were used in Nootka Sound (Beaglehole 1967:318) and two rows were used in the Puget Sound area (Haeberlin and Gunther 1952:16). In a few cases, benches were placed at right angles to house walls as well as paralleling them. The Webber drawing of the interior of a house in Nootka Sound (Bushnell 1928: Plate 3) shows benches resting on the floor of the house, parallel to a partition and apparently at right angles to a house wall. Paul Kane's drawing and painting of the interior of a shed-roof house on Vancouver Island (Harper 1971: Figures 192 and 194) also illustrates benches at right angles to the house walls. In view of this evidence, the

benches in House 2 at Ozette that apparently were at right angles to the west wall of the dwelling (Figure 63) do not seem exceptional.

Gunther (1927:168) reports that benches in Klallam houses were adjacent to only three walls of the dwellings. The area next to the fourth wall was used for storing firewood. Among the Quinault, benches were parallel only to the long walls of their houses. The bench data from Ozette excavations (Figures 61 and 63) suggest that the benches were by no means continuous and that there were large gaps between them, possibly for storage and for work areas.

Although some benches rested directly upon the floors of houses, others often were raised off the floors. Bench heights varied from three inches for the front benches in Makah houses (Swan 1870:6) to three feet among the Lummi (Stern 1934:31). Raised benches generally were supported by stakes driven into the floors of houses. The Songish rested their benches on cross-poles lashed to upright stakes (Boas 1890:564). According to Koppert (1930:17), the Clayoquots drove a row of stakes close to the house walls and a second row 18 in out from the walls. Benches were then placed upon these stakes. Among the Northern and Central Nootkas, benches were raised on poles or small logs (Drucker 1951:149). At Ozette, benches in Houses 1 and 2 were supported by stakes driven into the house floors without the aid of cross-poles.

There is no mention in the ethnographic literature of lipped benches such as those found at Ozette. A Webber drawing of the interior of a Nootka Sound dwelling shows the front of one of the raised benches decorated with a circle motif (Bushnell 1928: Plate 13). It is difficult to determine whether the front in the picture is part of the bench or a separate plank. Koppert (1930:17) reports that among the Clayoquot a vertical plank was placed in front of the bench and held in place by pegs. A Paul Kane sketch of the interior of a shed-roof house on Vancouver Island shows a similar arrangement (Harper 1971: Figure 194). Barnett mentions back rests among the Strait of Georgia Salish consisting of boards leaned against the house walls. Such rests also were placed against the stakes supporting the bench planks (Barnett 1955:38) and bench fronts also may have served the same function.

Canopies over the sleeping areas also are reported in the literature. Among the Squamish, mat canopies were used (Barnett 1955:52). At Musquam, there was a second "tier" above the bed platform (Barnett 1955:53). This tier was raised in a manner similar to the bed platforms and had a front drop of blankets or mats to shield the lower benches. No evidence of tiers or canopies above the benches was found in the buried houses at Ozette. The square holes near the ends of many Ozette benches may have related to vertical supports for canopies; this explanation does not, however, explain their multiple occurrence on some benches.

Space Allocation and Partitions

Within the shed-roof house area, the existence of multiple nuclear families, extended families and, in some cases, entire villages living under one roof would seem to have required a high degree of spatial organization. From the historic and ethnographic literature, it is apparent that such spatial organization existed and was related to kinship and rank. Drucker (1951:71) notes that space within Northern and Central Nootkan houses was allotted according to a system based upon the rank of individuals and their families. This system apparently operated within houses and prevailed throughout the villages.

Boundaries of nuclear family territories certainly existed conceptually and often were marked by physical divisions such as mat or plank partitions. Lacking physical partitions, portions of the house structures served as reference points for the conceptual territories within the dwellings. Among the Katzie (Jenness 1955:7), Songish (Boas 1890:564), and Lummi (Stern 1934:31), for example, rafter-support posts marked social subunits.

It is probable that in many cases physical partitions functioned as more than boundary markers. The proximity of benches to partitions, as seen in the drawings of Paul Kane and John Webber, for example, suggests that they also may have been used as back rests.

The relationship between partitions and family space is especially apparent in segmented houses. There, partitions sometimes extended across the full widths of the houses. At times, the "apartments" formed by these partitions were connected by doors as in a Cowichan Bay house reported by Barnett (1955:41). Haeberlin and Gunther (1952:16) note, however, that such divisions were not always connected, each having its own entrance from the outside.

It is possible that the degree of partitioning was related to the social and kinship distance between groups within a house. In the case of segmented houses, where greater social distances existed among the occupants of such houses, full, wall-like partitions seem to have been employed.

Physical partitions generally were of mats or were wall-like structures of boards and light poles. Possessions such as storage boxes also were used to mark family boundaries. Few data are available on the construction of mat partitions although it may be assumed that they were suspended from overhead poles. The construction of plank partitions may be seen in both Kane and Webber drawings, as well as implied from early accounts. Both Kane and Webber show partitions as involving one or more planks, set on edge and held upright between pairs of poles bound together by withes. As with windbreaks, partitions were built in the same fashion as shed-roof and Wakashan house walls, but on a smaller scale.

Carved Planks

Occurrences of the carved panels or "tamanous" planks encountered in House 1 at Ozette are poorly documented outside of the Makah area. George Gibbs (1970:203) reports that in burials among the Chinook and Chehalis the "Tomahno-us board of the owner [deceased] was placed near him." He also states that Puget Sound groups did not make these boards.

One cannot be certain that the planks mentioned by Gibbs represent the same phenomenon as the carved planks recovered at the Ozette Site. Probably closer is a painted wood screen described and illustrated by Boas (1890:592) for the Songish. Such screens were found among the Southern Nootkans in historic times (Sendey 1977:65–67) and may have been preceded by carved and painted panels such as those found at Ozette. These screens were used in puberty enclosures and as dance screens, and often were decorated with representations of family stories.

Storage

In addition to the indirect storage functions of many of the architectural features in shed-roof houses, some features were designed or reserved for storage. Sproat, for example, reports that corners were popular areas for storage among Barclay Sound groups (Sproat 1868:42).

Overhead storage facilities frequently are reported in the ethnographic and historic literature. In some cases, these took the form of shelves over the benches in houses as among Puget Sound groups (Haeberlin and Gunther 1952:16) and the Lummi (Stern 1934:31). In other cases, lofts were constructed below the roofs of houses. Sproat (1868:41) describes such a frame for Barclay Sound groups and a similar arrangement may be indicated in the Paul Kane sketch of a house interior on Vancouver Island (Harper 1971: Figure 194).

Some storage facilities were suspended, either partially or completely, from the rafters of houses. Waterman and Greiner (1921:37) mention three-foot-wide shelves suspended above the bed places among Puget Sound groups. Another technique involved fastening ends of horizontal poles over

the lowest rafter pole and suspending the other end by withes, apparently from the rafter beams or rafter poles (Waterman and Greiner 1921:38). As discussed in chapter five, overhead storage facilities are indicated for the Makahs but not evidenced in the structural remains from Ozette.

Accessory Structures

Fish-Drying Racks

Fish-drying racks as they occurred at Ozette, extending above the roofs of the houses, are not mentioned in the historic and ethnographic literature. While some illustrations show wall poles extending above the roofs of shed-roof houses outside the Makah area, cross-poles are rarely seen attached to these. It is possible that the use of fish racks was seasonal and the cross-pieces were taken down for part of the year.

Other Structures

According to Barnett (1955:38) the Coast Salish had narrow platforms, 10 (3 m) to 12 ft (3.7 m) high and 20 ft (6.1 m) long in front of their houses. These platforms were used for distributing potlatch gifts. Such a platform is illustrated by Boas (1890:564) for the Songish. These platforms are unknown for the Makahs and no evidence of such platforms was found at Ozette.

Banked earth constructions with plank retaining walls occasionally are mentioned for some Coast Salish groups. Barnett (1955:38) reports that the earth in front of wealthier houses among the Strait of George Salish was banked up and held in place with retaining planks to form a level area for lounging. In the gabled houses among the Pentlatch, shallow house excavations were lined with retaining planks (Barnett 1955:43). Among the Slaiaman, banked earth "streets" were constructed in front of the houses (Barnett 1955:49). No mention is made in the literature of drainage features similar to those found at Ozette.

Abandonment

While traditional houses on the Northwest Coast often stood for indefinite lengths of time, abandonment of these dwellings did occur for one reason or another. In some cases, the abandonment was only temporary and part of the economic pattern of the group; in other cases, abandonment was permanent, occasionally for reasons that were catastrophic in nature.

Seasonal abandonment of houses at summer and winter village sites was a common pattern among the native groups bordering the Strait of Juan de Fuca. In the case of the Makahs, this was part of the traditional pattern for exploiting local resources. The occupation of Makah summer and winter villages required shifts in residence at particular times of the year. While the villages may not have been wholly deserted, it is likely that a large portion of the population was involved in these movements. In July 1903, for example, the Indian Agent in Neah Bay visited Ozette village and reported it deserted, stating that the inhabitants were off halibut and salmon fishing (Chalcraft 1903). To facilitate these shifts in residence, house frames were maintained at the seasonal village sites, and planks often were moved from one dwelling to another so that only one set of boards was involved in maintaining and occupying two or more house frames.

Swan (1870:6) reports that the Makahs shifted only the roof planks of their houses from one site to another. Traditionally, more planks may have been involved since by Swan's time nails

probably were in general use, rendering wall planks immovable. Similar practices are reported for the Northern and Central Nootka (Drucker 1950:178; Meares 1790:126), the groups inhabiting Clayoquot Sound (Hoskins n.d.:144, 152, 155), Barclay Sound groups (Sproat 168:28) and Coast Salish groups on the southeast coast of Vancouver Island and the mainland (Barnett 1955:40). The practice of seasonally dismantling roof and wall planks and moving them to different locations may explain why Macquinna's house was only partially roofed (Meany 1957b:20) and why many villages were reported as deserted during the Spanish and English exploration of the Strait of Juan de Fuca. In part, withe-slung wall planking and loose roof planks may be viewed as an adaptation to this sort of economic pattern (Mauger 1977).

In the case of historic Ozette village, the site was finally abandoned as a part of the general pattern of amalgamation of all Makah villages in Neah Bay. Few data are available on the actual abandonment of the village except that it was a gradual process over a number of years. There also is little known of the fate of the historic dwellings at the site. Some may have been torn down and the lumber salvaged while others decayed or were disassembled for use in shelters by hunters and tourists. The historic abandonment of Ozette village represents a special case involving non-traditional pressures in a rapidly changing cultural context.

Swan (1870:6) reports that the Makahs did not move their dwellings except for some emergency. He did not specify the nature of the emergencies that might force such a move although war or depletion of local resources may have been factors.

Among some Puget Sound groups, houses were burned or given away at the death of the owners (Haeberlin and Gunther 1930:16). If occupants other than the owner of a dwelling died, the house was deserted for a period. Gibbs (1970:202), discussing Vancouver's report of burned areas containing human bones, suggests that these were actually dwellings whose occupants had died of disease. If this were the case, this practice doubtlessly became more frequent after the introduction of contagious diseases through contact with nonnative groups.

Often catastrophes may have caused the abandonment of houses. Fires must have had a devastating effect in Northwest Coast villages although, curiously, none is mentioned in the ethnographic literature nor are major house fires evidenced at Ozette. Gunther (1927:188) reports a Klallam house that collapsed under the weight of a heavy snowfall. Eells (Ruby and Brown 1976:64) also knew of a Puget Sound house that suffered the same fate.

At Ozette village, mudslides were the most prominent factor forcing abandonment. While the Unit IV mudslide was particularly destructive, other slides (such as the temp. VI slide in House 5 and the Unit II slide) simply flooded the houses without collapsing them. In such cases, the house occupants chose to disassemble the houses rather than remove the intrusive mud. Such decisions may have been influenced by traditions of earlier destructive mudslides. Slides may not have been restricted to Ozette village since several house sites in Makah territory were situated at the base of steep slopes. In recent years, for example, a landslide at Archawat buried the remains of a historic shed-roof house.

Summary

The buried Ozette dwellings were but a local expression of a broader architectural tradition. Structurally, shed-roof houses in the study area varied little except in elaboration along certain lines and the absence or presence of relatively minor traits. The differences between these houses generally reflect local or regional trends that seldom coincide with tribal or ethnic group boundaries.

Certain structural features and traits reported for other shed-roof houses appear to be absent at Ozette. Among these are overhead storage facilities (including shelves and lofts), wall chinking

and wall mats, windbreaks, and mat and plank partitions. One of several possible explanations may account for their absence.

Some structural features are absent at Ozette simply because they were not included in the traditional architectural system or material culture of the protohistoric Ozettes. This apparently is true of decoration on wall poles, rafter-support posts and rafter beams (?) despite the fact that these components were painted and carved in historic times by the Makahs. It is difficult to ascribe the absence of this trait in House 1 or House 2 to any other factor.

Some architectural features such as partitions are described in the literature as having been used only seasonally. Others are not specifically mentioned but may well have been just used seasonally, for example, fish-drying racks and windbreaks or partitions. Therefore, the season in which the Unit IV mudslide occurred also may account for the absence of some architectural features at the site.

Another possible explanation for the absence of certain structural features at Ozette is that they may have been present but cannot be identified in the structural debris. It is known that many roof components of the buried houses either were washed onto the beach or salvaged after the mudslide. Along with roof components, overhead features such as shelves and lofts that were structurally related to the roofs also may have been washed out or salvaged. It also is possible that such features were collapsed into the houses but were so broken up and scattered that their elements cannot be related to the features.

While certain structural features found elsewhere are absent from Ozette, other features present at the site are not mentioned in the ethnographic and historic literature on shed-roof and Wakashan houses. Among these are carved panels or "Tamanous" planks, interior drainage-control features (including baseboards and exit trenches in the houses), retaining walls, bank buttresses, and exterior drainage-control features such as the south whalebone feature. Maintenance efforts in general, including repair techniques, are poorly described in the literature. Considering the climatological and topographic conditions that prevail throughout the study area, similar features must have been associated with many shed-roof houses. To a large degree the absence of these features in the literature may be due to the fact that until the Ozette excavations there has been no opportunity to systematically study and describe a protohistoric Northwest Coast dwelling. In addition, there have been few opportunities to similarly examine early historic houses before their architecture was influenced by non-traditional factors. Much of the available ethnographic data on house structures is based upon informant interviews in which such details may have been glossed over or forgotten. Early historic data often were recorded by untrained observers and some structural features would not have been visible to a visitor in an early shed-roof house since they were below the surface of the floor or the exterior midden.

CHAPTER 8

SUMMARY AND CONCLUSIONS

This study has defined and described the architectural system in operation at Ozette village in the protohistoric period and compared this system to the shed-roof tradition in the Pacific Northwest. The purpose of such a comparison was to provide new insights into shed-roof house architecture allowed by the special preservation conditions encountered at Ozette and to establish the degree to which the buried Ozette houses were a manifestation of the shed-roof tradition.

Many of the data presented in this study are based upon an analysis of the protohistoric house remains recovered at Ozette. These remains are from at least two houses that were partially buried by a massive mudslide just before effective European contact in this area of the Northwest Coast. While the mudslide was very destructive, it also created conditions that allowed the buried house remains and contents to be preserved and recovered with minimum deterioration.

The data from Ozette has been organized and presented according to a model that distinguishes structural elements from structural features. Structural elements are the basic parts from which the Ozette dwellings were constructed. The materials used as structural elements included rock, whalebone, and wood with the latter occurring in a number of morphological and functional classes. Structural features involved various configurations of structural elements (Figure 81) and represent patterned and repeated cultural responses to various problems encountered in raising and covering a house and adapting the dwelling to the activities that took place within it.

The greatest utility of the structural element concept lies in explication of the processes of selection and preparation of house construction materials by the protohistoric Ozettes. Each class and subclass of structural elements represent a series of choices of morphological and manufacturing attributes by the builders. Often these choices were determined by the tasks in which the elements were employed. Comparatively massive timbers, for example, must have been chosen for rafter beams and rafter-support posts because of their function in bearing the weight of a roof. At other times the selection of manufacturing and morphological attributes was purely stylistic and not related to function as, for example, in the cross-sections of rafter-support posts. The structural element concept is also useful in classifying and describing those structural remains that were disassociated from the features in which they were involved and whose function is undetermined.

The concept of structural features is useful in that house construction can be approached as a series of constructional problems subject to separate analyses and description. Walls, for instance, present a set of construction problems entirely different from roofs. The separate analysis of structural features also is useful in that most of the comparative material on shed-roof houses is on the feature level. This allows the comparison of architectural systems on the basis of the presence or absence of specific traits or features as well as on a precise definition of the variation between houses.

The comparison between the Ozette houses and other houses in the shed-roof tradition shows that variation occurred within the shed-roof tradition and that Ozette houses varied from other shed-roof houses in certain features. The variation within the shed-roof tradition seems fairly insignificant in view of the structural homogeneity of these dwellings. The same construction techniques and structural features occur repeatedly throughout the shed-roof house area with significant variation only occurring after contact with the introduction of totally foreign construction techniques and materials.

Most of the variation between the Ozette and other shed-roof houses can be related to either the adequacy of historic and ethnographic accounts of these dwellings, or to sampling error (in the broadest possible sense, including the archaeological visibility of some features) at Ozette. Many subsurface construction features found in the Ozette houses would not have been visible to early

Figure 81. Wall elements in House 1, along the east wall.

visitors to shed-roof houses, nor is it likely that historic informants would have recalled or known of them. The absence of certain structural features at Ozette that are common in other shed-roof houses may be due to their seasonal use and/or the fact that they cannot be identified in the structural debris caused by the Unit IV mudslide.

An important question generated by this study relates to the nature and degree of relationship between shed-roof and other house types on the Northwest Coast. On a broad level it must be admitted that all Northwest Coast houses do share some general attributes that distinguish them from other native North American house types. These include plank construction, a rectangular plan, and use of massive rafter beams and rafter-support posts. These and other features led Philip Drucker (1965:25) to suggest that all of these types are local modifications of a single ancestral plan. Shed-roof houses, however, differ from all other house types on the coast in a single important

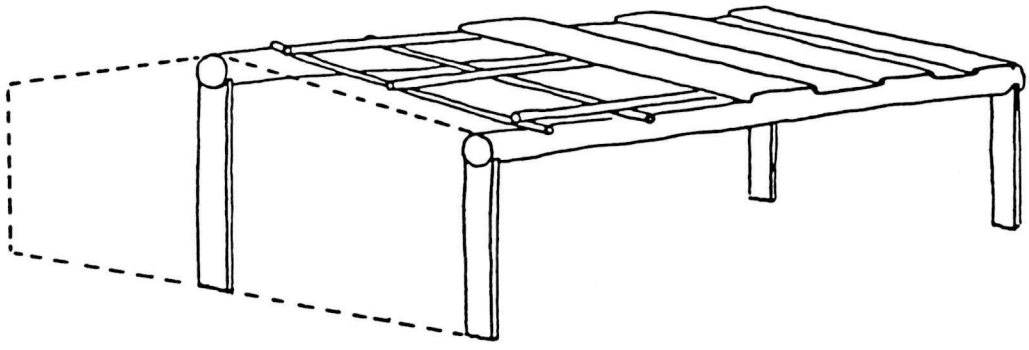


Figure 82. Structural relationships in half of a gabled house.

feature: the roof-supporting frame which produces the flat, single-pitched roofs characteristic of these houses.

In discussing historical relationships of Northwest Coast houses, there is some tendency to view the shed-roof house type as simply half of a gabled structure. If such were the case, then it would be a simple matter to derive shed-roof houses from gabled types and their frames would display the following attributes:

1. Rafter-support posts would occur in each of the four corners of a dwelling.
2. The widths of the rafter-support posts would be at right angles to the structural long axis of a dwelling.
3. The rafter-support posts would support eave beams along the eaves of the long walls of a house. Roof components would rest directly on these beams.
4. The roof would involve two sets of poles. The first of these would span the width of a house and rest on the eave beams. The second set would rest on the first, parallel the long axis of a dwelling and support the roof planks.

Such a frame is illustrated in Figure 82 and it in no way resembles that of a shed-roof house. The use of eave beams is isolated and rare in the shed-roof house area and as Barnett (1955:37) notes, rafter beams in shed-roof houses, not eave beams, are the structural analogues to eave and ridge beams in gabled houses. Even in a single-unit shed-roof house, the widths of the rafter-support posts parallel the structural long axis of the dwelling. Roofs involving two sets of rafter poles at right angles to each other are not found in the shed-roof house area despite the fact that this construction technique is used on the roofs of Wakashan houses. Given these facts, little can be added to the following comment by Barnett:

> The two types [shed-roofed and gabled] are not related structurally; one is not one-half of the other, and consequently there is reason to believe that they have had different histories. This conjecture is suggested even more strongly by a consideration of their distribution and relative importance in the area under discussion [the Strait of Georgia region]. Both were known and used by most groups, but not indiscriminately. Generally speaking, they were, socially as well as structurally, distinct types (Barnett 1955:37).

While shed-roof houses differ substantially from other Northwest Coast houses in terms of the house frame, they do share certain features with gabled Wakashan dwellings. Both house types involve identical methods of wall construction and loose roof planks. These features may reflect similar adaptive patterns to similar economic situations rather than any sort of historical relationship, however. Seasonal residence changes between summer and winter villages involving partial dismantling of the dwellings is a characteristic of groups using shed-roof or Wakashan dwellings.

Withe-slung wall construction and loose roof planking both lend themselves to assembly and disassembly with relative ease.

The idea that shed-roof houses are structurally unrelated to gabled dwellings and that the two house types therefore probably had separate origins is hardly novel; it was proposed by Waterman and his collaborators in 1921 (Waterman and others 1921:27–30; Waterman and Greiner 1921:49–51). They note the apparent intrusive nature of shed-roof houses in the central Northwest Coast and suggest that gabled dwellings were the original house type in this area. Salishan-speaking groups, moving from the interior to the coast, borrowed the idea of plank houses and modified it with traits of their own, producing the shed-roof house type. This form then spread to their Southern Nootka (including Makah) and Chemakuan-speaking neighbors. Barnett (1955:56) apparently is of the same opinion as Waterman and his collaborators in that he suggests the lower Fraser River as the dissemination point for the shed-roof house type.

These arguments are based upon two fundamental points: (1) the apparent intrusive nature of shed-roof houses in an otherwise continuous distribution of gabled-roof houses; and (2) the association of shed-roof houses with Coast Salish-speaking groups. In regard to the first point, shed-roof houses are intrusive only if all Northwest Coast gabled dwellings are considered manifestations of a single architectural system. This has yet to be demonstrated; the association of Northwest Coast gabled houses is based upon roof form alone, rather than a comparison and evaluation of the architectural systems of each house type or subtype.

The association of shed-roof houses with Coast Salish speakers is in need of clarification. Interior analogues to the shed-roof house type apparently are lacking. The use of shed-roof houses among Coast Salish speakers is not universal; the Quinault and Bella Coola are notable exceptions. Finally, the mechanisms and reasons for the Southern Nootka and Chemakuan speakers adoption of this house type would be of interest.

While the spatial distribution of the shed-roof architectural tradition, at least in protohistoric and later times, is fairly well understood, the temporal distribution is very poorly known in prehistoric times. Because of its relatively recent date, the Ozette material can contribute little to this problem directly; nevertheless, it still has some relevance in that it provides a basis on which shed-roof houses might be identified in less well-preserved sites.

The distinction developed at Ozette between floor and exterior midden should have validity in other archaeological sites. Although the differences between these midden types are clearest when hydraulic excavation techniques are employed, they may still be distinguished with more traditional excavation techniques. If a floor deposit can be distinguished from surrounding midden, then the extent of the deposit can be mapped and the shape of the former dwelling and its long axis can be determined. The relation of rafter-support post pits, identified by the matrix and compaction differences and rock linings, to the long axis of a house floor would identify the house type.

In the case of gabled structures, rafter-support post pits are at the corners of the floor deposit (Figure 83A). Even if intermediate support posts had been used for the ridge and eave beams, their spacing would be distinct from rafter-support post pits in shed-roof house deposits, where they should parallel the long axis of the floor midden and be evenly spaced (Figure 83B). An archaeological deposit from a single-unit shed-roof dwelling might resemble that of a gabled house except the long axis of the floor midden most likely would be at right angles to a beach.

It has been suggested earlier in this study that the definition of historic and ethnographic shed-roof houses should rely upon the roof supporting frame since these houses often are confused with gabled dwellings. Shed-roof houses are distinguished by rafter beams at right angles to the structural long axes of the houses. In the case of archaeological remains, different criteria need to be applied although the same principle is reflected. In an archaeological context, rafter-support post pits would parallel the long axis of a floor deposit. Even in sites with poorly preserved organic remains, a few rafter-support post pits would serve to indicate the former existence of a shed-roof

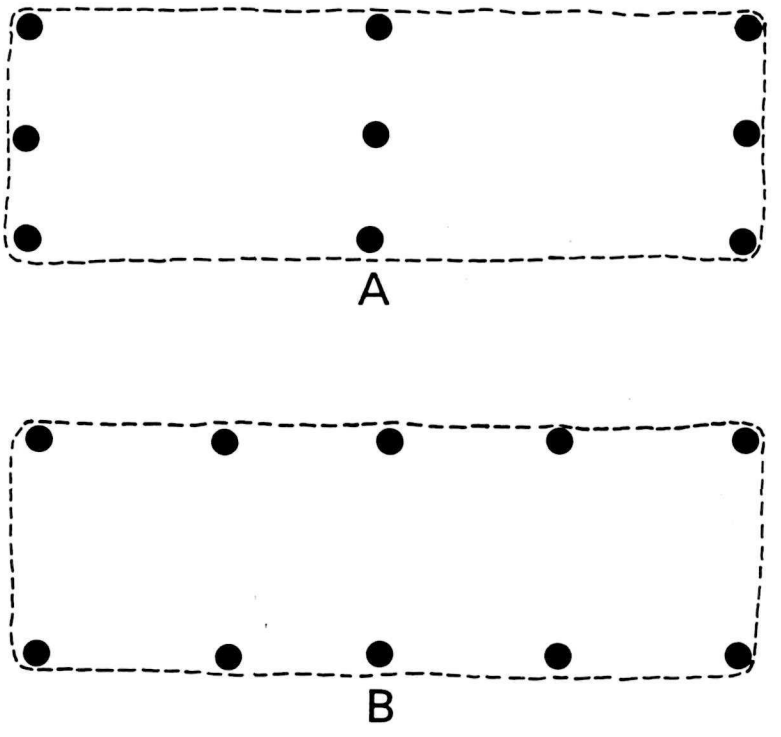


Figure 83. Distribution of rafter-support post pits in a: A - Wakashan and; B - shed-roof house.

dwelling. The identification of house types in archaeological contexts, even on the broad level of shed as opposed to gabled roofs, would greatly increase our understanding of the culture history of at least the central portion of the Northwest Coast.

Part III

PATTERNS IN OZETTE FLOOR MIDDENS: REFLECTIONS OF SOCIAL UNITS

By

Stephan R. Samuels

Photograph of a carved panel (129/IV/7) *in situ* with the figure of a Thunderbird (left) and a dog/wolf with forked tail (right).

Abstract

Activities conducted within these longhouses resulted in the deposition of objects and creation of features, forming floor middens. This part describes the midden matrix, midden constituents, and cultural features from three completely excavated house floors. Excellent preservation of organic materials permitted evaluation of an almost complete record of materials deposited within the culturally bounded universes of the houses. Feature areas within the floors and exterior midden deposits are described, and the depositional sequence for this portion of the site is presented.

A summary of house use and floor midden creation, based on ethnographic and historic sources, is compared to the compiled archaeological data. Based on these comparisons, a model for partitioning archaeological house floor space is proposed, and used to statistically examine distribution patterns for artifacts, postmolds and stakes. Relationships between occupation length and the quantity of postmold/stakes are explored among house floors, as is the consistency of artifact deposition patterns through time.

Tests are described which evaluate the potential influence of several classes of cultural activities (including curation, trampling, and housecleaning) on the distribution and quantity of midden elements. Results suggest housecleaning differences were an important factor behind variations in debris density among floor middens. Based on these results and other features within the excavated structures and floor middens, social distinctions between households are proposed.

CHAPTER 1

INTRODUCTION

This study evaluates spatial patterning within the floor-midden deposits of three Southern Northwest Coast protohistoric longhouses. This investigation has required re-evaluation of some theoretical issues in spatial analysis and development of new methods. The study of intrasite spatial patterning has the potential to develop into a more productive research area as archaeologists continue to collect complete information from cultural deposits and to use computer systems with greater manipulative power for asking involved and detailed questions of these data.

Several potentially complex problems confront any direct investigation of spatial patterning. Often, excavated cultural materials are not well preserved and provide only limited evidence of the complete range of cultural activities which produced the deposit. The nature and location of structures is often unclear, as are any relationships between structures and debris deposited as a result of cultural dynamics. Primary among these relationships is the degree of correspondence between past socioeconomic activity (such as food preparation or tool production) and excavated remnants of these activities uncovered by the archaeologist. The investigation of spatial association provides one potential avenue for elucidating these relationships, but this road is neither straight nor well-traveled.

This study developed methods to investigate the relationship between past socioeconomic activities and the patterns of past deposition. Because of the excellent preservation and extensive, detailed, and time-consuming excavations which have been conducted at Ozette, this investigation of spatial patterning has a greater potential for providing information about these relationships than would similar research at most other Northwest Coast midden sites. At the same time, the perspectives gained from this analysis can prove useful to others involved in investigations of spatial patterning at sites with more typical preservation and excavation procedures.

The history of excavation and analysis of the Ozette Archaeological Project is presented in part I. The excavations revealed that during protohistoric times a portion of Ozette village containing several large dwellings (longhouses) had been destroyed and their remains preserved by one of a series of mudslides. This analysis utilizes the fact that ethnographic sources report culturally defined living and working areas within Northwest Coast longhouses, assigned on the basis of social

rank. It was anticipated that longhouse-floor middens at Ozette would contain physical evidence of these culturally defined areas, and these would render comprehensible the spatial patterning of deposited materials.

This study provides a framework with which analyses using other Ozette material, such as the faunal debris, can be articulated. Faunal studies are more directly involved with investigation of economic life at Ozette, and in turn they can provide information for more detailed inquiry into spatial aspects of economic and social organization. Thus, spatial and economic studies can provide information to the other, resulting in a level of investigation which would otherwise be unobtainable.

There are four general aspects to this part:

1. description of Ozette stratigraphy;
2. description of research methods;
3. description of midden elements and their spatial patterns; and
4. evaluation and interpretation of these patterns.

The floor midden deposits of the three completely excavated houses (1, 2, and 5) provide the data for the analysis. Necessarily, much of this report is descriptive. The excavations were conducted continuously for 11 years and have resulted in a very large collection of recovered materials. Over 55,000 artifacts, 12,000 pieces of the structures, and over one million pieces of faunal material (bone and shell) have been recovered and analyzed. This collection affords an unusual glimpse into a protohistoric community, and basic description of the excavation results is important to developing Ozette's full potential.

Three levels of scientific analysis have been defined by Willey and Phillips (1962:4), observation, description, and explanation. Description is seen as a necessary prerequisite to explanation. Tugby (1965:2) suggests that placement of these three levels of analysis into a time/space framework would result in their modification respectively, into the objectives of identification, distribution, and processual analysis. Tugby's view of analytic structure guides this research.

Archaeological investigations of past processes naturally concern human behavior. Behavioral interpretations by archaeologists have often applied the assumption which has been well stated by Thompson and Longacre (1966:270):

> All of the material remains in an archaeological site are highly patterned or structured directly as a result of the ways in which the extinct society was organized and the patterned ways in which the people behaved.

Since this statement appeared, it has been repeatedly pointed out that making interpretations from archaeological patterns to past behavioral patterns is not as clear-cut as it may have seemed to these authors in 1966 (see Binford 1968:22; Krause and Thorne 1971:246; Schiffer and Rathje 1973:170; and Wilcox 1975:125). Schiffer (1972b:149) claims that the only way to provide a secure foundation for inferences between excavated remains (in archaeological context) and past human behaviors (in systemic context) is to develop testable and tested relationships. The nature of these relationships is seen differently by various authors. The relationships are conceived as "aspatial/atemporal laws" (Schiffer 1972a:156, 1975:837; Spaulding 1968:34), as "arguments of relevance" (Fritz 1972:138), or as "explanations of system interrelationships" (Tuggle et al. 1972:9). While these concepts differ in their explanatory procedures, all authors agree that archaeologists seeking explanatory level information cannot ignore the need to test propositions (of whatever sort) against the data when developing interpretations linking archaeological patterns to patterns of past cultural behavior. It is by proposing and conducting tests against the data that interpretations concerning cultural processes can be substantiated. This subject will be explored in chapter two.

Analysis of archaeological features has not received equal treatment with analysis of material remains until relatively recently (Marshall 1969:166). To some extent, this seems due to the complexity of feature analysis, especially when feature locations need to be correlated with the

distribution of material remains. The development of high-speed computers has made such analyses more efficient, and has promoted attempts to interpret intrasite spatial patterning. Spatial patterning is an important tool in the study of socioeconomic relations among prehistoric Northwest Coast peoples since ethnographic sources suggest strong status-related spatial considerations in socioeconomic organization. This discussion will be expanded in chapter three.

The procedures for correlating systemic and archaeological context have received much attention in the last few years, and it has become clear that various depositional processes have the potential for seriously altering the relationship between systemic and archaeological contexts (Fritz 1972:148; Schiffer 1972a:156). In particular, the locations where people conducted their day-to-day activities are not necessarily the same as where they disposed of the remains of these activities. This seems especially relevant for analyses concerning activities conducted within the confined space of their houses. Much of the analysis presented in chapter four will investigate the relationships between systemic and archaeological contexts.

Cultural Stratigraphy

Cultural stratigraphy is studied by recording matrices and the materials deposited therein by cultural activities and related noncultural events. Portions of Area B70 cultural stratigraphy have been described in numerous previous reports (Gleeson 1973a:8, 1973b:14–15, 1974a:8–9, 1974b:8, 1974c:18–28; Gleeson and Fisken 1977:16; Gleeson, Mauger, and Fisken 1976:16; Mauger 1974:8–10, 1975b:9–15, 1978a:10–13, 1980:17–19; Mauger and Daugherty 1974:5–6; Samuels 1980c:44–51), which will be incorporated in the following presentation. This provides a more detailed discussion of cultural stratigraphy than presented in part I. While the cultural stratigraphy in Area B70 of the Ozette site is complex, it can be simplified into four *in situ* cultural deposits separated by three clay deposits (see Figure 28).

Basal materials—Unit VIII

Basal deposits (Unit VIII) have been encountered in several places in the northeast portion of the excavation area. These consist of unconsolidated material, composed almost equally of gravel-, sand-, and silt/clay-sized particles (Samuels 1980c:46–51) (Figure 84). These deposits form a ledge, or bank, which drops sharply to the west and south, over which the initial clay slides flowed. Deep excavations in this area revealed a strong organic layer and natural drainage area with gravel, as well as slide clay, below House 5. The organic layers were as much as 30 cm thick and interfingered with the gravel, becoming more gleyed to the west. Both the gravel and organic layers contained cultural material, although artifact recovery was minimal. Broken rock, twigs, and wood/fiber fragments were abundant, along with a few shells. The pattern of the gravels and organics appears to be related to the landform of the basal deposits. The gravels probably were redeposited through slope wash from the nearby basal exposure. As one proceeds westward along a geologic test trench in the middle of the site, the gravels become much sparser and the organics interfinger with the clay component. The basal landform resulted in a general downward slope to the south and west for the Unit VI clay slides, and for the house floors set into and above these slide lobes.

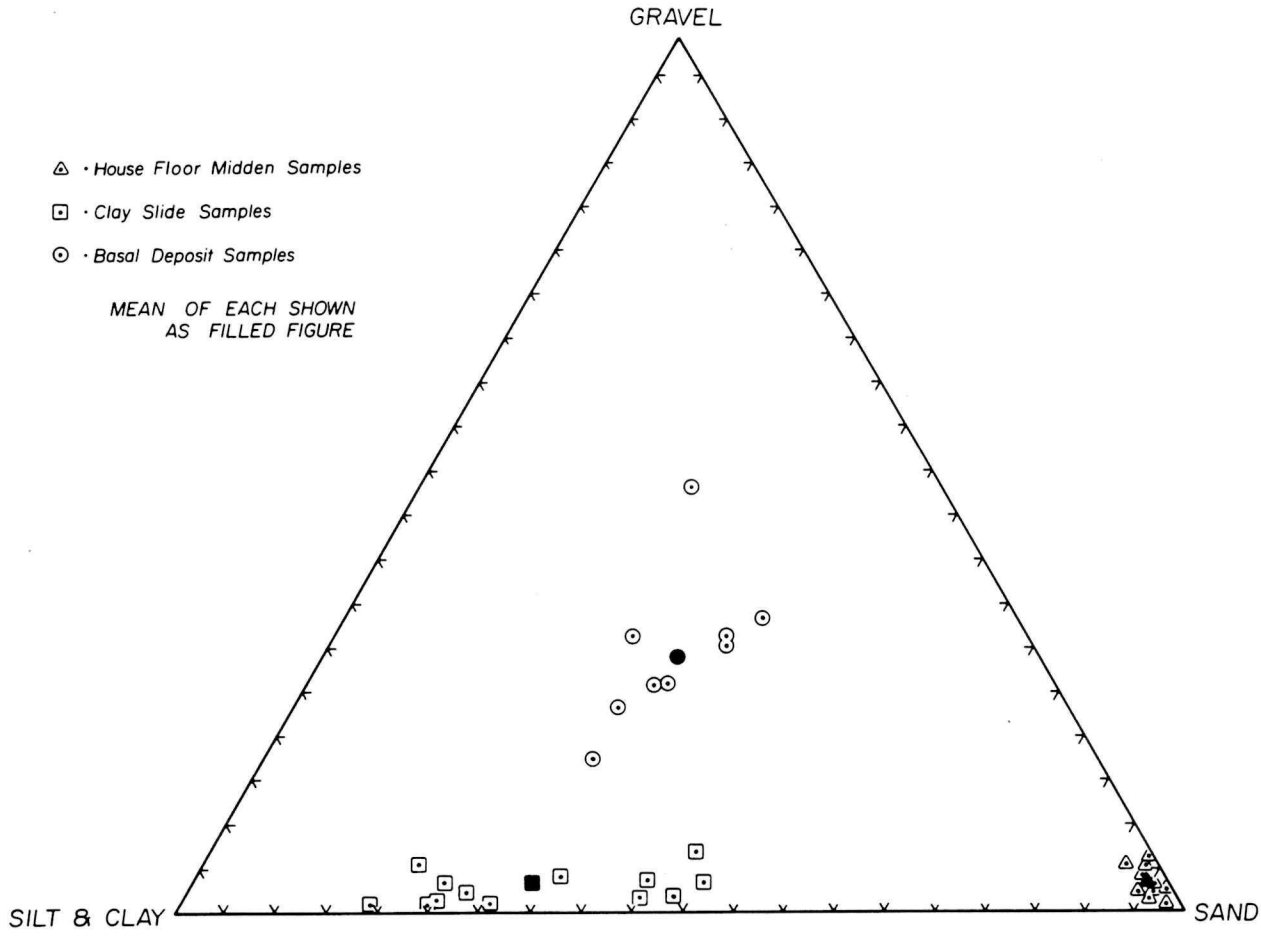


Figure 84. Sediment Ternary Diagram

Prehistoric level—Unit VII

The earliest known major cultural deposit in this portion of the site is known as Unit VII. It has been radiocarbon dated to about 800 B.P. on the basis of two dates, 790 ± 80 (WSU 1865) and 810 ± 70 (WSU 1777) (Mauger 1978a:10–13). Only one test excavation unit has reached this deposit; excellent preservation of organic materials was found.

Clay deposits—Unit VI

During the next 300 to 400 years, a series of both massive and redeposited clay slides (Unit VI) increased the ground surface height by up to two meters. Occasional cultural material, but no evidence of a major occupation, has been found throughout this unit in the B70 area. Midden deposits several hundred yards north along the beach suggest continuous occupation in that area, although the B70 area was probably marshy, and an undesirable location for houses during most of that time.

Protohistoric level—Unit V

The major focus of the B70 area excavation has been the Unit V occupation. The archaeological deposits consist of two types of remains. The lower levels are mostly *in situ* midden and structural remains deposited during the occupation (Unit V). The upper level is composed of the massive clay slide which covered this part of the village, and the cultural material disturbed by the action of this slide (Unit IV). The cultural material within Unit IV includes pieces of structures, other objects on or above the ground at the time of the slide, and some blocks of displaced midden. These items were moved by the force of the slide and redeposited within the lower portion of the clay cap. Analysis of spatial patterns utilizes the *in situ* material (Unit V), because this offers the opportunity to examine culturally produced spatial patterning without disturbance from the slide dislocation.

Unit V is a portion of a late protohistoric village, whose occupation began some 450 years ago (Mauger 1978a:4). Three stratigraphic levels within Unit V can be differentiated throughout most of this area:

- early—the initial construction level, including House 1, House 5, and the initial whalebone features. This level was designated as temp. VII (Mauger 1975b:12–15).
- middle—the construction of House 3 occurred in this level, as well as the deposition of clay slides and slurries. This level was designated as temp. VI (Mauger 1975b:12–15).
- late—the construction of House 2 and the reconstruction of whalebone features occurred within this level. This level was designated as temp. V (Mauger 1975b:12–15).

It is possible to stratigraphically depict all the cultural features in Area B70 with three maps (Figures 85, 86, and 87) that reflect these three depositional levels within Unit V.

Early Unit V (temp. VII)

The first major Unit V activity appears to have occurred on the lower (western) terrace. House 1 was constructed on a relatively level platform created by a cut and fill operation (Gleeson 1974c:26–27; Gleeson, Mauger, and Fisken 1976:Figure 3) (see Figure 57). About 30 m^3 of material, mostly from a clay slide toe, were removed from the northeast corner of the House 1 area and were redeposited along the west and south portions of this area. At the same time, or shortly after, a drainage trench lined with whalebones was begun just south of House 1 (Gleeson 1974a:7; Gleeson 1974c:4–5) (Figure 85). North of House 1, a whalebone retaining wall has been partially excavated under the south wall of House 3 (Gleeson, Mauger, and Fisken 1976:22). Another whalebone retaining wall was implanted in the bank edge just east of House 1 (Gleeson, Mauger, and Fisken 1976:15). This retaining wall was built into the toe of two Unit VI slide lobes. The northern slide lobe had been deposited first, and the southern slide lobe partially overlapped the northern one. This retaining wall was set into both slide lobes, but the construction pattern differs between the two lobes. In the northern lobe, a portion of the toe of the slide was cut away and whalebones were placed into the cut. They were held in place with stakes and the interlocking of the bones, as well as a large diameter log, and then partially covered with fill clay. In the southern lobe, the whalebones were driven (pressed?) directly into soft clay. No fill clay or other signs of refilling disturbance was found. This suggests that the northern slide was already solidified in place when construction began, while the southern slide was a recent addition and still soft when the whalebones were positioned. The large number of whalebones embedded in the southern slide lobe may well have been placed by the occupants of House 1 to prevent any further westward movement of this wet clay, which threatened the east wall of the structure.

A distinctive pattern of whalebones was created in portions of the south slide lobe by this construction activity. First, vertebrae were placed into the ground with their vertebral plates flat

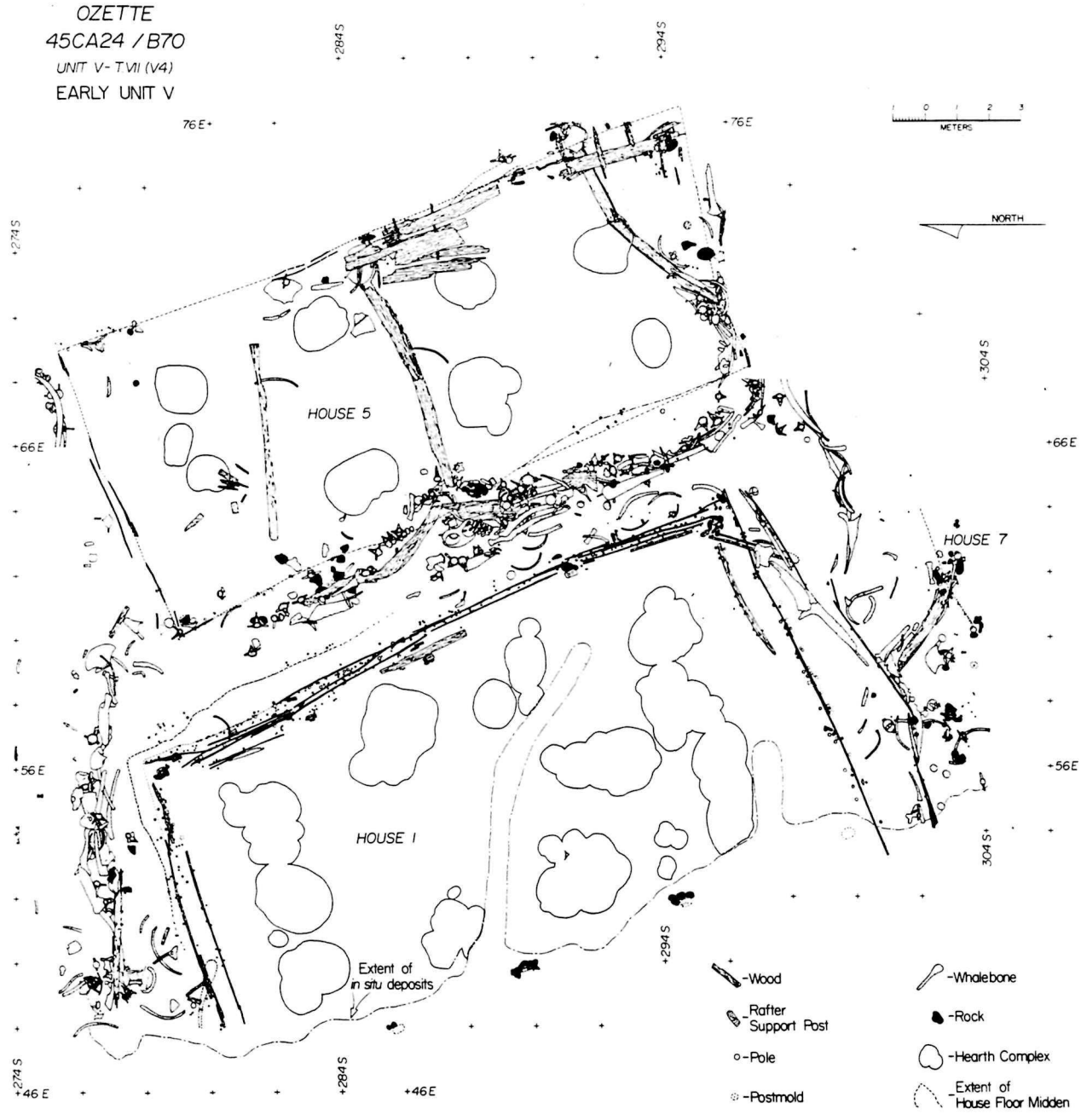


Figure 85. Early Unit V feature map.

on the ground surface. This provided the most stable base, since the orientation allowed the greatest amount of bone surface area to contact the wet clay. The vertebrae were positioned so that their processes abutted, often interlocking, maximizing lateral stability. Long whalebones, mostly ribs and mandibles, were placed directly above this row of vertebrae, and these were interlocked with the vertebrae. The vertebrae provided stability and support, so that the long bones would not sink into the wet clay, while the long bones provided lateral strength—in effect, tying together the vertebrae so sections of the clay lobe could not move independently. This stabilization of the southern slide lobe not only protected the east wall of House 1, but also produced a relatively level platform, providing a space large enough for placement of House 5.

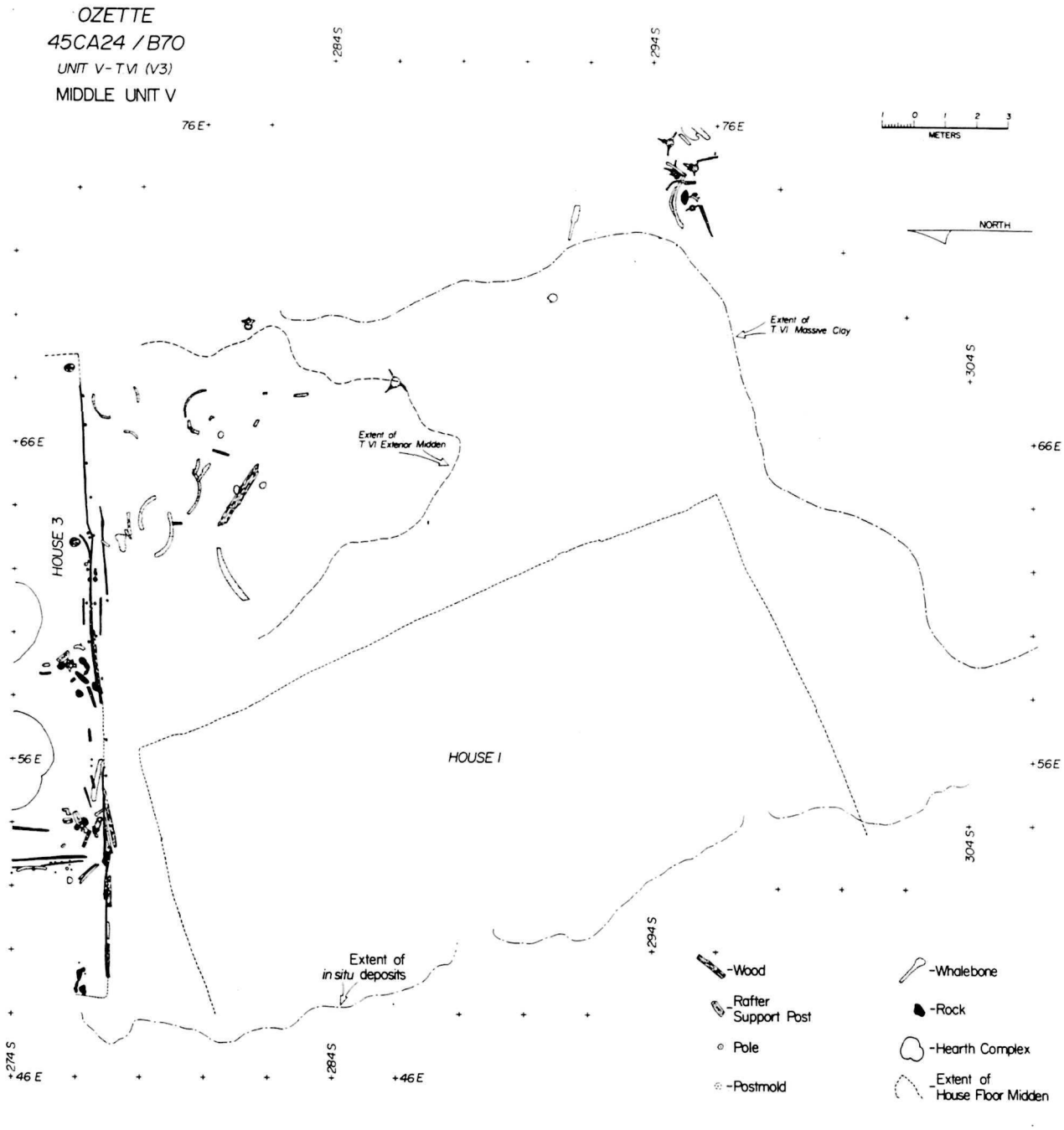


Figure 86. Middle Unit V feature map.

Shortly after this retaining wall construction, House 5 was built on this platform—about two meters due east of House 1. House 5 was occupied for a relatively short time and then abandoned (Gleeson, Mauger, and Fisken 1976:20). One cause for abandonment seems to have been the wet conditions of this area. Attempts were made to divert the runoff away from the house floor, in the form of covered trenches running through and around the house. Apparently, these eventually filled with sediment (Mauger 1980:19). After several episodes of clay slides which produced slurries through parts of the floor, the house was abandoned and dismantled.

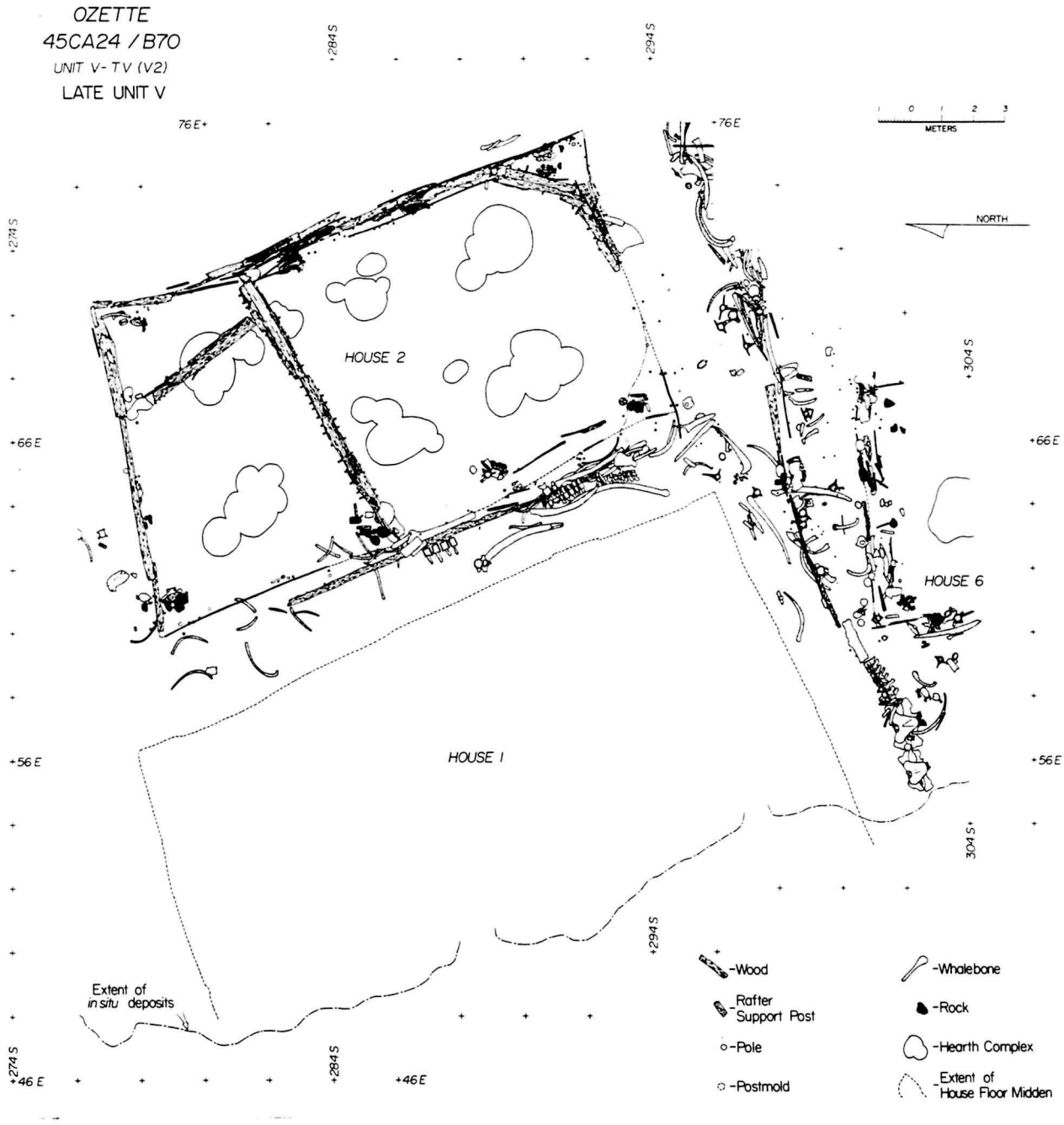


Figure 87. Late Unit V feature map.

Middle Unit V (temp. VI)

The next major event was a relatively large slide (temp. VI) which covered much of the southern portion of the B70 area (Mauger 1980:17–19) (Figure 86). This forms the best area-wide stratigraphic marker within the Unit V *in situ* deposit. Although the main mass of the slide was confined to the southern portion, slide clay redeposited by the action of slope wash has been traced throughout the excavation area. House 1 was still in use at this time. The massive clay slide was deposited south of this structure and did no apparent damage, although slope wash abutted the south and

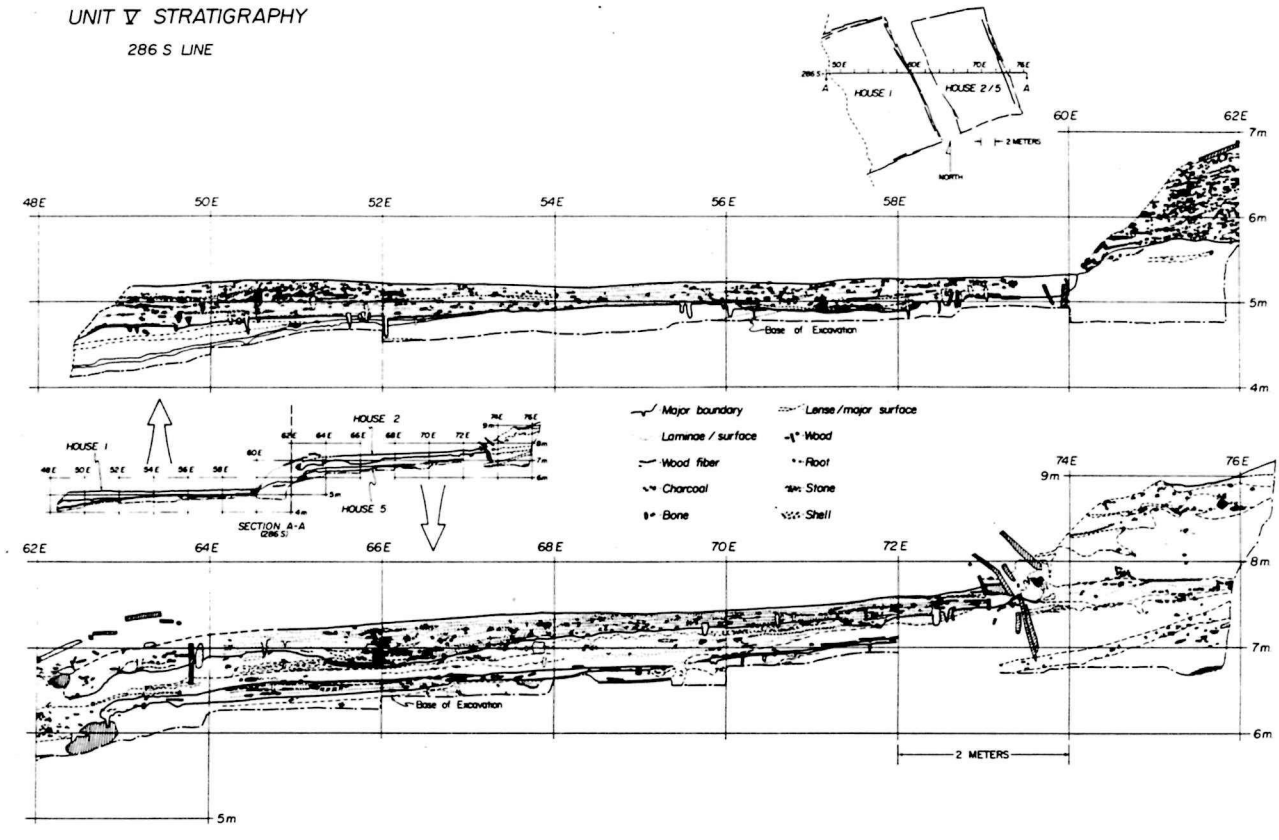


Figure 88. Area B70 stratigraphy profile cross-section.

east walls. House 3 was constructed at about this time on top of exterior midden deposits from House 1 and 5 occupations.

Late Unit V (temp. V)

The reconstruction of the whalebone retaining wall east of House 1 (above the early Unit V wall and middle Unit V clay deposits) represents the beginning of the third phase of Unit V cultural activity (Figure 87). Again whalebones were driven into the clay (temp. VI clay, in this case) however, the construction methods differ from the early (temp. VII) Unit V wall. Several groups of vertebrae were utilized to brace a large log. This log—10.5 m long—formed the main stabilization for the bank. South of this log, long whalebones extended the retaining feature to the south. House 2 construction soon followed, largely superimposed over the area previously covered by House 5.

The thickness of the deposit between the House 2 and House 5 floors decreased from west to east, due to the nature of the basal deposits (Unit VIII). In the east, about 10 cm separated the bottom of the House 2 floor from the House 5 deposit. In the west, over 50 cm separated the two floor middens. Due to this superimposition of House 2, portions of the east wall area of House 5 were disturbed by the construction of House 2 (Figure 88).

Houses 1, 2, and 5 were oriented with their long axes parallel to the beach. House 3 and House 4 were oriented with their long axes at right angles to the beach (see Figure 18). House 2 was built on the surface of the stabilized slide (middle Unit V) in the south, and above exterior

midden (associated with early House 3 occupation) in the north. At about the same time, the east end of the large southern drainage trench was rerouted to the north. This was necessitated by the massive clay deposit (middle Unit V) which covered the eastern portion of the earlier trench.

The combination of the construction of House 3 to the north, and the rerouting of the trench to the south, resulted in a relatively limited space in which to construct House 2. While Houses 1, 3, and 5 all contained five sets of rafter-support posts, House 2 was built with only four sets. The lack of space is a probable reason this structure was shorter than the other three houses. Spatial constraints also appear to have caused the construction of an angled north wall for House 2, as the south wall of House 3 was not perpendicular to the long axis of House 2, and available space was limited.

Houses 1 and 2 exhibit evidence of repair and rebuilding of structural elements through their occupation life (see part II). House 1 use spans the entire Unit V period, and it was in use at the time of the slide. Interpretation of the microstratigraphy shows that House 2 was constructed about halfway through the Unit V time span, and also was in use when destroyed by the Unit IV slide. House 3, built shortly before House 2, was occupied for a considerable period of time, but seems to have been at least partially abandoned at the time of the slide. The development of a relatively thick exterior midden above the east part of the house floor midden shows that portion of House 3 to have been abandoned prior to the Unit IV slide. While no exterior midden has been found covering the west part of the House 3 floor, the rafter-support posts were cut off just above the floor surface, suggesting that the entire house might have been abandoned prior to the Unit IV slide event. The length of occupation for House 5 seems to have been much shorter than these others, and no evidence of repair of this structure was found. However, because it was abandoned and dismantled any evidence of repair might have been removed. These differences in relative occupation length and house histories are taken into consideration in this analysis.

Dendrochronological studies have been used in an attempt to clarify the absolute dating of these events. Two preliminary dates have been obtained from House 1 wall plank fragments, 1613 A.D. and 1719 A.D. (Jozsa et al. 1982:41). In both samples the outer rings and bark were missing, therefore neither provided a cutting date. However, this does limit the occurrence of the Unit IV slide to sometime after 1719 A.D. A radiocarbon date of 440 $\pm$ 90 B.P. (WSU 1778) has been obtained from an early House 1 hearth area, providing an approximate early limit for this occupation level (Mauger 1978a:4). The deterioration and repair sequence in the House 1 and 2 structural members suggest that several generations of occupants resided in these houses. I therefore speculate that House 1 was occupied for about 100 years. Given the stratigraphic relationships found among floor and exterior middens, this suggests that House 2 was occupied for about 50 years and House 5 for about 10 to 20 years.

Clay slide—Unit IV

The Unit IV slide capped the area with up to three meters of massive clay deposit (see Figure 14A) snapping rafter and wall-support posts, collapsing the roofs, and crushing the walls of the standing houses. The lowest house on this portion of the hillside was House 1, and many of the structural remains from all affected houses came to rest there (see Figure 29); other structural remains may have been pushed off the bank onto the beach.

The clay cap contributed greatly to the preservation of organics—pieces of the structures, material in and around the structures at the time of the slide, and to the continued preservation of the midden deposits. The location of many of the objects and structural remains above ground at the time of the slide was disturbed by slide activity. Lower portions of the structures set into the

ground surface, and most of the midden deposits, were not disturbed by the slide, though in some cases sizable blocks of midden were plucked, rolled, and redeposited within the slide.

Historic levels—Unit I through Unit III

Subsequent cultural occupation in Area B70 occurred on top of the stabilized slide material in early historic times (Unit III). A small portion of the east wall of a longhouse structure, and some exterior midden deposits, have been excavated from this level.

Another major slide (Unit II) covered much of the southern portion of the excavated area around 1850. The last use of Ozette as a village (represented by Unit I) ended about 1910, with a gradual abandonment in which the occupants moved to nearby Neah Bay. Since that time, the area has been used only occasionally as a hunting and fishing camp.

Protohistoric Midden

Two major types of midden are found in Unit V—floor and exterior deposits. Five major feature types have been defined within these midden deposits:

- **Longhouse structural features** are the lower remnants of walls (Figure 89A), rafter-support posts, bench-support stakes, and bench-back planks. These features were found and identified in (and around) the floor-midden deposits. A detailed discussion of the structural features can be found in part II.
- **Hearth complexes** are features found in floor midden, composed of from two to 11 discernible, superimposed, hearth areas. Composition included ash, fire-cracked rock, charcoal, partially burnt and unburned wood, bone, shell, and other midden constituents (Figure 90A). Some pits were refilled with a nodular clay. Many had layers of small pebbles at their base (Figure 90B). Some had a lens composed of clay deposited in a liquid state capping the hearth. In size, hearth complexes ranged from 50 cm to over two meters in diameter. Occasional single hearth areas, but not the multiple area hearth complexes, were found in exterior midden.
- **Pebble layers** are areas of sorted, rounded pebbles, three to five deep, with large areal extent (often over six square meters) (Figure 89B). These areas were usually composed of pebbles two to six cm in diameter, and occurred in both floor and exterior midden. Many may have been used as drain fields, aiding surface water flow.
- **Water-diversion features** are drainage trenches within both floor and exterior midden deposits. Because of the wet conditions throughout much of the year, ground water and roof runoff were channeled around and under the house floors to prevent water from running uncontrolled through the structures. In floor midden, plank-covered trenches diverted and channeled the water flow (Figures 91A and 91B). In exterior deposits, open trenches with plank and whalebone retaining walls formed these channels (see Figure 66).
- **Bank-stabilization features** are found in and under exterior midden deposits. House 1 was constructed at a lower level than Houses 2/5 and 3. One to two meters of clay and midden bank were exposed near the north and east walls of House 1. Much of this bank was covered by linked whalebone and log features (see Figures 67 and 91C), which stabilized the bank edge, preventing downslope movement of materials into the House 1 walls. This type of feature was found only in exterior midden.

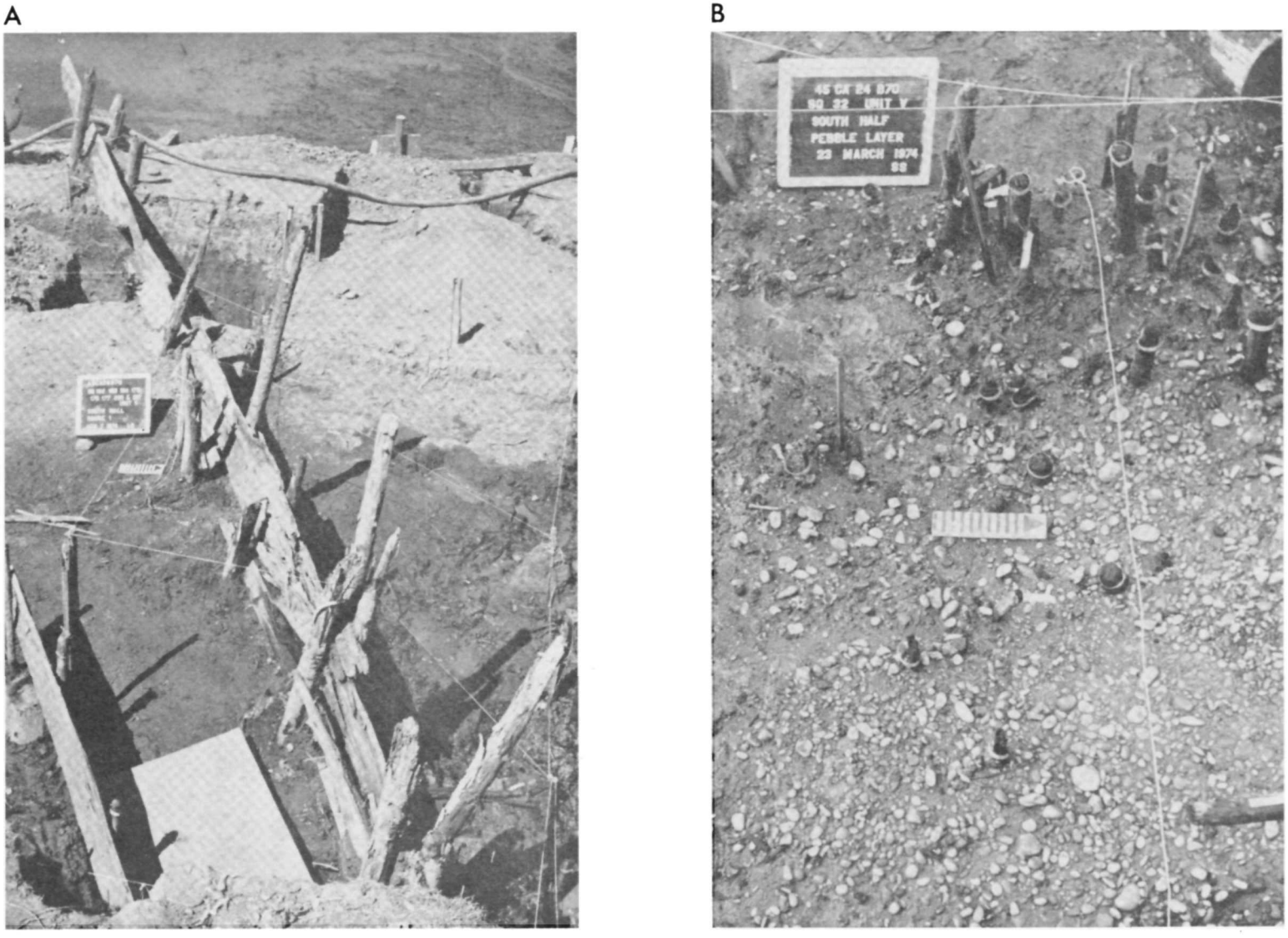


Figure 89. Photographs of House 1: A - south wall; B - pebble layer.

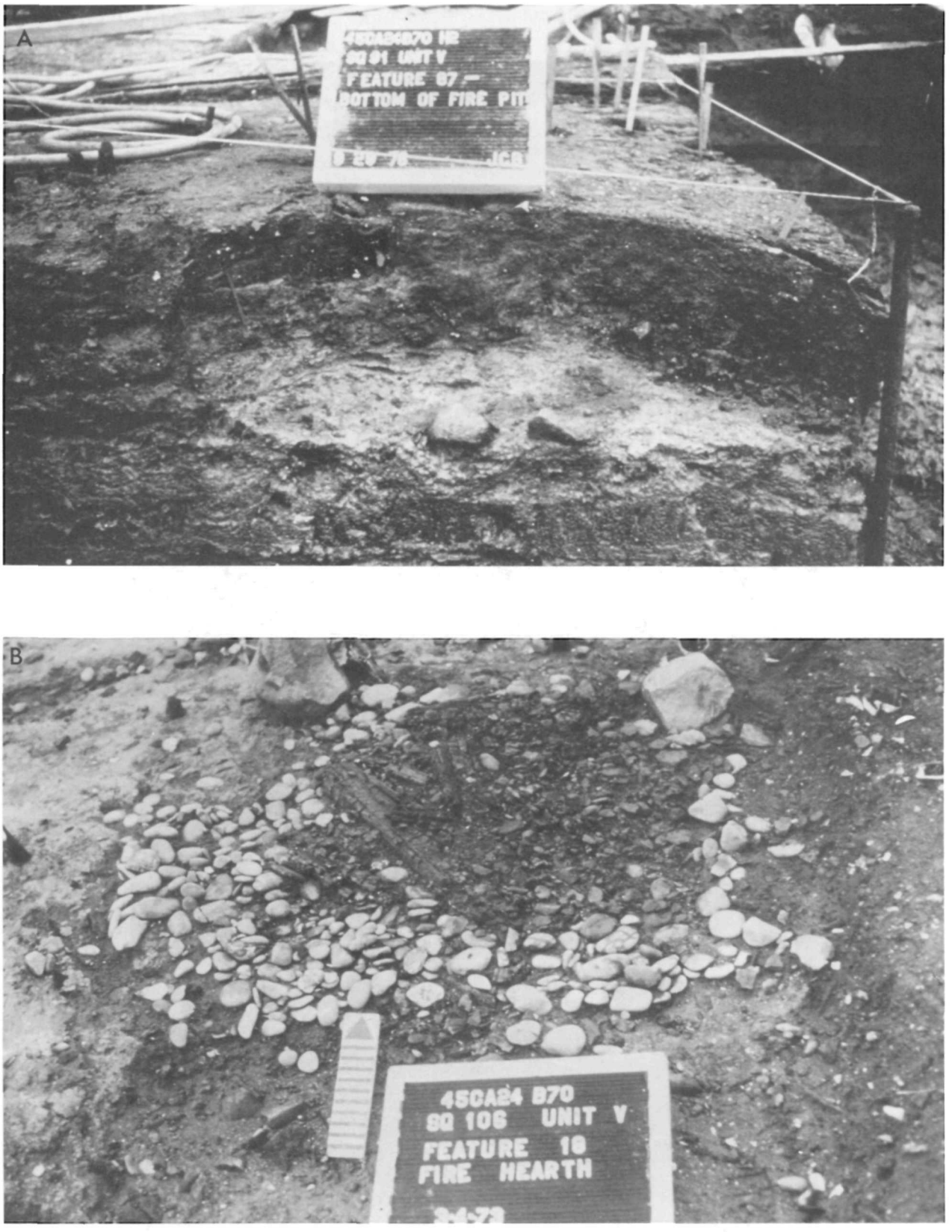


Figure 90. Photographs of hearth complexes: A - from House 2 with hearth fill excavated, showing ash at base; B - from House 1 showing pebble lining and charred wood.

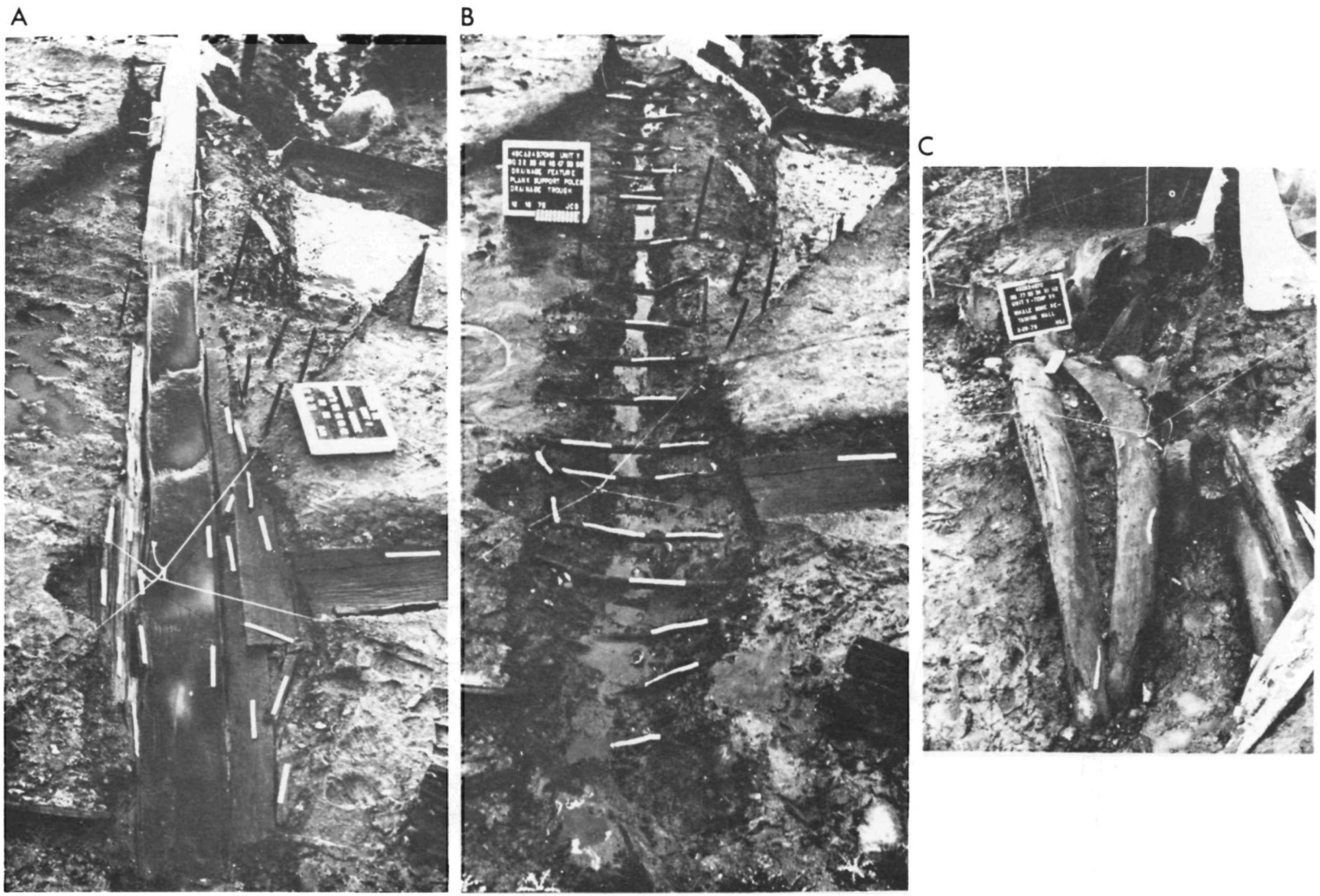


Figure 91. House 2 mid-floor drainage trench facing west: A - with plank cover; B - with cover removed. C - portion of whalebone retaining wall between Houses 1 and 2.

The sediment composition of interior and exterior middens was similar (Lyon 1976:4). Both were composed of from 90% to 97% sand-sized particles (Figure 84), with about equal parts (3% to 5%) of gravel- and silt/clay-sized particles (Samuels 1978:4; Mauger 1980:56–57). This particle size range corresponds closely to the size range for the beach sand located just west of the houses, which is the probable source for much of the midden sediment.

Although the matrices are similar, there are consistently observable differences in the element composition between the two types of midden (Gleeson, M. 1973:30; Gleeson 1974c:19–22; Mauger and Daugherty 1974:2). Quantitative comparisons are not available, but from field observation it is the consensus of excavators and stratigraphers that exterior deposits contained larger items, often deposited in thick lenses of highly similar debris, especially shell concentrations (Figure 92). These appeared to be dumps. Little other material was found within these lenses. Few postmolds or hearths were found in exterior deposits, and there was little evidence of laminations. Often it was possible to discern individual surfaces within this midden, but usually by reference to the position of items upon a surface rather than by evidence of hardened midden. These exterior midden characteristics are similar to those labelled secondary refuse by Schiffer (1972a:162).

In contrast, floor midden contained massive hearth complexes, many thousands of postmolds and structural remains, and large areas of highly laminated midden composed of relatively small items which were generally not concentrated into large lenses of similar debris (Figure 93). An argument generated and tested during this research involves the determination of deposition type for the floor midden. While primary deposition usually is assumed for occupation floors, this analysis has been concerned with tests of this assumption.

Microstratigraphy showed that floor midden (especially in the center of each floor) was composed of a number of thin (< 1 cm), hard, parallel laminae. The process of compaction which formed these laminae is not clearly understood. They may result from a combination of oils (from processing activities) soaking into the floor, and from trampling (from activities within the structure) (Gleeson 1974c:19–22). Whatever the processes involved, these laminae were created at the surface of the floor midden, and subsequently covered by further deposition. Stratigraphic compilations (see Figure 88) tracing these laminae show that buildup of the midden was consistent in all parts of the house, though the total depth (and thus the deposition rate) varied. This information allowed temporal division of the midden, as will be presented in chapter four. The following chapter discusses theoretical aspects of this research and describes methods used in the excavation and analysis.

Figure 92. Photograph of stratigraphy in Unit V exterior midden, just north of House 1.

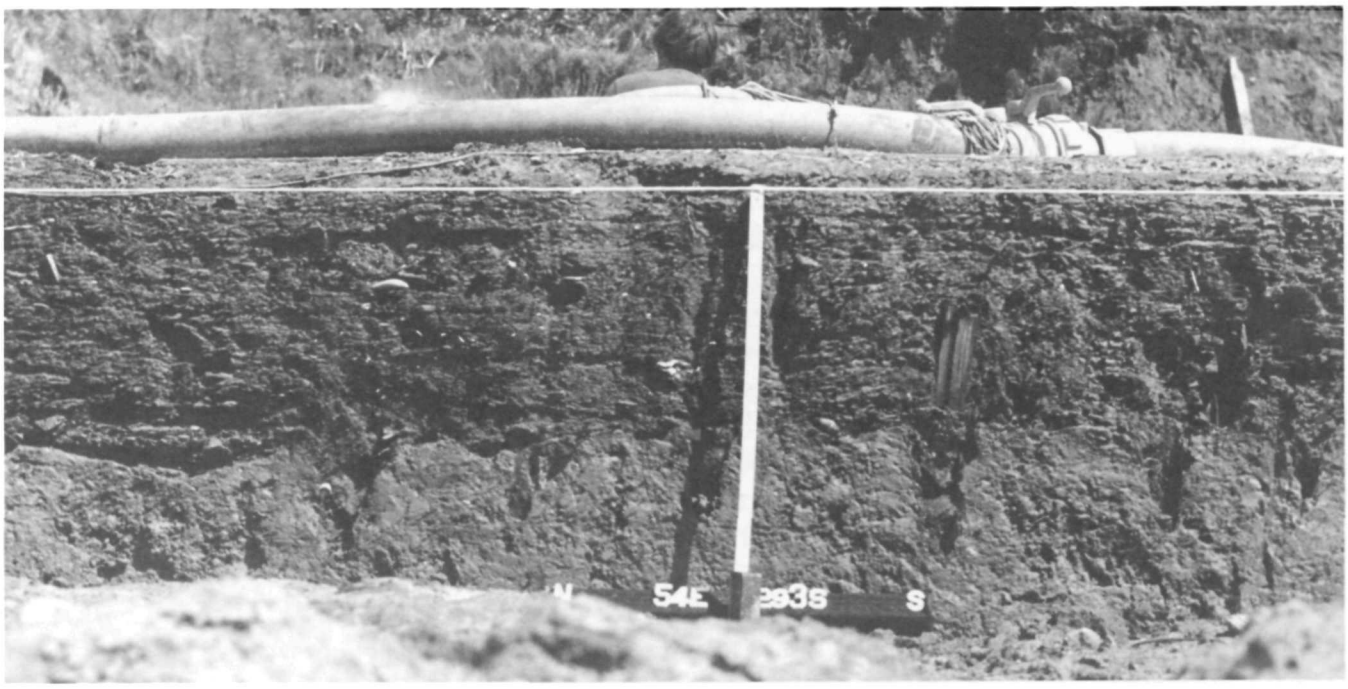


Figure 93. Photograph of stratigraphy in House 1 floor midden.

CHAPTER 2

SPATIAL THEORY AND RESEARCH METHODS

Theoretical Considerations

Spaulding (1971:24) has defined the three dimensions of archaeological research as those of form, space, and time. Spatial analyses have been defined as "the retrieval of information from archaeological spatial relationships and the study of spatial consequences of former hominid activity patterns" (Clarke 1977:3). There are two aspects to this definition of spatial analysis: retrieval of information; and interpretation of spatial consequences of human behavior. Each pose different methodological problems for the archaeologist. Retrieval of locational information is relatively straightforward. The location of material items and features (including strata) are recorded in a way that permits examination of spatial relationships among the various classes of materials from excavated deposits. When Area B70 excavations began, two levels of provenience systems were in general use. These were: (1) provenience based on location measured in two- or three-dimensional space; and (2) provenience based on location by survey or excavation block, natural or cultural strata, location within a feature, and so forth. While measured location provided more precise spatial information, generally it was more time consuming to obtain this level of information than it was to record quadrat location. At Ozette, both levels of provenience recording were used, as will be discussed below. Whichever level of provenience was recorded, the objective was to obtain pertinent information from the archaeological record preserved in the ground and tie it to the item or feature recovered.

Operationalizing the "spatial consequences of former hominid activity patterns" was less obvious. The archaeological record is "something created in the past by means of which we observe something in the past" (Fritz 1972:137). This observation is indirect, since both the human behavior and deposition of material occurred in the past. Because of this, relating past human behavior to the present archaeological record involves overcoming at least two distinct concerns. The first involves linking specific past human behaviors to the past depositional record. The second involves the relationship between that past depositional record and its excavated archaeological traces. This has been of less concern at Ozette than at many sites, since virtually all types of material deposited in the past remained preserved in the present archaeological record. This permits analysis to focus on relationships between past behavioral and depositional events. As Fritz has pointed out, archaeologists have given considerable attention to the effect of postdepositional differential preservation (the second concern), but less to "those which produce the initial deposition of these objects and features" (Fritz 1972:148).

The processes which may have disturbed (or transformed) the record of past human activities (forming the present archaeological record) have been divided into two groups by Schiffer and Rathje (1973:170). These are known as noncultural and cultural transformations. Noncultural transformations (n-transforms) are alterations to the nature and/or locations of archaeological material due to natural processes. Examples include destruction of organic materials through microbial activity or soil formation processes; or alteration in location of materials through downslope movement, freeze/thaw cycles, or rodent burrowing. These processes generally influence the relationship between the past deposit and the present deposit.

In all floor middens, relatively minor evidence of natural disturbances was seen. Recent bank erosion had disturbed the west walls of Houses 1 and 3 at the time of initial excavation in 1970.

Small sections of all floors were disturbed by slumping during the excavation process. These areas are easily recognized in the stratigraphy profiles.

Often, a major n-transform is differential preservation. At Ozette, only soft animal tissues were not well preserved throughout the midden. Differences in the degree of organic preservation were noted, but generally were limited to differential deterioration of the surface finish on materials, rather than complete disintegration of wooden or fiber items. Therefore, in this study the effects of differential preservation should not result in modification of spatial patterns, and the small areas where slumping occurred have been excluded.

Cultural transformations (c-transforms) are more difficult to identify. These are defined as disturbance processes introduced by the occupants, which have modified distribution patterns for elements in the archaeological context. Storage, housekeeping, and other discard practices are prime examples of cultural disturbance processes. However, not all investigators agree with this characterization. Binford (1981:195–208) claimed that Schiffer's characterization of cultural disturbance processes was unrealistic. In Binford's view, only n-transforms are "distortions" to the material manifestation of a cultural system. C-transforms are seen as a part of the total cultural system, and would be conceived of as distorting only if they destroyed some particular aspect of patterned association in which a researcher had an *a priori* research interest. In this view, our inferences about the archaeological record may be wrong "not because the archaeological record is a distortion of the past, but because we do not accurately understand the relationship between statics and dynamics [occurring in the past]" (Binford 1981:200). Certainly such cultural disturbance processes are a part of the cultural pattern under investigation. However, to be able to undertake a comprehensive investigation of spatial patterning, archaeologists should attempt to isolate these processes from other cultural activities. At Ozette, a major research interest involved probing spatial aspects of the socioeconomic organization, for example the location of food processing and tool manufacture within the houses. In order to get at this level of information the effects of cultural disturbance processes could not be ignored. Since the relationship between these past socioeconomic activities and the resulting pattern of physical remains is of great interest, investigation of cultural disturbance processes forms an aspect of this study.

Gifford (1980:97) has defined three categories of cultural disturbance processes: (1) those contributing to deposition of materials; (2) those determining spatial patterning once the materials have been deposited; and (3) those human activities which interact with non-cultural processes to produce differential preservation of materials. The first two have the potential for affecting the nature or location of items in these floor middens and are being investigated. The third process has been discussed above.

Schiffer (1972a:161) proposed three types of refuse: de facto, secondary, and primary. In the Ozette excavations, this classification has been expanded to include all cultural deposits, not just refuse. These three classes of deposit have been defined in Area B70 at Ozette as follows:

- **De facto deposits** are materials reaching archaeological context without discard activities. At Ozette, the lower portions of the house walls and support posts were a de facto deposit. The location of these elements was not altered by slide action and, therefore they have an important role in defining past activity locations. Other Unit IV cultural material, moved by the force of the slide, also reached its depositional location without discard activities, but in this case the disruptive action of the slide lowered its potential for providing spatial information.
- **Secondary deposits** are materials deposited at a location other than the site of the pre-discard activity. Exterior midden exhibited characteristics of a secondary deposit. At Ozette, the utility of spatial analysis concerning activity location was limited by the lack of any definite relationship between the past discard location and the site of the related pre-discard activity.

- **Primary deposits** are materials (or non-material elements such as postmolds) deposited at the location of a related socioeconomic activity. Some elements in the floor midden clearly were primary deposits, e.g., features (such as hearth complexes), structural remains, or postmolds. These items mark the location of an associated activity, but the movable material items occurring as a result of these activities may have been affected by cultural disturbance processes, such as storage or housekeeping. At Ozette, the distinction between primary and de facto deposits is based on the nature of the activity. Primary deposits involve discard while de facto deposits do not.

How are cultural disturbance processes to be recognized? Since the activity, the disturbance, and the deposition all occurred in the past, this poses a difficult question. In attempting to resolve this problem, it is necessary to examine how any link can be made between past human behavior and a resulting past cultural deposit. Fritz (1972:135–157) suggests three basic steps to follow in order to create "arguments of relevance" in forging such links.

1. Construct a plausible linking argument(s) in which
   a. the relevant characteristics of the past sociocultural phenomena are explicitly defined;
   b. the final characteristics of the observed archaeological phenomena are described; and
   c. statements linking the two (a and b) are presented.
2. Construct and conduct tests of the argument, using relevant data. These should indicate how and why certain human behavior has been manifest in the archaeological record. These should contain propositions with general relevance, such as law-like propositions, which are not limited to a specific time or place. The general propositions also need to be shown applicable to the specific site situation. The credibility of the arguments can increase with the quantity, variety, and precision of the related test data. Performance of the tests always requires the observation of new data not utilized in the creation of the argument, although the new data may be derived from the same source as were the arguments.
3. Evaluate the outcome of the tests. The definitions, linking arguments, data, and test results together form a system for describing the past.

The objective of these procedures is to describe and interpret regularities, or patterns, discovered in the spatial distribution of midden elements. The concept of "pattern" is important; Wilcox (1975:126) defines patterns as "the statistically regular outcome of 'operations' on classes of propositions.... Patterns are not defined on [the basis of] individual ... events. Their domains are sets of similar ... events." The concept of recurrent actions conducted over time is inherent in this definition of "pattern," and thus a time parameter needs to be considered. Ordinary, repeated activities and actions are the focus of investigation, not the unique or unusual events.

Most of the Ozette analyses are directed toward investigating socioeconomic relationships, which include day-to-day subsistence activities, mostly concerned with the procurement, processing, and consumption of foodstuffs. This study searches the data for patterned relationships among midden elements that may reflect recurrent past cultural behavior.

The following analytic sequence has been used in this study:

- Compile archaeological field records into maps which depict the floor-midden features, major structural support locations, and midden extent.
- Obtain ethnographic house construction and use information, and propose a model of spatial partitioning within the houses based on this data.
- Examine the archaeological feature maps and partition the archaeological floor space. Temporal as well as spatial divisions are made in the floor middens representing extended occupation. Distribution maps have been created and statistical evaluations produced for cultural elements within each floor.
- Propose and test interpretations about the nature of cultural disturbance processes operating within these houses in the past. This evaluation of spatial patterns can form a baseline

against which more specific questions involving differences in resource utilization and social ranking can be examined.

Results of investigating cultural disturbance processes have direct relevance to other ongoing research which more directly approaches aspects of Ozette economic life. In turn, results from these economic studies provide data for tests of cultural disturbance processes. This spatial study develops a framework for coordination of the diverse economic studies, gaining more information about the material remains than would be obtained by any single investigation.

Detailed evaluation of the artifacts themselves certainly can provide other important socioeconomic information. Schiffer's concept of activity chains (1975:103–119) would form a useful focus for such analyses. As Schiffer points out, it is activities–not artifacts themselves–that were differentially located in space (Schiffer 1975:116). In order to interpret past human behavioral patterns, artifacts need to be examined with the goal of reconstructing probable activity chains (such as production sequences). Relevant information concerning artifact function and condition still needs to be obtained in order to conduct this level of analysis. The field artifact cataloguing system employed at Ozette recorded much information about each object, but it was designed to be a descriptive, not a functional, classification. Metric attributes, breakage patterns, stylistic classifications, and other detailed information should be added to the field catalog in order to analyze the cultural activities represented by these objects. With over 13,000 artifacts representing over 200 descriptive classes and subclasses recovered from the three house floor middens alone, this will be a major task. The Ozette descriptive (field) artifact typology (Gleeson, Flynn, and Mauger 1980) is presented as Appendix A in the Phase XIII interim final report (Gleeson 1980a).

Excavation Techniques

Two major types of provenience-recording techniques have been used for the midden elements: measured and quadrat location.

- For measured location, three-dimensional point provenience (to the centimeter) has been recorded for *in situ* artifacts, vertical structural elements, postmolds, features, and special samples.
- For quadrat location, excavation unit/cultural level (square/level) provenience has been used for non-artifact debris material, such as shell, bone, wood chips, and fire-cracked rock.

The large quantity of preserved, highly crafted items recovered, combined with realities of excavation time and finances, required these distinctions in provenience recording. At Ozette, **artifacts** were defined as material objects which exhibited some major cultural modification in shape or form. **Non-artifact** material did not exhibit a major modification from its natural state. Detritus resulting from manufacturing processes—such as wood chips and bone fragments—also were not considered to be artifacts. Additional detritus resulted from food processing or consumption activities, and this was not considered artifactual either. These distinctions were necessitated by the limited time available combined with the large quantities of preserved materials.

The two provenience systems influenced, but did not prevent, the use of both types of data for spatial analysis. Further distinctions in the analysis between material collected with these two provenience systems will be discussed in context with each analysis presented in chapter four.

Computer Graphics Applications

The main computer system at W.S.U. (at the time of analysis, an AMDAHL 470-V8 mainframe system) has been used for data storage, manipulation, statistical testing, and graphic display. Data storage involves the creation of coding systems, translation of field records onto computer code sheets, and the entry into disk storage computer files. Separate files exist for each of the midden elements; these can be combined or contrasted to meet the requirements of individual research.

Data manipulation involves the reorganization of files, addition of spatial/temporal partitioning information, conversion of raw counts to density of elements, and other data conversions. The statistics used in this research are presented in various forms. Absolute value ranges within classes of variables are displayed using histograms, cumulative frequency graphs, and are presented in tables. Relative value relationships are displayed using ternary diagrams, percentage tables, and pie charts. Tests of nonrandomness are performed using analysis of variance. These all will be described more fully in the context of each analysis.

Two types of graphic display have been used to represent spatial distributions.

- **OZMAP**. This system, developed by the Ozette project, plots the actual point location of each item. Consequently, it can be used only for midden elements located with measured provenience. The OZMAP plots portray the distribution of items in the midden with a scatter of symbols, with each symbol representing the center point of one item. Patterns in these distributions can be evaluated visually, as well as quantified within the partitions.
- **SYMAP**. This system (short for SYnagraphic MAPping system) is produced and distributed by the Laboratory for Computer Graphics and Spatial Analysis, Graduate School of Design, Harvard University (Dougnenik and Sheehan 1975:i). The subprogram used is an isoplethic mapping system. This means that rather than displaying the location for individual items, it maps quantities of items from areas, presents the center of the area as the spatial location of the quantity, and interpolates between these spatial locations (Robinson and Sale 1969:156). It is used in this study as a display and interpretive tool. The SYMAP plots provide visual representations of the spatial distribution of various data classes within the floor middens. Information collected using both provenience recording systems can be displayed with SYMAP, making spatial comparisons possible among all midden elements. These plots become a powerful tool in identification and interpretation of patterns, especially when used in association with other information such as hearth and structural feature locations. The methods used in creation of these distribution maps have been standardized so that visual interpretation will be based on the same criteria from map to map.

The SYMAP computer program was developed by Howard T. Fisher during the 1960s for use in geographic research. Archaeologists soon became attracted to this program due to its potential for displaying distributional information (Cowgill 1967:55; Dunnell and Lewarch 1974:25), and realized that use of SYMAP could result in a standardization of mapping procedures, which in turn would contribute to the effectiveness of archaeological research (Redman and Watson 1970:289). SYMAP has been used in a number of archaeological mapping projects both for surface (Dohm 1981; Dunnell and Lewarch 1974; Jermann 1978; Redman and Watson 1970; Whitlam 1975, 1980) and subsurface (Howes 1982; Redman and Watson 1970; Whitlam 1975) data distributions. Most authors agree that SYMAP is a rapid and accurate mapping technique, when used with care (Aldrich 1979:146; Arnold 1982:204).

Care must be taken in map creation because several factors control the appearance of isoplethic maps. Since visual interpretation of the maps is desirable, it is important to examine the cartographic as well as archaeological literature concerning construction of isoplethic maps.

Cartographers have long realized that any isoplethic map is only one of an infinite series of possible maps which could be constructed from the same data by varying decisions made during

map creation (Armstrong 1969:382; Jenks 1963:23). A map of distributional data is often presented as **the** map of the data, without sufficient regard for the ability of a cartographer to alter the appearance and interpretation of the map by choices made during map creation. One of the major advantages in using a computer program to "draw" distribution maps is the necessity to make explicit decisions concerning map creation including grid size, scale, and contour interval, which are decisions usually left implicit in hand-drawn maps (Redman and Watson 1970:289), but which have a powerful effect on the appearance, and therefore the interpretation of the maps (Armstrong 1969:382; Jenks 1963:18; Jermann and Dunnell 1979:35; Mackay 1955:71).

Cartographers have attempted to define a standardized procedure in isoplethic map construction for at least 40 years (Alexander and Zahorchak 1943; Armstrong 1969; Jenks 1963; Jenks and Caspall 1971; Mackay 1955; Monmonier 1972; and Scripter 1970, among others), with little actual success. However, there is now general agreement that map construction procedures must be considered in the light of their appropriateness in a specific application. Although standardization is desired, there is no single "correct" way to draw all maps. Consistency in map-creation decisions has been suggested for archaeological applications by a number of investigators (Howes 1982:74; Jermann 1978:87; Redman and Watson 1970:289; Whitlam 1980:95) when visual comparisons are to be made between maps.

Jenks (1963:18) defined three important factors which can be manipulated to shape isoplethic maps: the number of class intervals; the selection of grey-tone characters used to represent the classes; and the choice of interval values. Previous Ozette reports have detailed the effects of varying each of these three factors (Samuels 1983a, 1983b) and only a summary is presented here.

Jenks (1963:20) showed that no more than seven grey-tone classes can be readily perceived using SYMAP. Six levels have been used in all SYMAP plots created during this study. The lowest of the six (lightest tone) always is reserved for areas devoid of the item portrayed (a quantity of zero), providing a presence/absence-level evaluation. The darker five levels portray quantity variations in areas where at least some items were found.

The grey-tone scale used attempted to maintain a smooth transition from light (low quantity) to dark (high quantity) symbols, so that there were no noticeable jumps in darkness between adjacent levels. The default SYMAP symbol set proved acceptable and was used.

Several methods were tested for choosing interval values (see Samuels 1983a, 1983b). The final choice was a cumulative-percent algorithm which divided the value range (maximum minus minimum) into classes based on the "shape" of the particular frequency distribution as well as its minimum and maximum values. This algorithm results in each class (of the five used for portraying density variations) representing 20% of the total quantity (100%) of items on the map.

Since these characteristics were standardized for all SYMAP plots, visual interpretation between maps has been made more meaningful. The shape and size of regions with high densities of specific debris-types can be compared directly since there is a similar relationship between the floor deposits and their representation with SYMAP for all classes of cultural material.

CHAPTER 3

FLOOR MIDDEN PARTITIONING

Architectural Summary

Both gabled and shed-roof houses have been reported for the Makah, though the traditional house form was the shed-roof type (see part II). In these houses, the front and rear walls formed the long axes, and the single-pitched roof sloped down from front to rear. The front wall was 10 to 12 ft (three to four meters) high, while the top of the rear wall was six to eight feet (two to three meters) above the floor (see Figure 27). House construction, detailed in part II, can be conceptualized as having seven steps:

1. First, a space of the required size was cleared and leveled.
2. The rafter-support post holes were dug in pairs along the long axis, and the rafter-support posts, notched at the top, were inserted (see Figures 41 and 55).
3. The roof beams spanning the width of the house were raised atop the paired support posts and placed into the notches.
4. Stringers were placed across the roof beams, and the roof was finished by placing interlocking roof planks at right angles to the stringers (thus, parallel to the short axis). These planks were not tied down, but were weighted down by large stones (see Figure 57).

This completed the roof structure. The walls were constructed separately:

5. The wall-support poles were implanted into the ground in paired sets, around the perimeter set by the rafter-support posts. The distance between pairs was about one to two meters. The two poles (of a pair) were separated by several inches.
6. The wall planks were placed between the poles of each paired set, and lashed to them with withe. These planks were laid in horizontal courses, with some overlap between the courses so that they formed a relatively weather-proof seal (see Figure 59).
7. The interior furnishings were constructed. Beds were benches set near the walls, about 18 inches above the ground. Low platforms were set inside these benches, with hearths placed just inside these platforms (see Figure 26).

Ethnographic Reports of House Utilization

The location of houses within a village sometimes appears to have mirrored the ranks of the chiefs at the time the village was founded. Koppert, in his study of the Clayoquot, says that after conquering and burning the village at Opitsit "the chief selects his lot somewhere near the center of the village ... the sub-chiefs build their homes to the right and left of the head-chief" (Koppert 1930:9). The size of the structure also may be related to the relative status of the owner. Curtis, quoting Cook, says that at Nootka Sound "the houses are disposed in three ranges or rows, rising gradually behind each other; the largest being that in front, and the others less; besides a few straggling, or single ones, at each end" (Curtis 1970:12). Barnett, in his study of the Coast Salish says that for "the Sanetch ... at Tealap ... the houses of the most important families were in the middle; those on the ends and back belonged to lesser men" (Barnett 1955:19). Although these rules of spatial organization may not have been inviolate (see Marshall 1989), where village organization has been mentioned in the ethnographies the placement of longhouses within a village

seems to reflect the current rank relationships, although subsequent changes in household ranks did not necessitate changes in household location.

There is no ethnographic evidence of semisubterranean floors in these structures. Neither have floor coverings, such as planks, been noted ethnographically. Flat dirt floors seem to have been the rule. Among the Northern and Central Nootka, a large hearth near the center of the floor served as the fire pit on ceremonial occasions, while each family area had its own fireplace for daily use (Drucker 1951:71). The highest-ranking family lived in the right rear corner (as one faces outside, from the doorway), and other corners were assigned to other important branches of the lineage, whereas the places in between were used by lower-ranking families.

The Coast Salish peoples also used shed-roof houses. Suttles (1974) discusses several aspects of their shed-roof houses in his work with the Coast Salish of Haro and Rosario Straits. His informants said that people chose a place to build a house where there were mussel shells and dirt that could be packed down to make a good floor. It was also reported that the floor was swept daily with a broom of hemlock boughs and was sometimes sprinkled with water (Suttles 1974:257). At Ozette, several tied hemlock-bough brooms have been found.

Suttles (1974:259) also describes some activities within the house:

> The winter house was more than a dwelling; it was a workshop and a factory for the preservation of food. According to a [Samish] informant ... women's crafts were generally practiced in the house, even the making of mats, which requires some space, and some men's work was done in the house. A man made halibut hooks ... bows and arrows were also worked on in the house, and even nets, unless the weather outside was especially attractive.

The food-processing activities which contributed much debris to the development of floor middens can be visualized from the following quote from Mozino (1970:19) regarding his visit to Nootka Sound in 1792 as the botanist on the expedition of Bodega y Quadra:

> Inside ... of their house they make large fires, clean their fish, and remove shellfish and snails from their shells, leaving a large part of the remains thrown upon the floor where it rots. This causes an unbearable repugnance to anyone who has not grown up in the midst of such stench. The filth is incomparably greater in the houses of the *meschimes* [commoners], both because they are all generally found to be sordid and also because the women do not show the least vestige of what we call cleanliness.

Use of ethnographic information to interpret the archaeological record is sometimes a hazardous procedure because of the uncertainty of connections between prehistoric behavior and ethnographic activity patterns. In this case, however, it is appropriate since the archaeological deposit is very close in time to the ethnographic period during which information was gathered about ansestors. Used with caution, ethnographic accounts provide a source for research questions and archaeological interpretations. A model of the idealized house plan is presented in Figure 94, based on ethnographic accounts and historic photographs.

The major ethnographic account classifies Ozette as a winter village (Swan 1870:6). According to this source, most able-bodied occupants moved to a summer residence in early spring, and returned to Ozette in the late fall. However, analyses of both shellfish (Wessen 1982:142) and fish (Huelsbeck 1981b:46) remains suggest a multiple-season occupation for the protohistoric houses. Swan suggests that occasionally, when there were insufficient planks to finish both summer and winter structures, the upper wall planks and roof planks were moved back and forth, while some occupants (very young and old residents) remained at the winter village all year. A photograph of the village at Friendly Cove taken in 1874 shows a house only partially in use (Sendey 1977:20). This was accomplished by moving the remaining wall and roof planks to one end of the house. This portion was made secure from the elements, while in the remainder of the house, the roof support structure was left exposed. A similar arrangement may have been used at Ozette, although no archaeological evidence has been recognized to support this possibility.

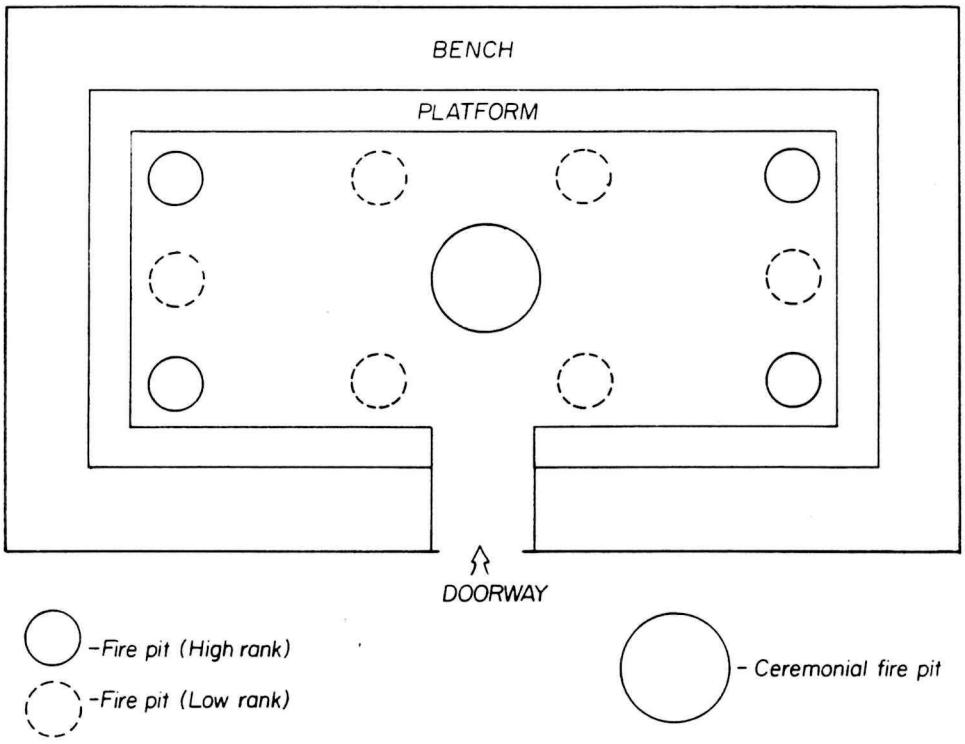


Figure 94. Idealized ethnographic house plan.

Archaeological Plan

Figure 95 shows the archaeological features from House 1. Those of House 2 are shown in Figure 96, and the House 5 features are presented in Figure 97. In Houses 1 and 2, the location of roof beams is estimated from the placement of the rafter-support posts.

The most striking relationship among structural and midden features can be seen between the location of hearth complexes and the roof structures. In all areas of Houses 1 and 2 where a major family hearth complex was discovered (16 of the 17 large hearth complexes), the complex was located between—not under—the roof-beam span (Figure 98). This highly consistent pattern is understandable given the nature of these hearth complexes. Nearly all contained evidence of at least one hearth area over two meters in diameter. A fire of this size easily can send flames three to four meters into the air. While it was relatively easy to remove roof planks to allow smoke and flames to escape, the roof beams were not easily moved. It seems probable that this pattern prevented the roof beams from being subjected to the direct effects of large fires, thus minimizing potential damage to the roof structure.

This analysis was not possible in House 5, as the locations for some House 5 rafter-support posts are more questionable. There are several reasons for this. First, House 5 is the only completely excavated house that was abandoned and dismantled prior to being capped by clay. Most of the structure had been removed before the middle Unit V (temp. VI) clay slide covered the southern portion of its floor. The posts had been removed in six of the 10 rafter-support post locations. Subsequent construction of House 2 and the reconstruction of the whalebone retaining wall removed evidence in three of these support-post locations. It was noted that in Houses 1 and 2, along the long axis the roof beams generally split the distance between adjacent family hearth complexes.

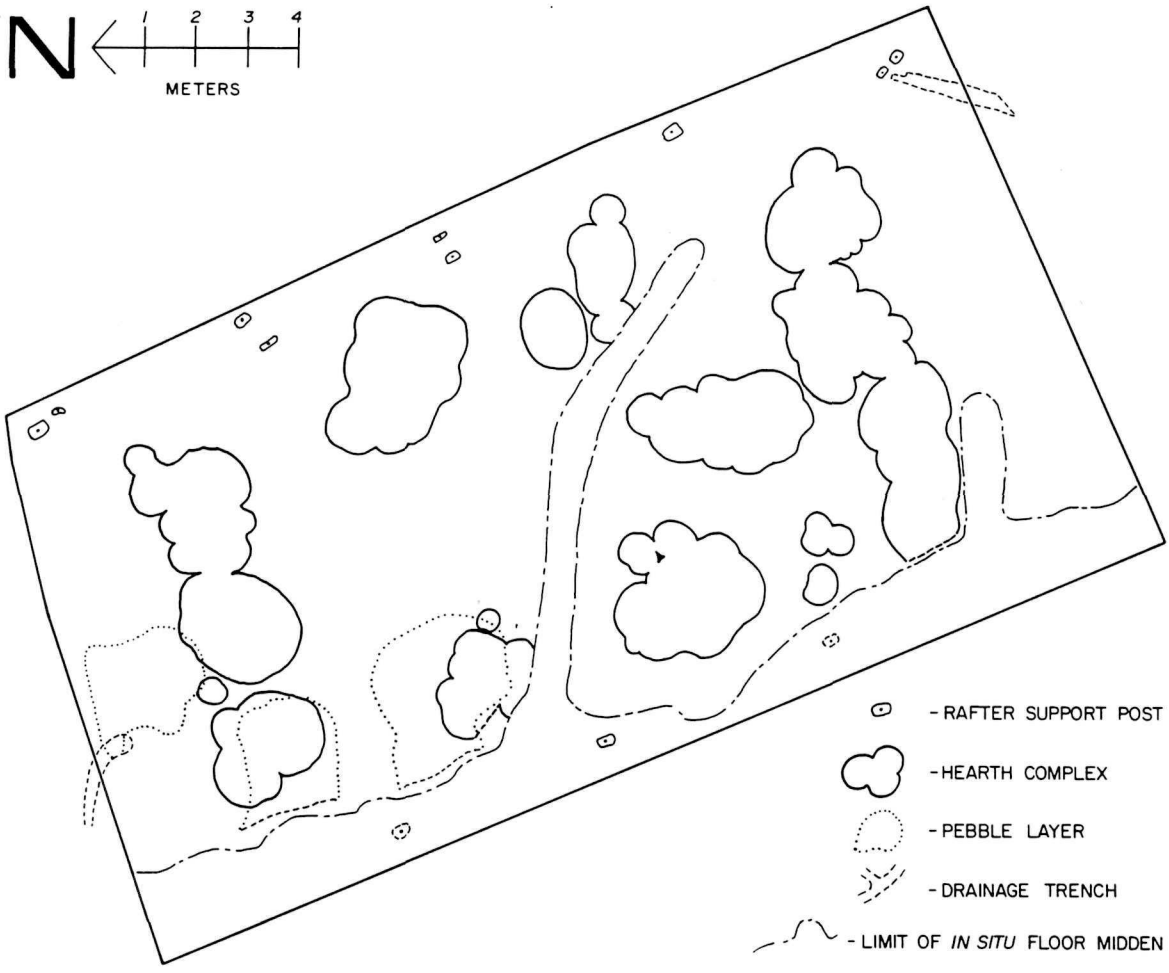


Figure 95. House 1 archaeological feature plan map.

This consistent pattern was used to reconstruct the locations for partitions in House 5, where rafter-support locations were disturbed or obliterated.

The feature maps from all three houses show a zone of hearths from two to four meters inside the house walls and following the perimeter of the structure. These were just inside of the benches, associated with family areas (see Figure 26). House 1 shows evidence of a central "ceremonial" hearth, in a complex just south of the house center which was not associated with a house wall, whereas in Houses 2 and 5 all hearth complexes were next to the benches.

As Suttles describes living arrangements within the house:

> The winter house was capable of holding four or more families. Each family occupied a section of the house. Usually a section was a space between two [roof support] posts on one side of the house. Each family had its own fire in its section.... The number of people in each section might vary from a childless couple to more than a dozen people (Suttles 1974:272).

The combination of ethnographic and archaeological plans supports the interpretation that, as in West Coast (Nootkan) villages (Marshall 1989), in these shed-roof structures each section or "living area" contained its own hearth complex, and the separation of living areas was delimited by the location of the rafter-support posts (with associated roof beams) and the location of family

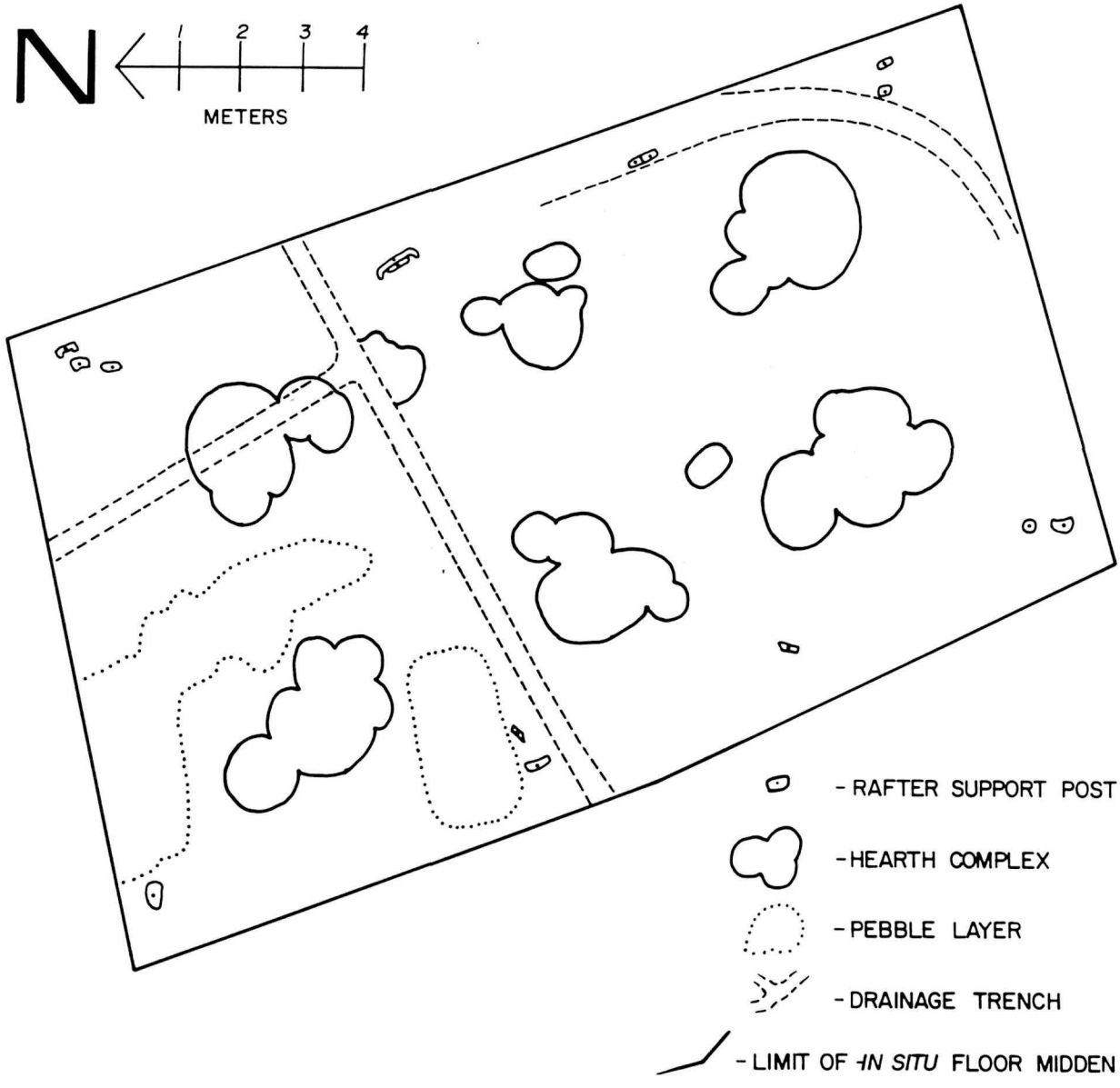


Figure 96. House 2 archaeological feature plan map.

hearth complexes. This means that a longhouse floor plan would have been set at the time of the initial construction (erection of the rafter-support posts).

The location of the doorway in these houses is uncertain. No structural evidence was expected, since ethnographic sources suggest the doorway was just an opening in the wall boards with no framing (see part II for further discussion of house entrances). However, the combination of several types of stratigraphic evidence suggests that the middle of the west wall contained the doorway for House 1 throughout much of the time that it was in use (see Figure 95). These are:

- A high density and compaction of the midden laminae were found in this part of the house floor. Included within the midden are large compacted layers of wood chip debris. This suggests a heavy traffic area where woodworking debris was swept out of the structure.
- Large, superimposed pebble layers were found in this area. These apparently extended to the west wall, although the wall in this area had been disturbed prior to excavation. Pebble

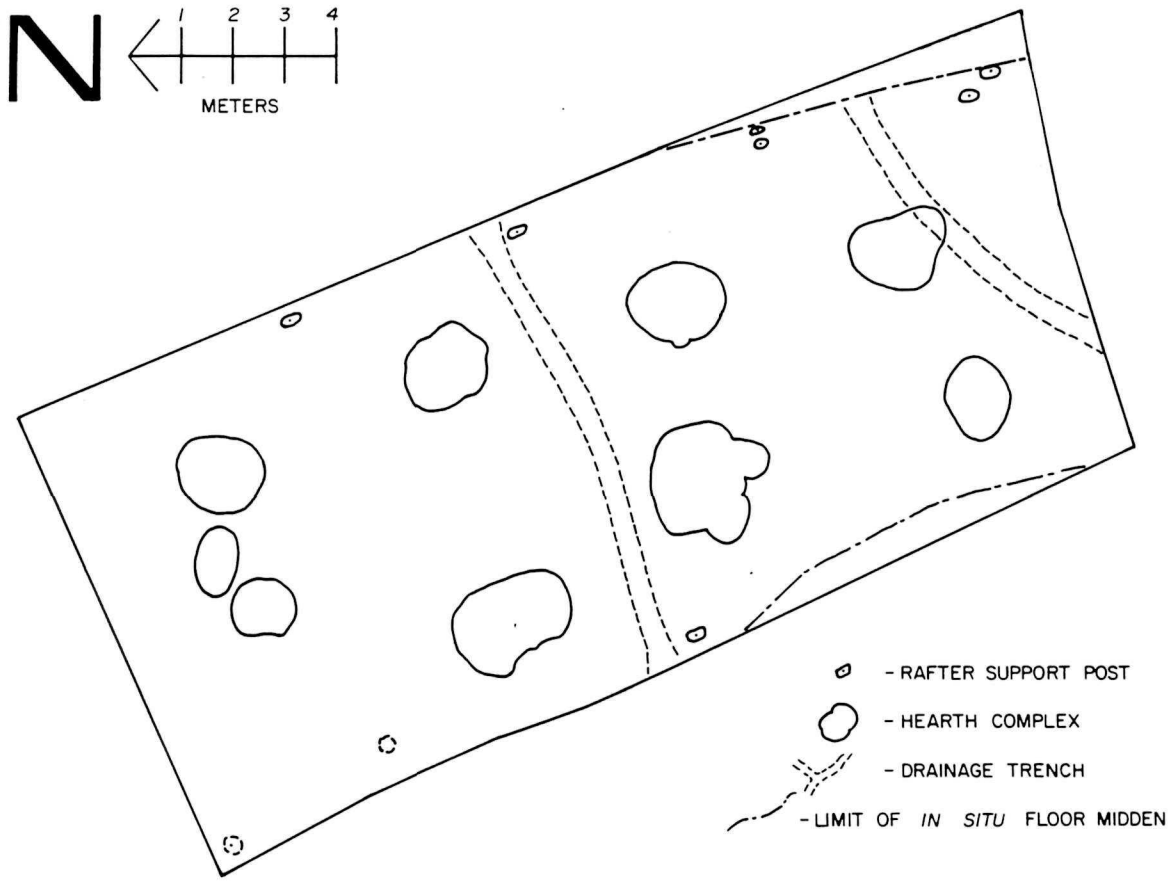


Figure 97. House 5 archaeological feature plan map.

layers may have been used as "doormats" to trap tracked-in dirt and provide good drainage during rainy weather.

- The nearby hearth complex is composed of only small-size hearths (less than one meter in diameter). This is the only complex in either the House 1 or 2 floor without at least one large hearth (at least two meters in diameter). Small hearths may represent the placement of "welcome fires," small fires ethnographically associated with house-entrance areas.

In House 2, two areas were seen with large, superimposed pebble layers. One was along the middle of the north wall, and the other along the west wall (see Figure 96). No hearth complex similar to one described in House 1 (composed only of small hearths) was found in the House 2 floor. Based on similarity with the House 1 floor, either of these areas containing pebble layers may have been the doorway at some point in time, and the doorway location may have changed during occupation. In House 5, pebble layers were not found. Hearths along the north wall are all relatively small; indeed, the northwest corner does not contain any hearth areas. No similar stratigraphic evidence has been found with which to propose a doorway location for House 5.

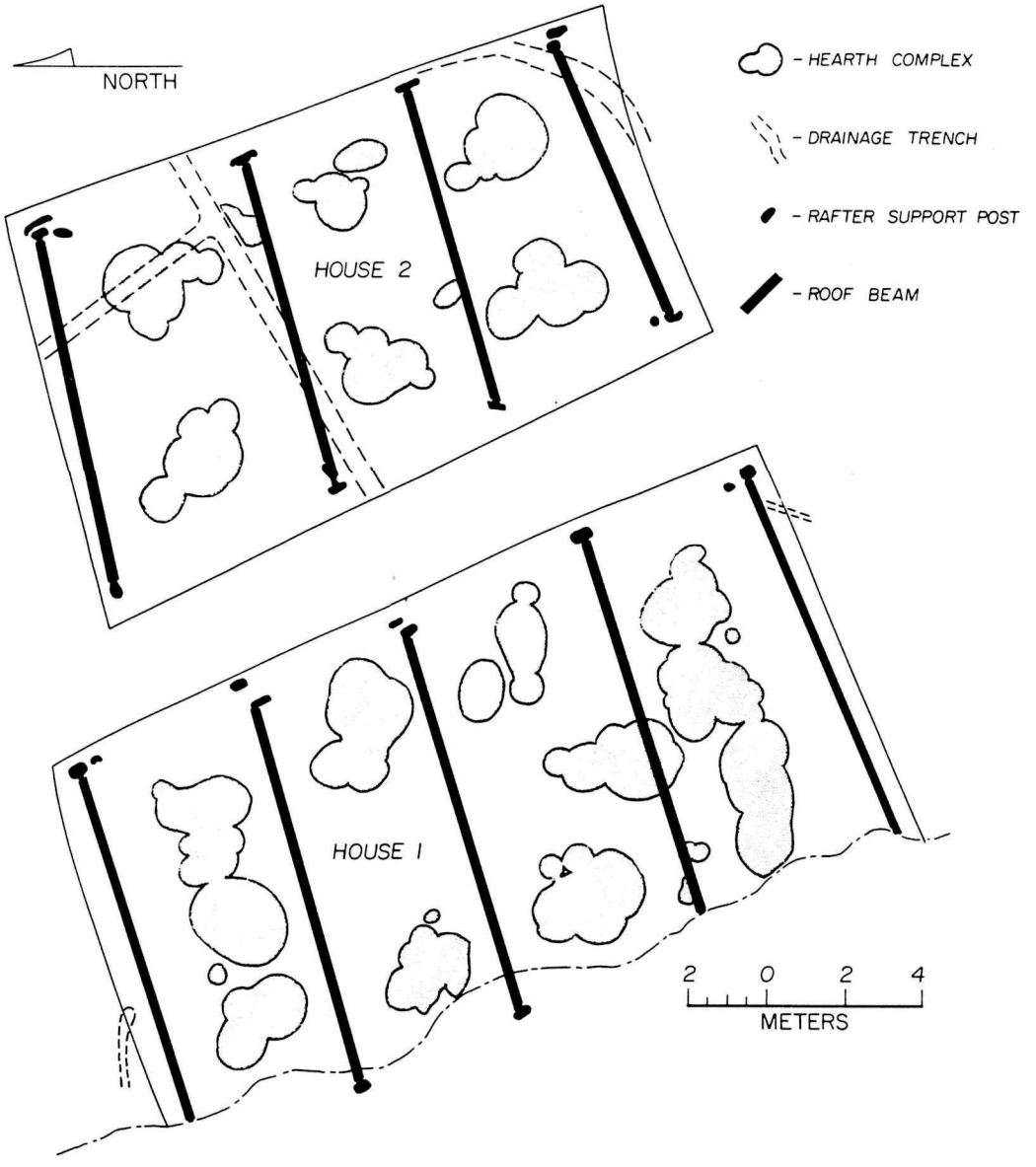


Figure 98. Houses 1 and 2 archaeological roof-beam location map.

Partitioning Interior Space

At Ozette, partitioning of areas within longhouse floors was accomplished on the basis of structural and hearth features, not on the basis of movable elements within the midden (such as shell, bone, or wooden artifacts). Structural and hearth features obviously mark the location of the activities we associate with these features (i.e., house construction and fire-making, respectively). Placement of these features was constrained by tradition. The distinct and repeated patterns that have been discovered in the location of these features from house to house provide the rationale for the partitioning scheme which form spatial units used in chapter four.

In House 1, the five sets of support posts resulted in four rows or "bays" between them, while in House 2 the four support-post sets resulted in three bays. House 5 also was four bays long, delimited by its five sets of support posts. Across the width of House 1, three hearth complexes

were found along both the north and south walls. Across the width of both House 2 and 5, two hearth complexes were found in each of the bays (except for the north wall of House 5). One group of spatial partitions ("areas") is based on these feature correlations. House 1 has been partitioned into 12 areas (four long by three wide), House 2 into six (three long by two wide), and House 5 into eight areas (four long by two wide).

Figure 99A shows these partitions overlayed upon feature locations in House 1. Figure 100A displays these partitions for House 2, and they are shown in Figure 101A for House 5. In House 1, two areas (five and eight) did not have the potential to be family residential units since they were not associated with the house walls. The other ten areas in House 1 are considered possible living areas for analytic purposes. The two middle west wall areas (six and nine) are not used in the analysis due to their extensive disturbance by winter storms. The remaining eight areas provide data for the House 1 analyses. In House 2 all six areas were associated with the house walls, as were the eight areas in House 5. These also are considered possible residential areas and are used in this analysis. The designation "living area" is not to suggest that the assumption has been made that each of these localities functioned as residences at all times. It is certainly possible (or even probable) that areas may have been differentially occupied as residences. Some areas, like the doorway in House 1 (Area 6), may never have been permanent family residences. The analysis of midden elements in chapter four explores this potential. Thus, the term "living area" is used to denote this aspect of the partitioning scheme, not to suggest the *a priori* assumption of permanent family residence.

Each floor also was partitioned into three depositional environments, or "zones", based on the consistent pattern of hearth locations relative to the house walls. The "bench zone" consists of the area between the house walls and the beginning of the hearth complexes, throughout a house floor. The "central zone" consists of the area inside the family hearth complexes, and the "hearth zone" consists of the area of the hearth complexes. Zone boundaries parallel the house walls. Zone partitions are overlayed on the feature maps for House 1 in Figure 99B, for House 2 in Figure 100B, and for House 5 in Figure 101B.

These two partitioning schemes interact in such a way that all three zones are represented in each area adjacent to the house walls. Computer programs added this partitioning information to the data records for three-dimensional provenience midden elements to create the spatial groups.

Statistical tests used to assess randomness required both mean and standard deviation values for quantities of midden constituents as grouped within each partition. This was accomplished by counting objects given three-dimensional provenience within 50 cm square horizontal units called "subsquares." Each two meter excavation unit was therefore divided into 16 subsquares (four by four). The 50 cm grid size was mainly used for pragmatic reasons. It provided a maximum of spatial differentiation without producing an unwieldy number of data points for statistical manipulations. House 1 contained 889 subsquares, House 2 had 705, and House 5 had 736 subsquares. Area and zone partition designations were assigned for each subsquare containing floor midden. Counts compiled by subsquare were then obtained for the various three-dimensional provenience items excavated *in situ* (described below).

This choice of subsquare size affects the possibility for observing patterns. The size of an overlaid grid determines the minimum size of pattern observable in the data; patterns must be at least twice the grid size in order to be certain of detection (Peucker 1972:23). Given this rule, use of subsquare totals permitted "clusters" of one meter or more in diameter to be detected. Further ramifications of this grid size are discussed in chapter four.

Since neither the excavation units nor the subsquares exactly coincided with the floor midden extent, units at the house walls were not always composed completely of floor midden. As well, there were depth differences in the midden. These factors resulted in differences for surface area and volume of floor midden in each excavation unit. Given this fact, simple counts of midden elements

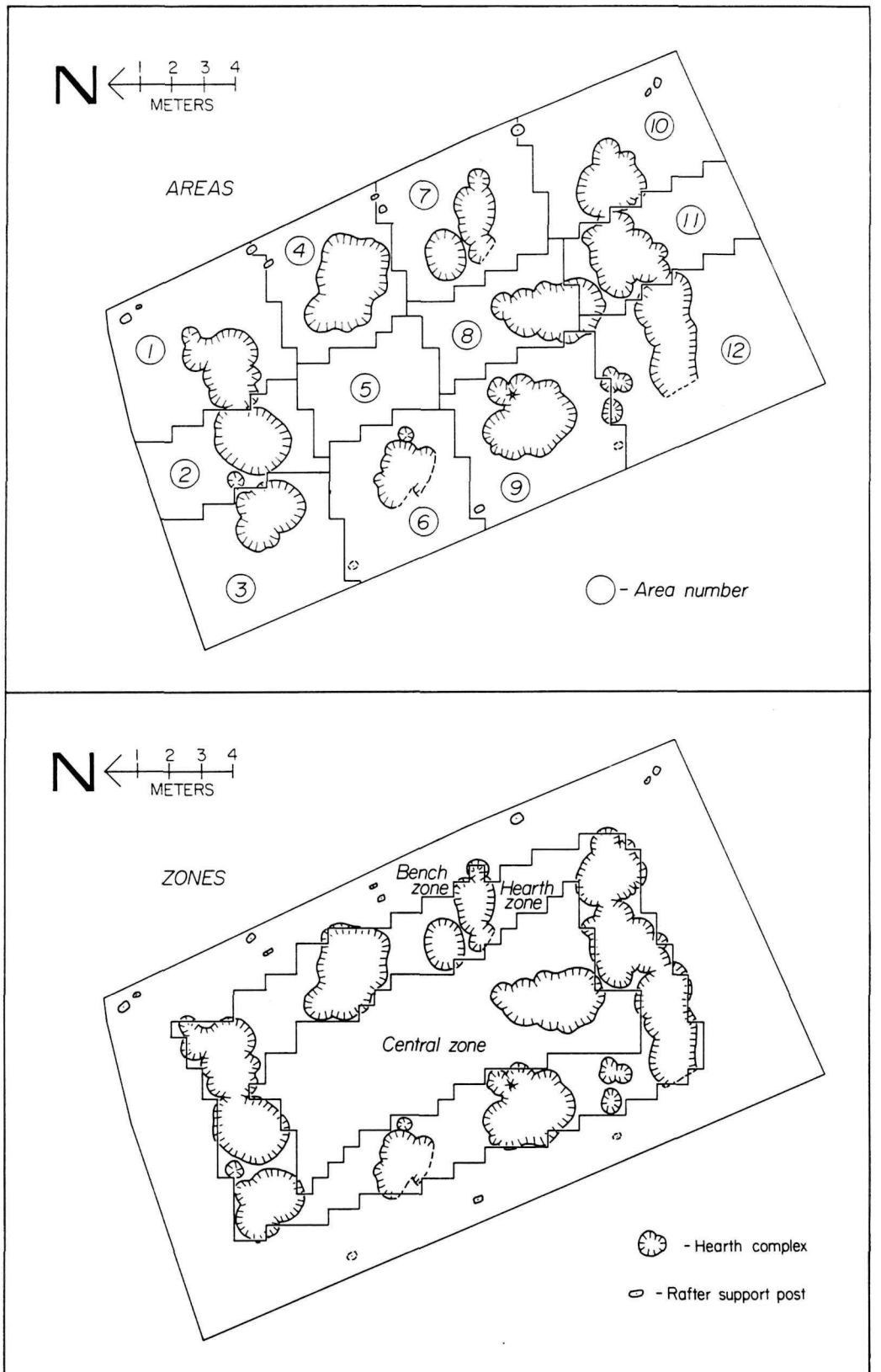


Figure 99. House 1: A - area; B - zone partition maps.

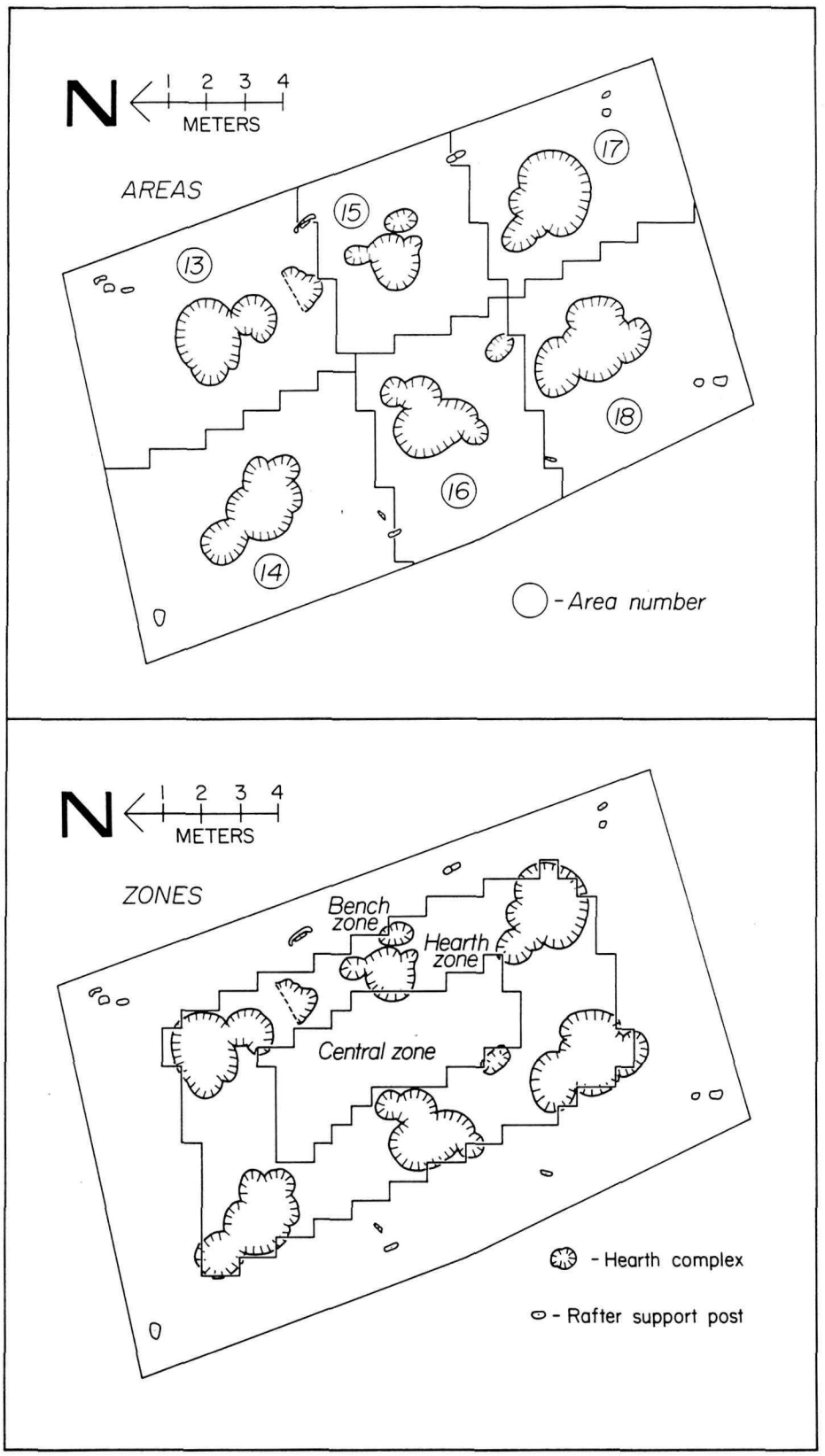


Figure 100. House 2: A - area; B - zone partition maps.

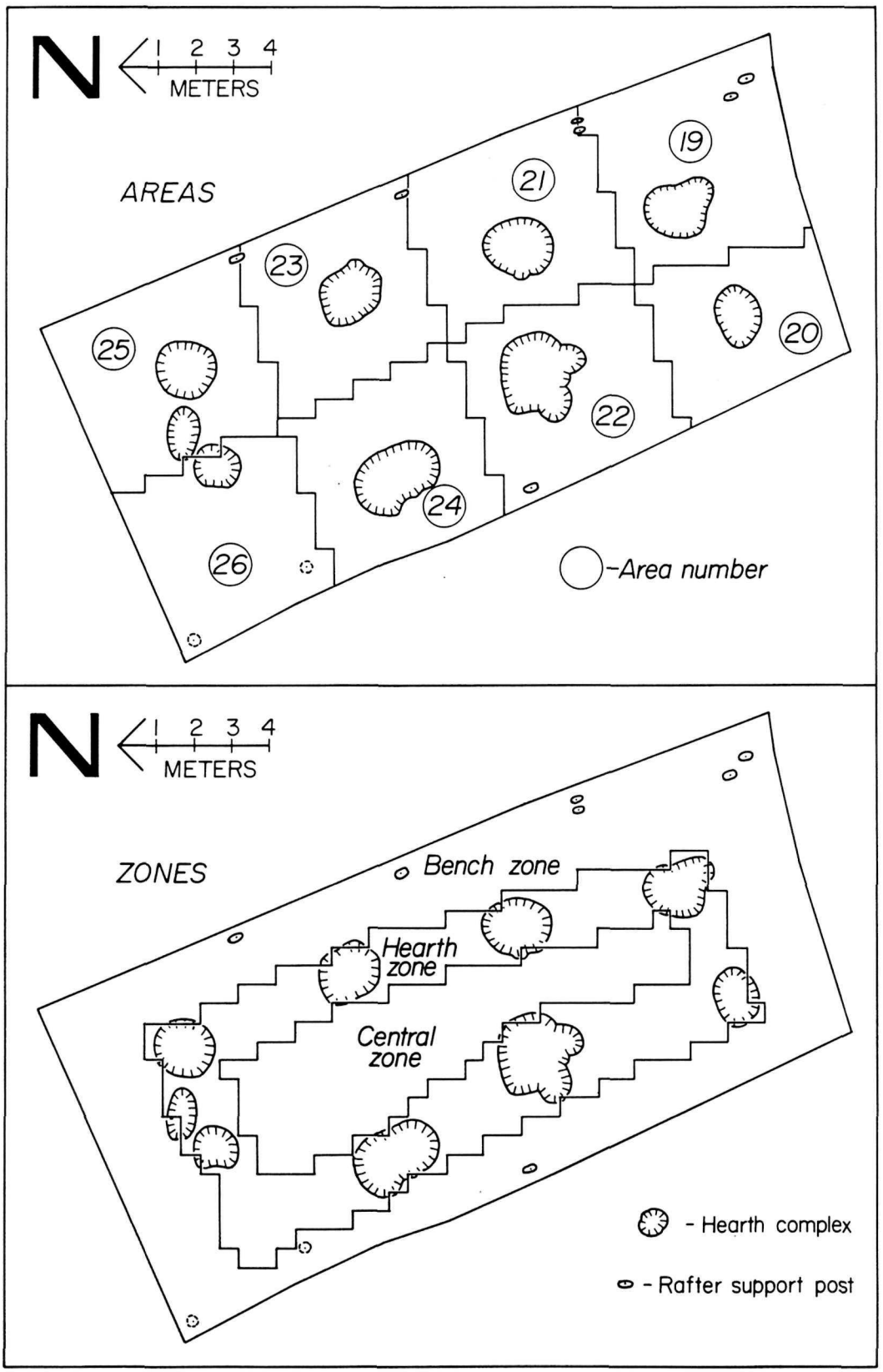


Figure 101. House 5: A - area; B - zone partition maps.

recovered from each excavation unit (or subsquare) would not reflect similar quantities of midden. In order to standardize these differences and provide comparable information, computer programs were developed which converted counts into density for each excavation unit, subsquare, and for each analytic partition. Density was defined as the count of items recovered divided by the volume of floor midden actually excavated, and was expressed as count per cubic meter. This provided for more meaningful comparisons between excavation units, areas and zones, and among house floors. Graphic display and most statistics in this report use quantities obtained after this density conversion.

CHAPTER 4

MIDDEN ELEMENT DENSITIES AND DISTRIBUTION PATTERNS

Fritz's concept of analysis was discussed in chapter two. In summary, it requires describing relevant characteristics of past sociocultural phenomena and relevant characteristics from the present archaeological data; and constructing plausible, testable arguments linking these two together.

The relevant ethnographic record of past socioeconomic activities conducted within the longhouse has been presented in chapter three. More specific descriptions of intrahouse activities are lacking in early ethnographic accounts. Lack of interest in house activities may be partially related to the early ethnographers ethnocentric characterization of "unbearable repugnance" towards the "stench" emanating from the houses (see Mozino 1970:19). Also, it seems that unique or unusual occurrences were more often recorded than were the normal events of day-to-day life.

Whatever the cause, day-to-day household activities are not described in any detail. Yet it is these very repeated activities which contributed most to the formation of structure or pattern in the archaeological record. Therefore, in this research it has been necessary to assume that a similar basic range of household socioeconomic activities were responsible for creation of features, artifacts, and debris in all three structures. This assumption allows comparisons among spatial patterns resulting from broad classes of archaeological data without detailed knowledge of all the specific activities represented.

The relevant archaeological data are subdivided for this study into features and other midden elements. The feature classes have been described in chapter one, and the partitioning system presented in chapter three. Other midden elements are defined below and their characteristics described in context of test results.

Linking arguments focus on two basic goals: description of characteristics found in the data themselves, and utilization of these descriptions in investigation of the role of behavioral processes in altering the past socioeconomic activity patterns into the patterns of past deposition.

Definition of Midden Elements

Six broad classes of midden elements are used in these tests: the artifacts (ART), the postmolds (PM) and stakes (SR), the mammal-bone detritus (MBONE), fish-bone detritus (FBONE), and shell detritus (SHELL). Artifact, postmold, and stake locations have been recorded with three-dimensional provenience (measured location); thus, the partitioning system can be superimposed upon these locations. Again, the Ozette definition of what constitutes an artifact is more rigorous than in many archaeological projects. Detritus material was not classed as artifactual, and was collected with square/level provenience (quadrat location). Therefore, only house-wide comparisons are made using these data.

- **ART**. Artifacts are defined as midden elements which show major modification from their natural state. They range from raw material bundles, blanks, and preforms to finished, repaired and discarded items.

  All objects found in the floor midden were counted, unless they were known to be multiple fragments of the same item. When two or more pieces of an object were found clearly associated, they were recorded as multiple fragments but counted as one object. This discretionary counting permitted a more accurate evaluation of the number of items actually deposited prior to fragmentation.

In tests of nonrandomness and other comparisons using the partitioning system, only *in situ* objects could be used. In tests utilizing square/level provenience, all artifacts were used whether they were recovered *in situ* or not, as long as they retained association with a specific excavation unit within floor midden matrix.

- **SR and PM.** All vertical or oblique objects driven into the floor were placed into this class. Horizontal planks were not counted because no adequate method was found to reduce the provenience of large horizontal objects to a single three-dimensional point. Vertical and oblique objects had their location designated by a single point in space. Location of an oblique object was recorded as the point where it entered the midden (as these objects were often found partially exposed above the floor midden deposit). This permitted the most accurate positioning of the object as it was before disturbance by the Unit IV slide.

  As with the artifacts, only one portion of a multiple-fragment stake was counted and the same restrictions apply regarding *in situ* versus disturbed objects.
- **SHELL.** This midden element (along with mammal and fish bone) are objects which were not altered sufficiently to be classed as artifacts. All shell pieces were counted, regardless of the species or the degree of completeness. Shell size was recorded based on fit to an outline (or template), so that original size could be determined for fragments (see Wessen 1982). For this study, an approximation of actual fragment size was made on the basis of species, template size, and degree of completeness.
- **MBONE.** All mammal bones were counted. The identified bone and the non-identifiable mammal bones form distinct subsets.
- **FBONE.** All identified fish bones were counted.

A major difference between the postmold/stakes and the other midden elements is found in the nature of incorporation into the floor midden. For postmold/stakes, the cultural activity—whether house construction, food preparation, object manufacture, or play—took place at the location where the postmold/stake remains were found archaeologically. In contrast, The artifacts (along with all other tested midden elements) are objects capable of being easily moved from an activity to a depositional location. This distinction effects interpretation of spatial patterns for these two classes of objects. In order to maintain this distinction, the postmolds and stakes are "stationary" while these other objects are referred to as "movable."

The stationary elements will be considered first, in order to provide a baseline from which to consider the others. The artifact distributions will be examined next, since the partitioning system can be applied to these objects as well as to the stationary elements, making comparisons possible. Finally, the faunal debris (mammal bone, fish bone, and shell) will be examined in terms of both mean density in each house and their distributions within the floors.

Distribution Patterns and Nonrandomness Evaluations

A quantified measure of nonrandomness in the distribution of midden elements has been sought to help interpret the distribution patterns for the elements themselves, and to help determine the success of the partitioning system introduced in chapter three in describing these patterns. This test will explore the relationship between this archaeological material and the idealized ethnographic spatial pattern. Visual inspection of OZMAP plots are used to ascertain whether uniform or clustered patterns are indicated.

The S.P.S.S. ANOVA program (Nie et al. 1975) is used for this test. ANOVA (short for ANalysis Of VAriance) seeks to determine the probability that a predictor (independent) variable could yield results different from those dictated by chance alone (Iverson and Norpoth 1976:5). The dependent values used in this test are subsquare densities for the tested element.

Table 12

Postmold and Stake ANOVA Test Results by House.

$$\text{KEY} = \frac{\text{Significance of F}}{\text{Strength } (Eta^2)}$$

Distribution	Effect			
	Main	Zone	Area	Total
House 1 PM Density	.118 .022	.150 .004	.067 .021	.170 .043
House 1 SR Density	.002 .036	.001 .015	.365 .013	.097 .047
House 2 PM Density	.000 .143	.073 .006	.000 .138	.000 .162
House 2 SR Density	.001 .033	.007 .014	.012 .020	.003 .052
House 5 PM Density	.033 .024	.039 .009	.080 .019	.044 .048
House 5 SR Density	.020 .027	.293 .003	.029 .021	.310 .035

The null hypothesis in this test is that the subsquare densities for each element were distributed randomly throughout the house floor (across all areas and zones, which serve as the independent variables in this analysis). The alternative hypothesis is that the element was distributed non-randomly by reference to these same areas and zones. The "significance of F" calculation is used as the test of randomness. The rejection level for the null hypothesis has been chosen at .05. A value less than this signifies that such a sample could have been drawn from a randomly distributed population of elements less than 5% of the time. In these cases the alternative hypothesis of non-randomness is supported. Thus, a value of .000 signifies that the tested element distribution would be expected by chance less than 1 time in 1000.

Eta^2, the correlation ratio, is a nonlinear coefficient of association. It is a measure (expressed in percent) of the improvement in the prediction of a value for the dependent variable through knowledge of a value for the predictor (or independent) variable. While F measures statistical significance, Eta^2 measures the strength of the effect. Potential Eta^2 values range from .000 (no increase in predictability) to 1.000 (perfect predictability). The Eta^2 statistic is used to ascertain the relative importance of each partition (area and zone) in differentiating floor-midden portions with varying subsquare densities. The more important an effect, the greater will be its strength measure, and such strength measures—unlike measures of significance—are not dependent on sample size. Results are presented in tabular form (Tables 12 and 13), with the significance value above the strength value for each effect.

Stationary Elements

Plan-view point-plotted maps (OZMAP plots) for House 1 are shown in Figure 102 for the postmolds, and Figure 103 for the stakes. For House 2 these maps are shown in Figure 104 for the postmolds, and Figure 105 for the stakes. For House 5, Figure 106 displays the postmolds, and Figure 107 shows the OZMAP plot for the stakes. There is a good deal of visual similarity in the distribution of postmolds and stakes within (and between) House 1 and House 2 floors. Heavy concentrations appear around the hearth complexes, especially just inside (towards the center floor)

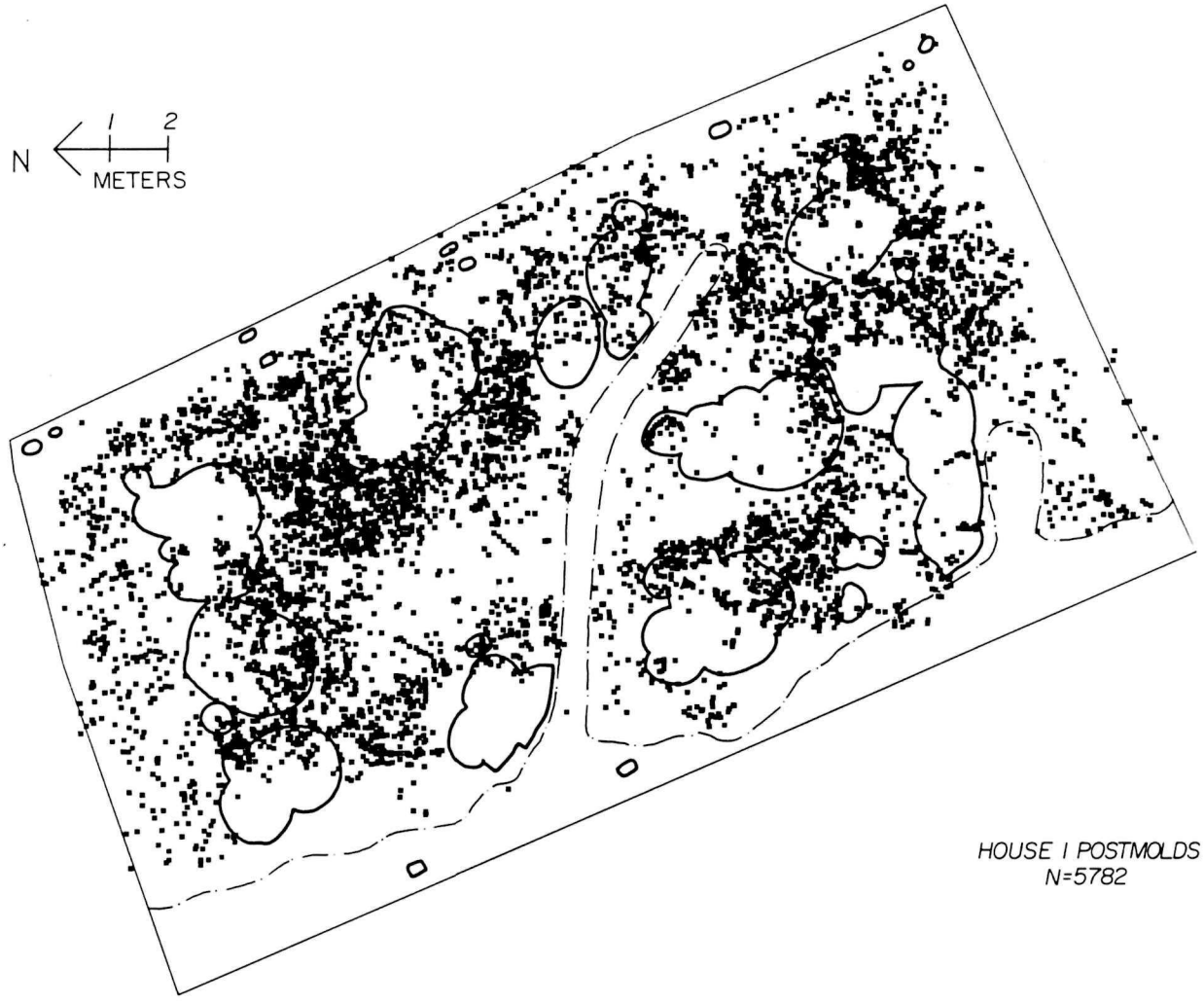


Figure 102. House 1 postmold map.

of each, in a line generally parallel to the house walls. A rectangular central zone is outlined by the low number of these elements, especially stakes. In the bench zone, clusters of postmolds and stakes were found in bands perpendicular to the house walls. House 5 distributions appear similar, especially in the southern half of this floor. The northern areas (Areas 25 and 26) appear most different from the pattern seen in Houses 1 and 2, with relatively few postmolds or stakes.

ANOVA statistics for these element distributions within the house partitions are presented in Table 12. Four aspects of variance are tested for each distribution. The two partitions, living area (**Area**) and depositional environment (**Zone**), combine to form the **Main** effects. Each is tested individually, and the **Total** explained includes interaction effects between **Area** and **Zone**. In order for any effect to be significant, subsquare densities need to be markedly more homogeneous within a partition (area or zone) than when taken as a house-wide group (disregarding the partition). If subsquare densities within most areas (or zones) are quite hetrogeneous, then even if mean density values are somewhat different among areas (or zones) the null hypothesis of randomness may not be rejectable.

The significance values obtained for the **Main** effects and **Total** explained are both beyond the level necessary for rejection of the null hypothesis for eight of the 12 values in the three house

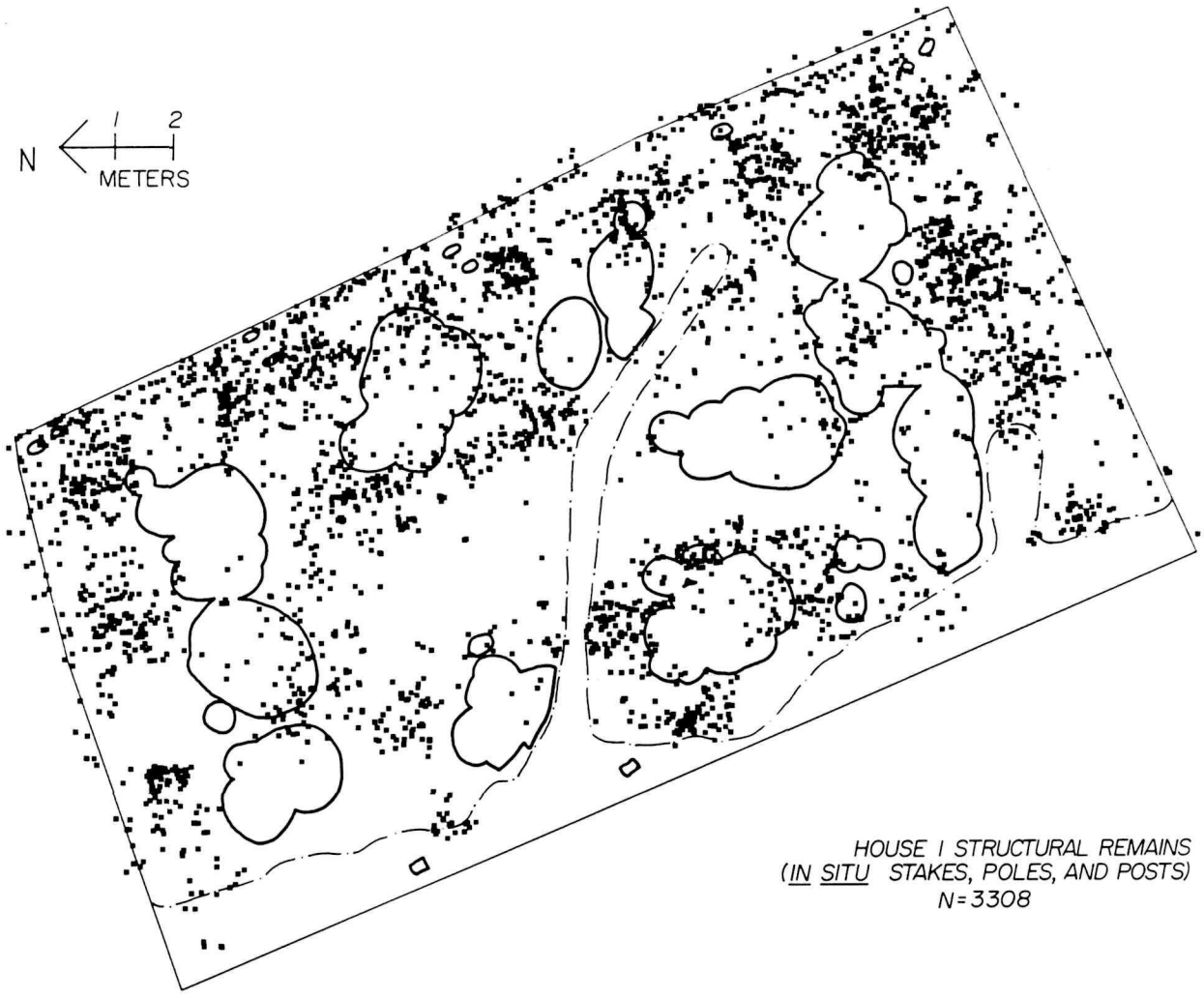


Figure 103. House 1 stake map.

floors. In House 1, the null hypothesis can be rejected only for the stake **Main** effects, as the **Total** explained can not allow rejection of the null hypothesis. Neither value can be rejected as random for the House 1 postmolds. In House 2, the null hypothesis can be rejected for both the **Main** and **Total** explained, for both postmolds and stakes. In House 5, the null hypothesis cannot be rejected for the stake **Total** explained, but can be rejected for the other three effects. For the partitions themselves (area and zone), six of the 12 significance levels exceed the level necessary for rejection. In House 1, the null hypothesis can be rejected only for the effect of **Zone** on the stakes. The other three values do not allow rejection of the null hypothesis. In House 2, three of the four values allow rejection. Only the effect of **Zone** on the postmolds does not. In House 5, two of the four allow rejection of the null hypothesis, the effect of **Zone** on the postmolds and the effect of **Area** on the stakes. Given this result, the null hypothesis cannot be rejected for House 1. For Houses 2 and 5 however, the preponderance of the evidence suggests that the null hypothesis can be rejected and the alternative hypothesis supported; both of these elements are nonrandomly distributed within these two house floors. Visual inspection of the OZMAP plots suggest clustered, not uniform, nonrandom patterning.

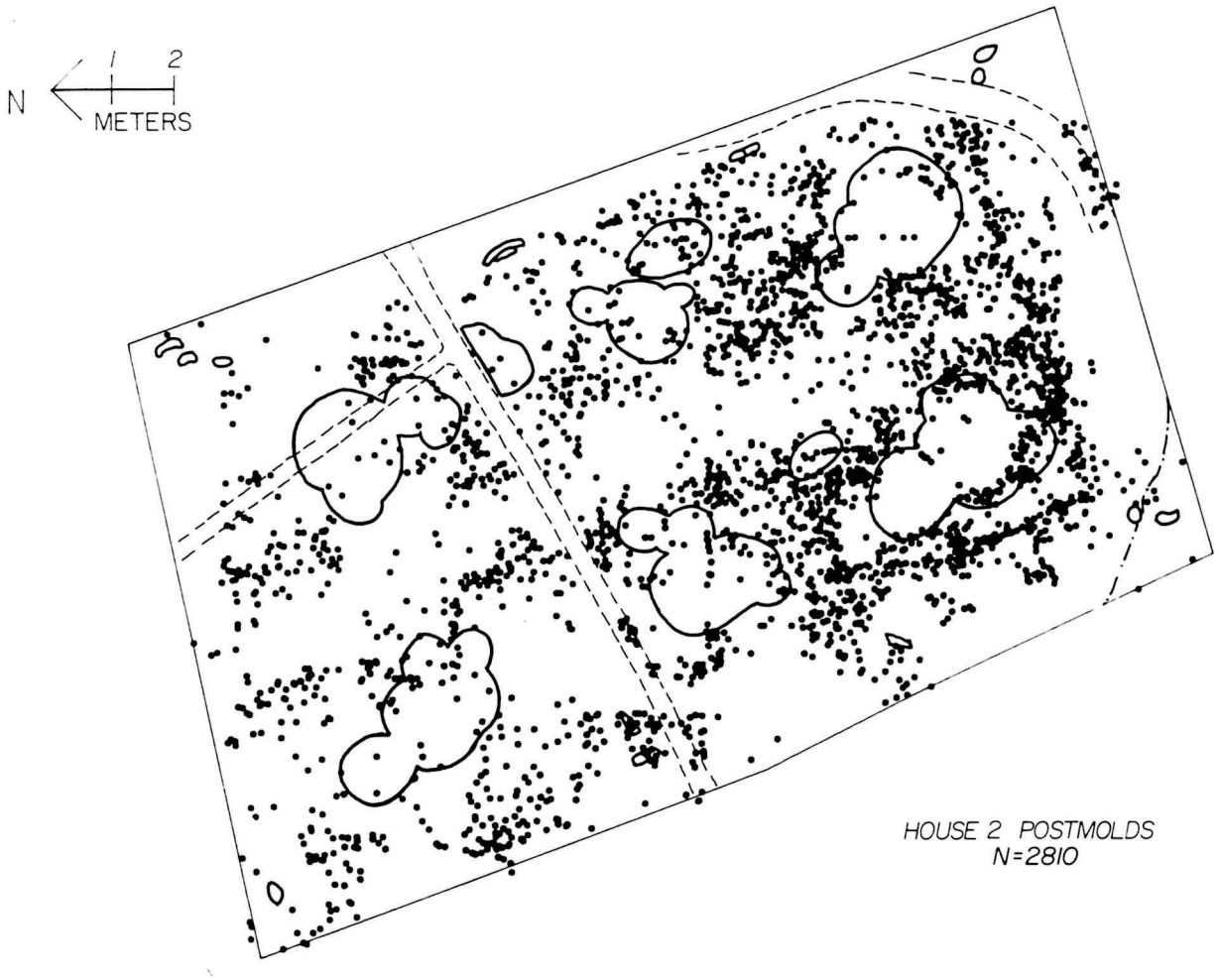


Figure 104. House 2 postmold map.

In five of the six element tests, **Area** is a stronger predictor than **Zone**. Generally there is greater variation in subsquare density among the living areas than among the three depositional zones for these elements. The strength values (Eta^2) are low, ranging from < 1% to 14% increase in predictability. In House 2, postmolds produce stronger effects than do stakes. In Houses 1 and 5 the strength for postmolds and stakes are almost the same. The strength levels for both elements are greatest in House 2, with Houses 5 and 1 weaker. While the significance levels allow rejection of the null hypothesis in House 5 elements, this cannot be said for those of House 1. It can be concluded that the partitions are not particularly successful in defining spaces of differing subsquare density in House 1, and only partially successful in House 5. Visual observation of these distribution maps suggests clustered patterns, even though random distributions cannot be ruled out by these test results. Aside from the actual occurrence of random patterns, two other explanations may be proposed to account for this limited success.

The partitions themselves may be misplaced, so that they crosscut actual density variations, and/or the effect of subsquare size may be responsible. As discussed briefly in chapter three, the 50 cm size of the subsquares is not necessarily optimal for grouping this element, and thus visually distinct patterns may not be well replicated. The use of area- and zone-wide mean density values is one way to remove the effects of the subsquare grid size. Following tests investigate that possibility.

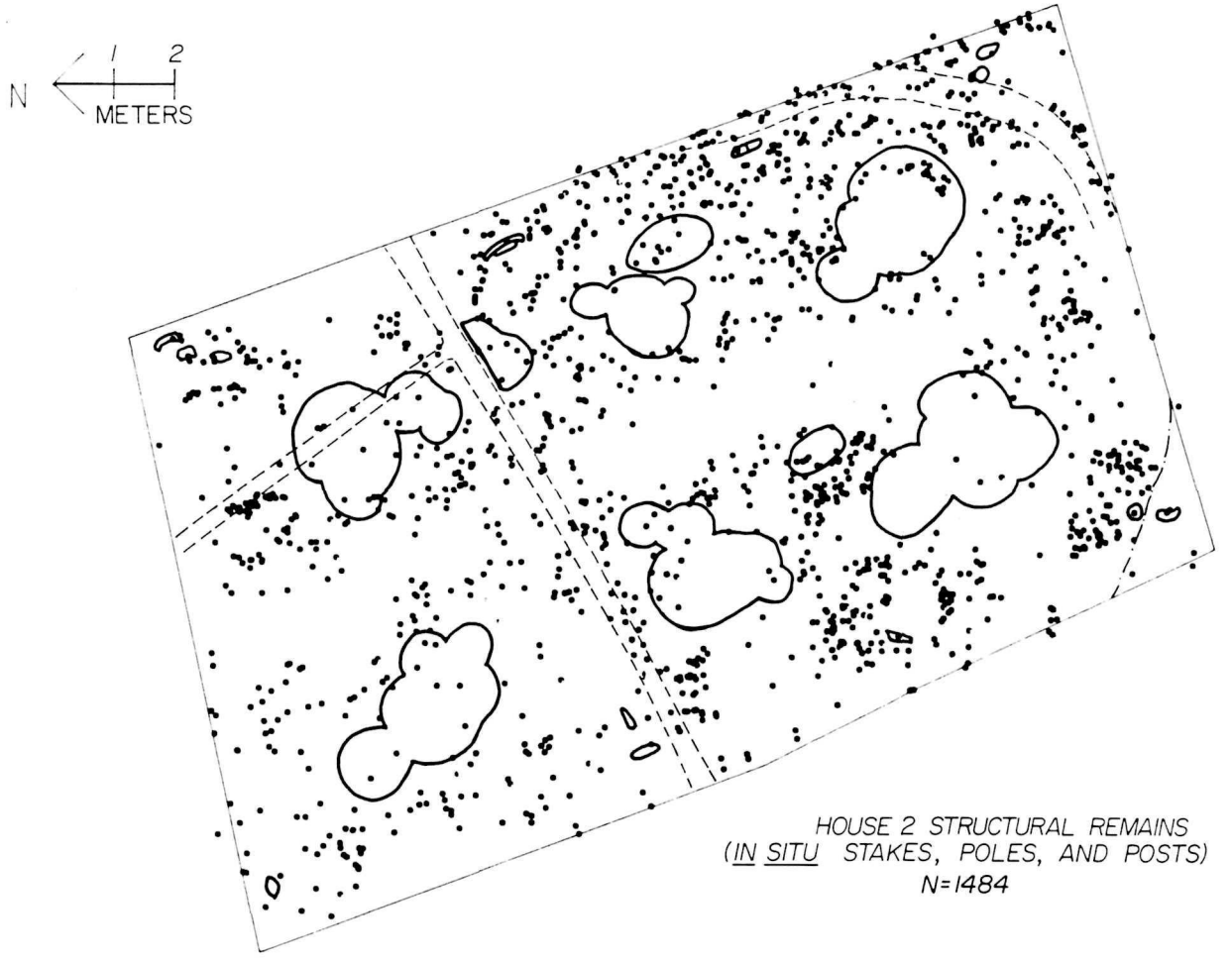


Figure 105. House 2 stake map.

Movable Elements

For the artifact distributions, the null hypothesis of randomness can be rejected for all **Main** and **Total** effects, in all three house floors (Table 13). In fact, all 12 significance values are well beyond the level necessary for rejection of the null hypothesis. These distributions are shown in Figure 108 for House 1, Figure 109 for House 2, and in Figure 110 for House 5. Visual inspection strongly suggests clustered, not uniform, patterning. **Zone** is a much stronger predictor than **Area** for artifacts in Houses 1 and 2, unlike the result for postmolds and stakes. This implies greater diversity among depositional zones than among living areas, and this supports the visual interpretation of the maps. The strength values are generally higher than obtained in the postmold and stake results, ranging from < 2% to over 20% increase in predictability. In House 5, both **Area** and **Zone** are significant, with living area showing greater strength than depositional zone.

This result supports the visual interpretation of the OZMAP plots, where high numbers of artifacts are seen throughout the bench zone of Houses 1 and 2, and in the southern part of House 5. Few artifacts were found in the bench zone in the northern part of House 5; therefore, tests show greater diversity among living areas for this floor than in Houses 1 and 2. The partitions are most

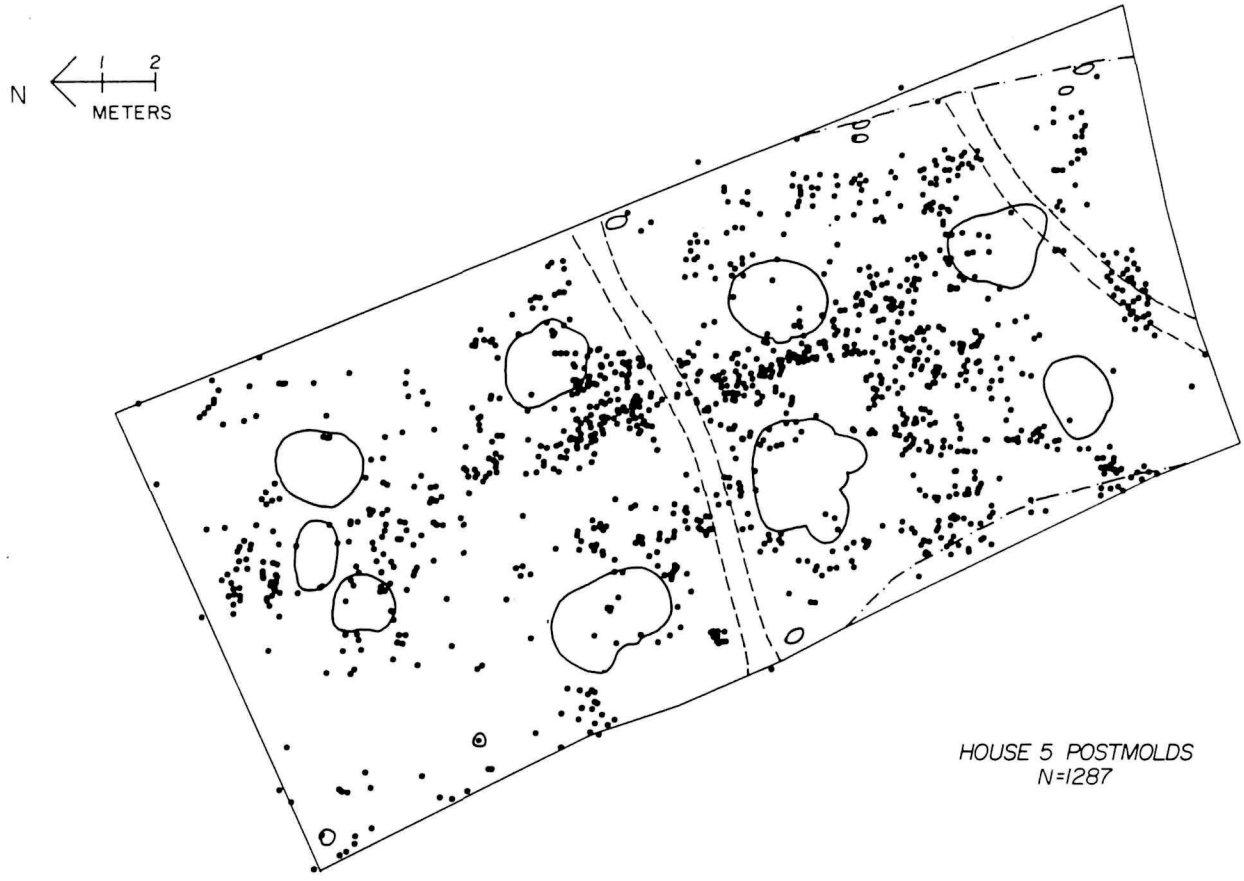


Figure 106. House 5 postmold map.

successful in increasing predictability for the locations of the artifacts in House 2, as was the result for stationary elements.

Conclusions

These results indicate that the distribution of these elements is not random in these house floors. Especially for House 2, variations in subsquare density of stationary elements are best differentiated among areas, while variations in subsquare density of the movable elements are best differentiated among zones. The partitions appear very successful in defining areas of differing subsquare density for the artifacts, unlike the results for the postmolds and stakes. This is seen most strongly in House 1. In all three houses the **Total** effects using the artifacts were stronger than those either the postmold or stake distributions in any house.

Tentative behavioral implications can be drawn from these results. The variation in past household activity locations (which are represented by the stationary element subsquare densities) are generally greatest among living areas. This suggests differences in utilization among living areas. On the other hand, the variation in past depositional locations (which are represented by the movable element subsquare densities) are greatest among zones. This suggests that depositional processes worked relatively similarly in all living areas, regardless of any differences in utilization

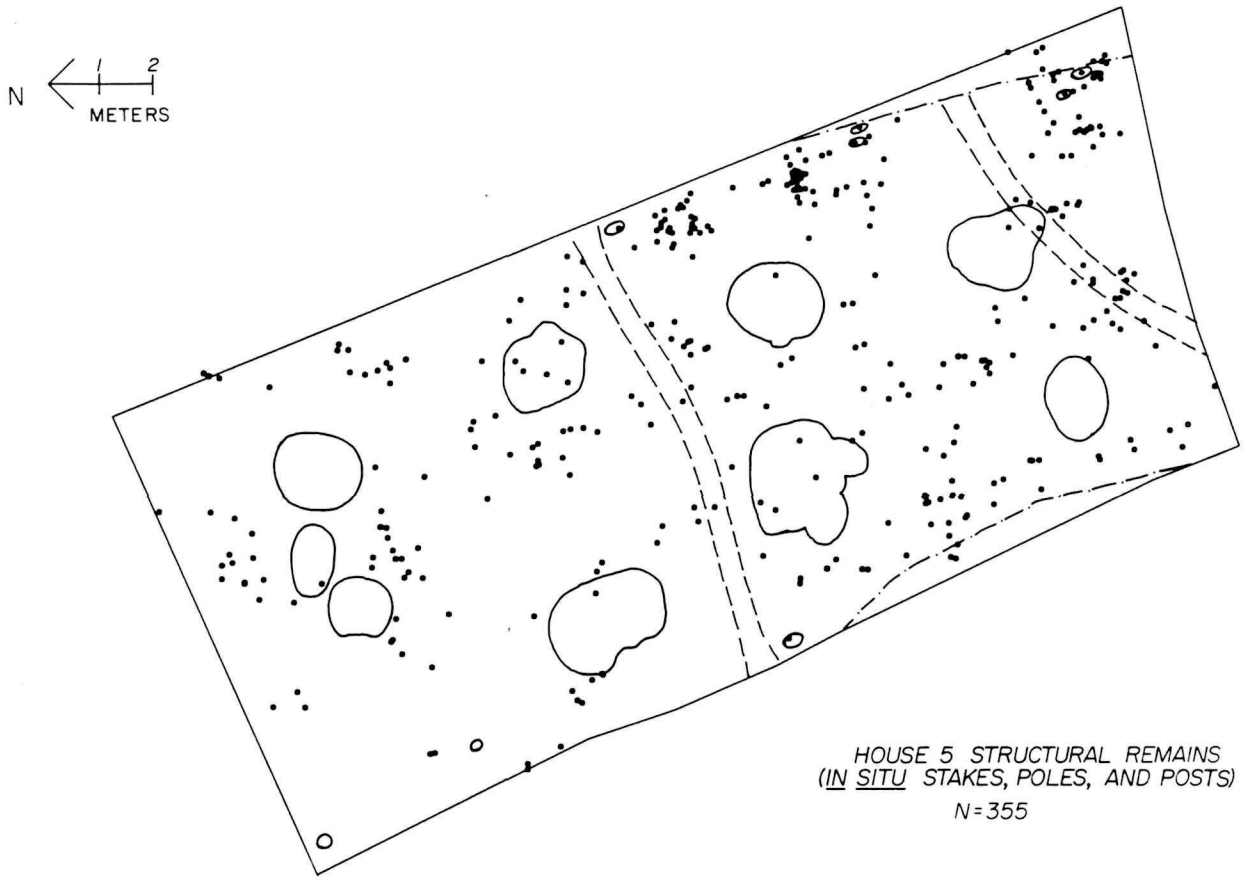


Figure 107. House 5 stake map.

Table 13

Artifact ANOVA Test Results by House.

$$\text{KEY} = \frac{\text{Significance of F}}{\text{Strength } (Eta^2)}$$

Distribution	Effect: Main	Zone	Area	Total
House 1 ART Density	.000 / .186	.000 / .154	.001 / .031	.000 / .205
House 2 ART Density	.000 / .151	.000 / .128	.000 / .040	.000 / .175
House 5 ART Density	.000 / .135	.001 / .018	.000 / .092	.000 / .175

among these areas. The nature of these disturbance processes will be further explored in the following section.

The small number and small size of hearths in the northern part of House 5 indicate these areas were not used in the same way as the rest of the house. Stratigraphy suggests two factors which may account for the difference in use of northern and southern portions in House 5. The slurries

Figure 108. House 1 artifact map.

which preceeded house abandonment and dismantling were deposited in the northern part of the house, making that part less desirable as a permanent household location. As well, the relatively short total occupation span may accentuate fluctuations in living area use which were not seen in Houses 1 and 2, with their longer occupation spans. Longer use may well result in more consistent and distinctive patterning for repetitive activities. Further tests concerning this proposal will be presented below.

Cultural Deposition Process Evaluations

These tests must be more inferential than tests of statistical randomness, because they attempt to examine probable past behavior, not simply test the randomness of the present archaeological patterns. The concept used is that although inferential hypotheses can never be "proved," when the results of testing the total set of relevant data suggest one interpretation to the exclusion of others, that interpretation can be considered supported.

Figure 109. House 2 artifact map.

Two graphing techniques are used to compare densities for stationary and movable elements—scatterplots and ternary diagrams. Scatterplots are used to graph absolute density values for individual areas and house-wide means. They compare two element densities at a time, with each axis representing one element density. Ternary diagrams are used for comparing the zonal density values for these elements. They graph the relative percent contribution made by each of the three zones (zonal proportions) in density of the tested element. Ternary diagrams display the maximum value (100%) at each apex point in the triangle, and the minimum value (0%) at each opposite side. Ternary diagrams standardize comparisons among the distributions in two ways. As with scatterplots, use of density values holds constant midden volume differences among living areas and house floors. As well, use of proportional rather than absolute density values holds constant differences in the element densities among areas and floors. This double standardization permits the comparison of relationships among the zones for each element within each area or house floor. The density value used in both types of graph was calculated as the mean density of the element (total count divided by total midden volume). The 50 cm subsquare densities used for the ANOVA tests were not needed in this investigation since the computed density value was an overall mean rather than the mean of all subsquare densities. The grid size effect introduced into ANOVA procedures by using subsquare densities is not a factor in these tests.

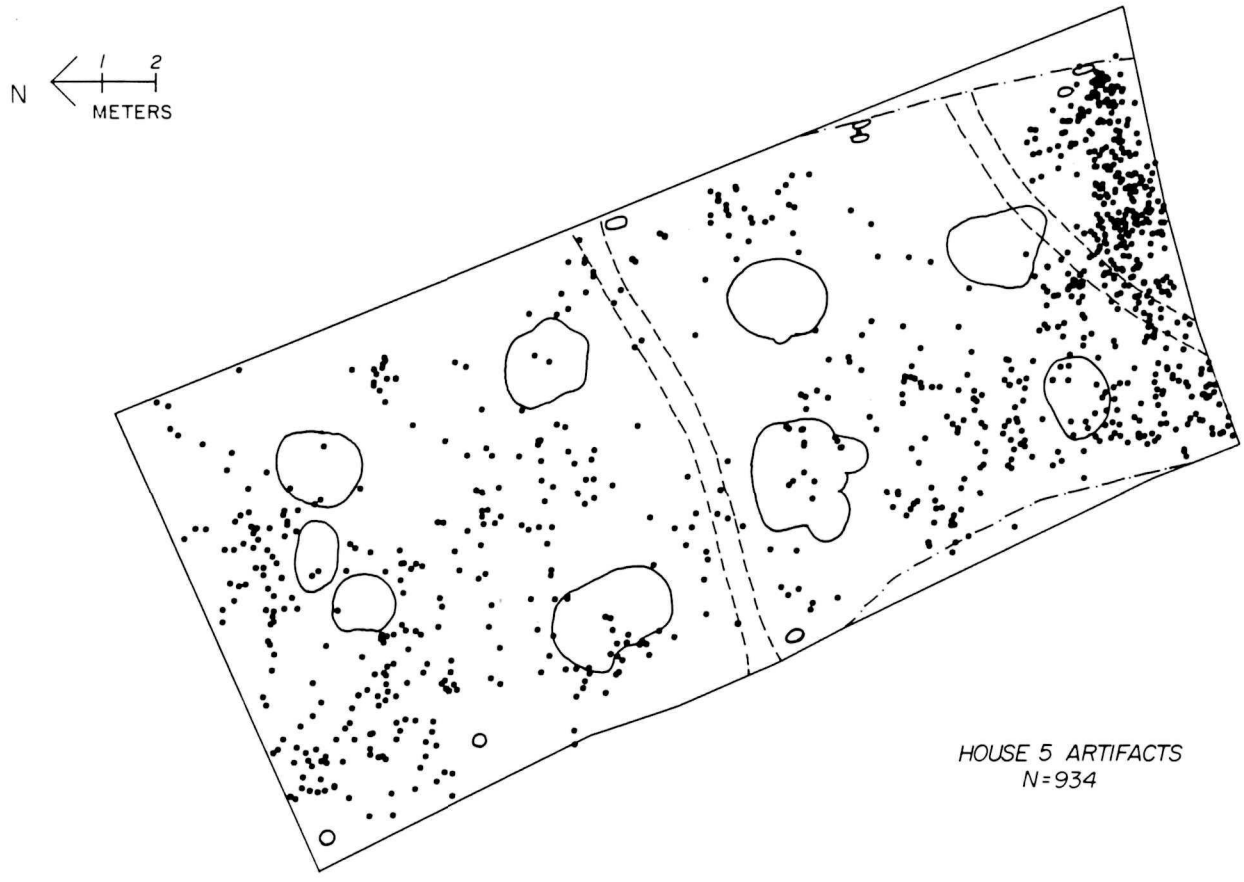


Figure 110. House 5 artifact map.

Postmolds and Stakes

Postmolds and stakes are the result of various cultural processes, the details of which are not fully understood. However, these processes can be grouped into two classes; those related to house construction/repair activities, and those related to processing/production activities or other repetitive activities conducted within the house. The first argument presented for testing is that the postmold and stake elements are the archaeological manifestation of a similar range of cultural activities with alternative discard practices. If this argument is supported, the postmolds and stakes will be combined for subsequent tests. This will allow more accurate evaluation of the cultural activities represented than by use of either element alone.

Three alternatives are proposed for discard once the usefulness of an SR in the ground had ended:

1. A stake could remain in place, forgotten or purposefully left in the floor. Midden accumulation would gradually cover this object, and with adequate preservation, it would have been excavated as an stake.
2. A stake could have been driven further into the ground or broken off at the ground surface. Either activity would have removed the object from under foot in high traffic areas. Given adequate preservation, a stake would have been excavated.
3. A stake could have been pulled out of the ground. In this case, a postmold would result. This may have been the preferred practice when the stake was reusable. A postmold also

Table 14

Relative Density of Stationary Elements by House.

Element	House 1 Count	House 1 Density	House 1 %	House 2 Count	House 2 Density	House 2 %	House 5 Count	House 5 Density	House 5 %
PM	5774	125.66	64.1	2775	72.02	65.5	1250	72.30	78.2
SR	3240	70.51	35.9	1460	37.89	34.5	349	20.19	21.8
Total	9014	196.18		4235	109.91		1599	92.49	

would result if adequate preservation did not occur within the first two alternative discard practices.

For this argument to be supported, similarities between the postmold and stake distributions and metric attributes within each floor would be expected. If these alternative actions were performed as a regular part of activities, similarities in the relative quantity of each element would be expected.

Comparison of Density and Diameter Ranges

The proportion of each element's density (to their combined density) is very consistent between House 1 and House 2 floors—within 1.4% (Table 14). In House 5, the proportion of postmolds is 13.4 percentage points greater than the mean for Houses 1 and 2. This may well be due in large part to House 5's dismantling, which would be expected to increase the proportion of postmolds found archaeologically.

Within each house floor, the area densities for the postmolds and stakes are graphed with scatterplots. Figure 111A displays the House 1 areas, Figure 111B shows those of House 2, and Figure 111C for House 5. Very high positive correlations are seen between the density of postmolds and the density of stakes among all areas in each house floor. The density values, correlation coefficients (r^2), and coefficient of variation (CV) are presented in Table 15.

Pearson correlation coefficients are used in this research to assess the linear covariation between two elements (at a time) by comparison of their density values. This coefficient value potentially varies from −1.000 to +1.000. Values around zero are obtained when a weak (or nonexistent) linear relationship is found. In other words, when the values of each element vary independently of each other. Values near 1.000 are obtained for strong linear relationships. The sign denotes a positive (+) or negative (−) relationship. In a positive correlation, both density values increase and decrease alike, while in a negative correlation as one value increases the other decreases.

The high positive linear correlations show that the density of postmolds vary consistently with the density of stakes. Areas with many stakes also have many postmolds, while areas with few stakes have few postmolds. The coefficient of variation (CV) is a measure of the dispersion of area density values about their house-wide mean value. It is computed by division of the standard deviation by the mean. Low values denote little variation about the mean, while high values denote greater variation. In each house, the CV for postmold and stake densities are relatively similar. Those for House 1 are slightly lower than for House 2, while for House 5 both CV values are much greater than in either of the other two houses. The greatest variation in density among areas for

postmolds and stakes occurs in House 5, the least variation in postmold density is seen for House 1 while the least variation in stake density is seen for House 2.

The diameter ranges of the postmolds and stakes for Houses 1, 2, and 5 are shown with frequency histograms in Figure 112. A great deal of similarity can be seen among all six diameter range histograms. There is a maximum difference of 0.8 cm among the means for all six diameter ranges, and all are within 0.25 standard deviations.

In each house floor, postmolds and stakes are very similar to each other in both their diameter range and distribution pattern. This lends support for the argument that postmolds and stakes represent alternative discard practices for the same range of cultural activities. The two elements have been combined (into postmold/stakes) for further analyses, and differences in their combined density are used as indicative of variations in the intensity of cultural activities which created them.

Creation Processes

It has been suggested that two major classes of activities produced the postmold/stakes: (1) construction/repair of the house structure and furnishings; and (2) activities associated with daily economic life in the houses. This argument can be tested by comparison of the diameter range for the two classes of activities represented by these elements. Field observation and previous research (part II) suggests that the stakes identifiable as house construction elements were generally of large diameter in comparison with the total diameter range for all stakes. It is argued that house construction and repair took place more often in the bench zone than the other two zones (hearth and central), since that is where most of the load-bearing supports for the structure and interior furnishings were implanted into the ground. Therefore, it would be expected that a greater proportion of large-diameter postmold/stakes would be located in the bench zone than in the other two zones, if this division into small- and large-diameter postmold/stakes reflects distinctions between construction and daily economic activities.

The mean postmold/stake diameter is 3.83 cm, with a standard deviation of $\pm$ 2.10 cm. The zonal proportion for postmold/stakes larger than one standard deviation above the mean (diameters greater than 5.93 cm) were compared with the proportions for postmold/stakes smaller than 5.93 cm in diameter. Figure 113 presents a ternary diagram showing three house-wide means for small- and large-diameter postmold/stakes. In all three houses the bench zone contributes a greater proportion of the large diameter postmold/stakes than do the other zones. In House 1, the difference is 38.8 percentage points. In House 2, the difference is almost half that in House 1, 19.5 percentage points. In House 5 the difference is 12.6 percentage points. The hearth and central zone decreases are almost equal in House 1, whereas in Houses 2 and 5 the central zone decreases more than the hearth zone. In House 1, seven of the eight areas show an increase in their bench zone proportion for the large-diameter postmold/stakes. In House 2, the bench zone proportion increase occurs in five of the six areas, while five of the eight areas in House 5 also correspond to this pattern. The majority of these test results agree; large-diameter postmold/stakes are found in higher proportions in the bench zone than are small-diameter postmold/stakes.

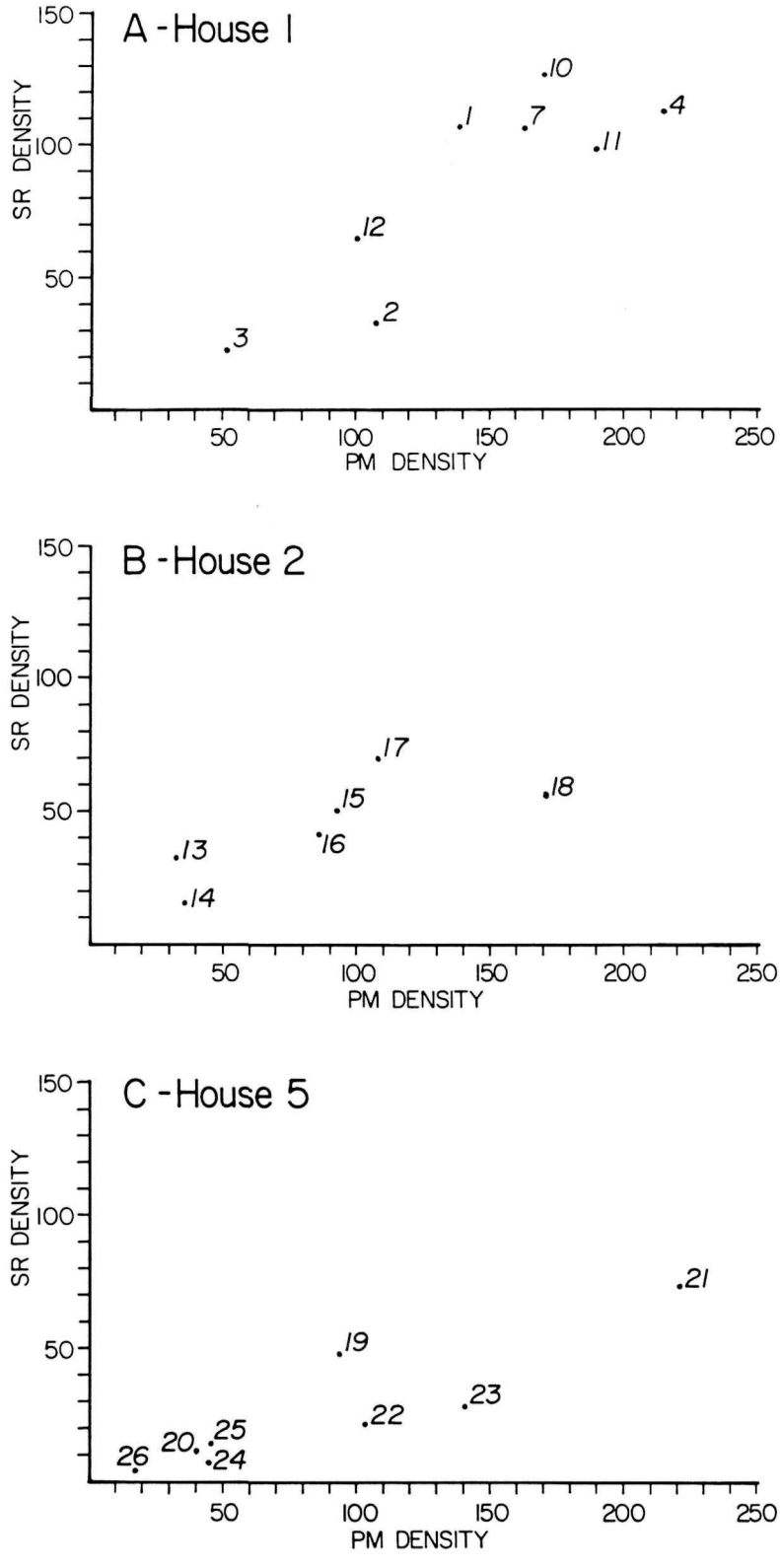


Figure 111. Postmold vs. stake density scatterplots by area in Houses 1, 2, and 5.

Table 15

Density of Stationary Elements by Area.

House 1			House 2			House 5		
Living Area	Density – PM	SR	Living Area	Density – PM	SR	Living Area	Density – PM	SR
1	137.58	106.68	13	31.70	32.41	19	94.66	48.01
2	107.36	32.95	14	35.91	15.40	20	40.75	13.07
3	50.32	21.44	15	91.87	49.78	21	231.55	73.71
4	215.77	112.37	16	86.71	41.53	22	104.36	20.69
7	161.25	106.34	17	107.54	70.87	23	140.81	29.20
10	170.25	126.01	18	191.99	56.84	24	45.93	7.13
11	189.73	97.63				25	45.94	14.62
12	100.86	64.70				26	18.39	4.45
CV =	0.379	0.467	CV =	0.589	0.436	CV =	0.775	0.897
	$r^2 = +0.856$			$r^2 = +0.754$			$r^2 = +0.902$	

Relationships to Occupation Length

Another argument generated and tested concerning the small-diameter postmold/stakes is that their relative amount in each house floor would be a reflection of the relative length of occupation for the houses. This argument is based on the proposal that activities associated with daily economic life were relatively consistently performed from year to year, and thus their record would be accumulated gradually over time. In contrast, house construction/repair activities would have been infrequent or periodic, and thus less apt to accurately reflect occupation length. For this test, the postmold and stake values used differ from those used above. Density was used in the tests above to standardize for differences in excavation volumes. This corrected for differences in surface area as well as for differences in depth of midden. In the context of the present tests, the concentration (number of items per square meter of floor midden) is used instead of density. This still corrects for differences in the surface area of area/zone partitions (and differences in overall house-floor surface areas), without correcting for variations in midden thickness. As all parts of each house floor were available for use by the occupants for the same length of time, it was not seen as appropriate to correct for midden depth differences in this estimation of occupation length. The term concentration (**Con.**) is used as a convenient way of differentiating between these counts per unit area and density—counts per unit volume. The concentration values for these stationary elements in Houses 1, 2, and 5 are presented in Table 16.

It has been argued that variations in the degree of concentration for small-diameter postmold/stakes among the houses would have been due to the interactions of three processes: (1) variations in the types of production/processing activities; (2) variations in the intensity of these activities; and/or (3) variations in the length of time these activities were conducted (Samuels 1983b). It is not within the scope of this paper to propose final statements concerning these three sources of variation, as their results and interactions are potentially very complex, and require continuing investigation. However, the results of faunal analyses have provided a qualitative measure of the variations among the house floors in the types of processing/production debris.

Of necessity in this study, it has been assumed that variations in the types of faunal debris accurately reflect variations in the types of processing/production activities. Results from faunal

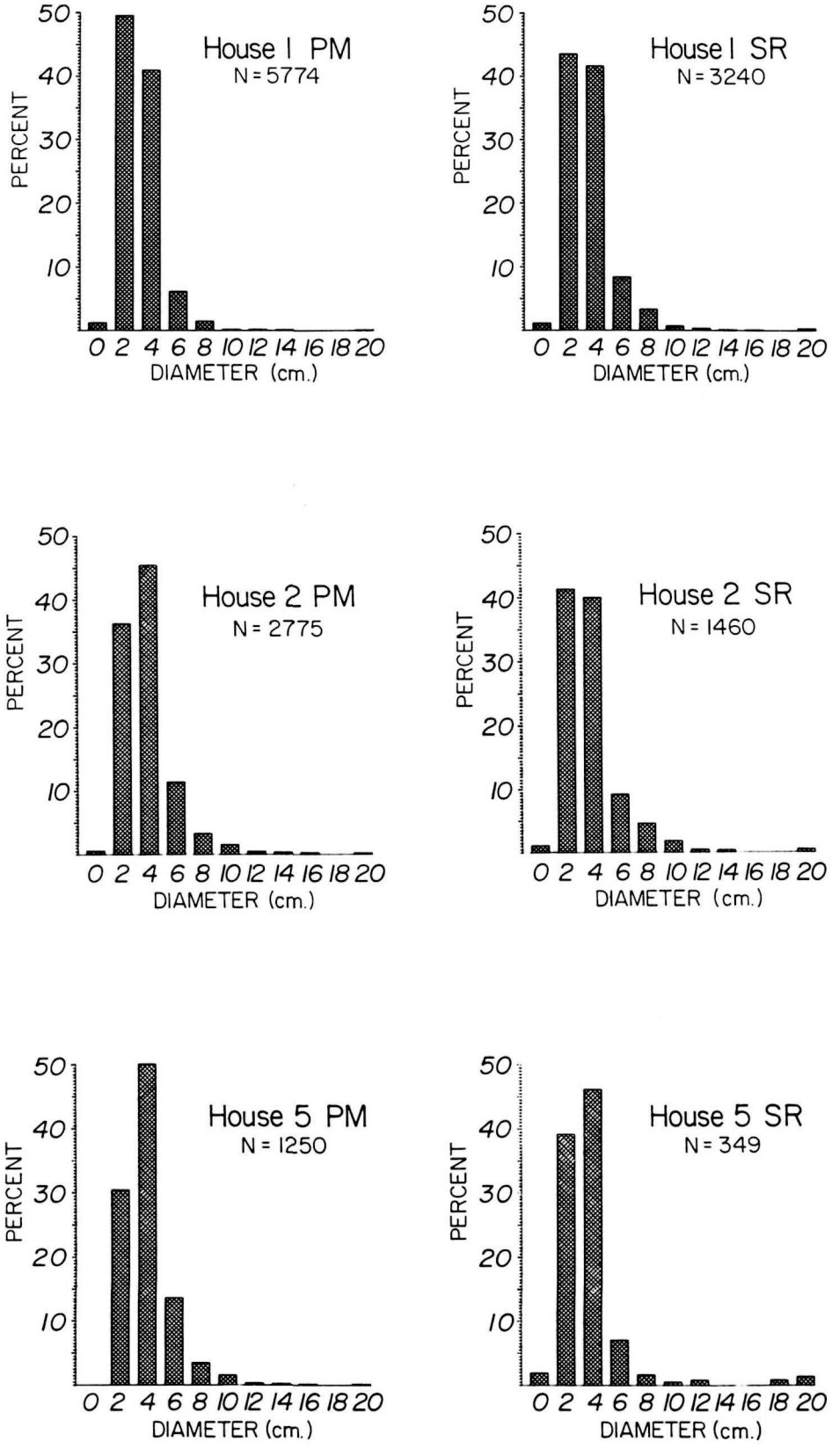


Figure 112. Histograms of stationary element diameters by house.

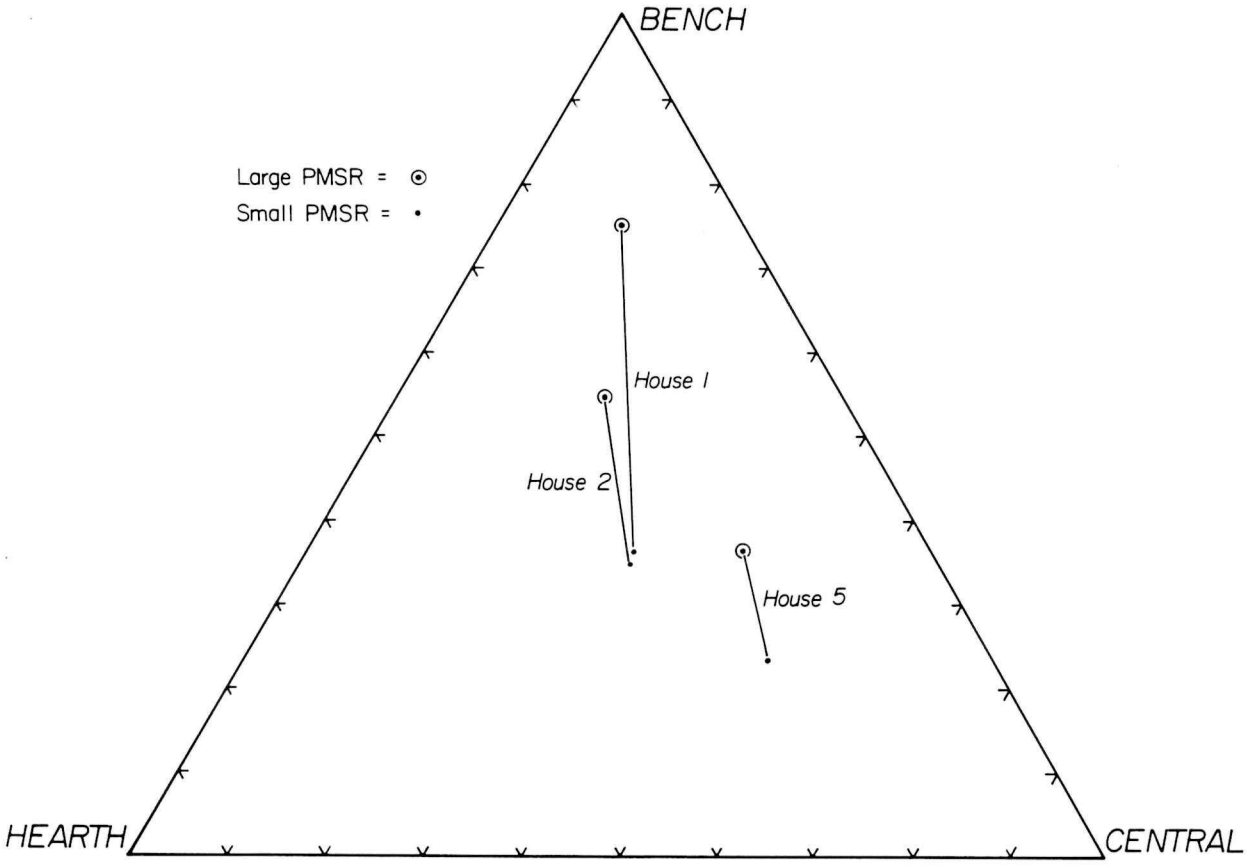


Figure 113. Ternary diagram of small- vs. large-diameter postmold/stakes by house.

analyses suggest that for sea and land mammal utilization, essentially the same species were exploited in all three houses, in approximately equal proportions. The variation among the houses in fish and shell utilization appears to have been greater than that of the mammals, with more small-size fish and more secondary prey shellfish used in House 2 than in House 1. However, based on this information, variations in activity type appear to have been relatively minor among the occupants in these three houses. Variations in intensity of processing/production activities among the houses also are difficult to evaluate quantitatively. However, it is expected that such variations would affect both stationary and movable element densities. Comparisons of small-diameter postmold/stake and artifact densities presented below do not suggest major intensity variations among the houses were likely in processing/production activities. For the current test, variations in intensity also are assumed to have been minor. Given this reasoning, variations in occupation length are proposed as the major source of the variation in concentration of small-diameter postmold/stakes among the houses.

For this argument to be supported, several relationships between small- and large-diameter postmold/stakes would be expected. First, greater length of occupation would have produced higher concentrations of the small-diameter elements. However, the concentration of large-diameter elements would not be expected to vary as consistently with occupation length, as these elements were more often the result of construction activity. It is proposed that house construction would initially have produced a high proportion of large-diameter elements, and subsequently, rebuilding/repair would have occasionally resulted in more large-diameter elements. The distinction is

Table 16

Small- vs. Large-Diameter Stationary Element Concentrations by House.

Element	Count	Con.
H1 small PM	5435	27.52
H1 small SR	3121	15.80
H1 small PMSR	8556	43.32
H1 large PM	369	1.87
H1 large SR	275	1.39
H1 large PMSR	644	3.26
H2 small PM	2363	14.74
H2 small SR	1418	8.85
H2 small PMSR	3781	23.59
H2 large PM	451	2.81
H2 large SR	214	1.34
H2 large PMSR	665	4.15
H5 small PM	1071	6.34
H5 small SR	329	1.95
H5 small PMSR	1400	8.29
H5 large PM	208	1.23
H5 large SR	29	0.17
H5 large PMSR	237	1.40

that construction/repair would have been an irregular activity, whereas the day-to-day economic and social activities that created small-diameter postmold/stakes as by-products would have resulted in a steady, relatively constant accumulation of these elements in the floor midden. An additional expectation is that differences among the houses in the degree to which the structure itself was recovered archaeologically should be reflected in the relative concentration of the large-diameter elements, but not in the concentration of small-diameter elements.

House 1 accounts for 57.6% of the total concentration of the small-diameter postmold/stakes (total from all three houses), House 2 for 31.4%, and House 5 for 11.0%. If this relationship is translated into estimated occupation lengths (by setting the House 1 total equal to 100 years), House 2 occupation would be 55 years, and House 5 would be 19 years. This relationship is very similar to the occupation length estimates independently obtained during excavation from analysis of the microstratigraphy.

For the large-diameter postmold/stakes, House 1 accounts for 37.0% of the total, House 2 for 47.1%, and House 5 for 15.9%. These proportions are consistent with expectations, given the factors presented above. House 2 contained the most complete structural remains, with all four walls represented. The east wall also showed at least one major rebuilding (Gleeson 1980a:19). In House 1, evidence of repair and rebuilding of the structure also was found, but the west wall was almost totally lost after having slumped onto the beach during the 1969–1970 winter storm (Gleeson 1973a:1). In House 5, most of the east wall, and portions of the west and south walls, were

disturbed by its dismantling and the subsequent House 2 construction activities (Gleeson 1980a: 22). Evidence of rebuilding was not noted along any House 5 wall. Thus, House 2 (with all four walls present) would be expected to contain the highest proportion of construction remains, and House 5 the least. These test results are consistent with the proposed model of variations in postmold/stake creation, and provide support for the argument that variations in occupation length among these houses are better reflected by the relative proportions of small-diameter postmold/stakes than by inclusion of large-diameter postmold/stakes.

Potential Movable Element Disturbances

It is proposed that the potential effect of cultural disturbance processes upon all movable elements could have been one or more of the following: (1) to alter their completeness (by fragmentation); (2) to remove these elements from the floor (becoming secondary refuse—exterior midden); or (3) to relocate them within the house. These processes would have occurred at the time of, or subsequent to, deposition **onto** the ground surface, but prior to total incorporation **into** the floor midden. The term "total incorporation" might be used, since material just under the midden surface could also be fragmented by pounding or heavy traffic. There are four cultural disturbance processes which potentially would have affected movable elements:

1. **Housecleaning processes.** These would be expected to have altered location by removing or relocating movable elements from the high-traffic zones to the low-traffic zone or out of the house entirely. The hearth and central zones have the potential to be high-traffic zones, while the bench zone is considered a low-traffic zone, due to its concentration of household furnishings. Material remaining in the houses which was affected by housecleaning would be moved from high- to low-traffic zones, in order to reduce the potential for hazards underfoot.
2. **Trampling processes.** These may include walking/dancing, sitting, and processing/production activities which involve pounding on the floor. These would have fragmented the more fragile (shell and fragile bone) elements in high-traffic zones, but not removed or relocated them. These processes would not have consistently affected elements in the low-traffic zone of these houses.
3. **Curation processes.** These include intentional storage of items subsequently forgotten and incorporated into the midden. These processes may have affected some artifact locations by moving these objects to the low-traffic (and storage) bench zone.
4. **Unintentional alteration processes.** These may have affected the completeness or locations of any of the movable elements, in any part of the house. Inadvertent loss and canine activity are examples of this type of process. The effects of this process may range from randomization to distinct patterning of movable elements. It is not possible to develop specific test expectations based solely on distribution patterns.

Artifact Dislocation Testing

The argument that cultural disturbance processes worked similarly on the artifacts within all areas in each house has been supported by ANOVA test results. The interpretation that small-diameter postmold/stake locations are indicative of day-to-day processing/production activities has been supported by stationary element test results. Because of these results, it is expected that there will be regular correspondences among the zones in relative density of small-diameter postmold/stakes and the of artifacts, within the areas of a house and among houses. Following

this reasoning, small-diameter postmold/stakes represent socioeconomic cultural activity locations while artifacts represent relative locations after cultural transforms.

These relationships have been tested using ternary diagrams and scatterplots. Ternary diagrams displaying the artifact distribution for each area (numbered) and the house-wide mean ($\overline{X}$) are presented in Figure 114. In House 1 (Figure 114A) the artifact zonal proportions are within 25 percentage points of each other among all areas. The three south-wall areas (10, 11, and 12) display a very high proportion of artifacts in the bench zone, while the other five areas are clustered tightly together—all are within 11 percentage points of each other. In this house, all areas contain greater than 57% of their artifact density in the bench zone.

In House 2 (Figure 114B) results are very similar to those for House 1. All areas are within 25 percentage points of each other. The two south wall areas (17 and 18) contain a high proportion of artifacts artifacts in their bench zones, while the other four areas in House 2 contained a lower proportion of artifacts in their bench zones, and cluster within 10 percentage points of each other. All areas in House 2 contained greater than 46% of their artifact density in the bench zone. This value is 11 percentage points less than the minimum bench zone proportion in the House 1 areas. The House 2 average bench zone proportion is also 11 percentage points lower than the mean for House 1. Thus the range of living area zonal proportions for House 2 is very similar to the range in House 1, with the major difference being an 11 percentage point lower bench zone contribution for all areas in House 2.

For the artifacts in House 5 (Figure 114C) the dispersion of zonal proportions is much greater than in either House 1 or 2. The range of artifact zonal proportions are within 53 percentage points of among all areas in House 5. Three of the west wall areas (22, 24, and 26) contain much lower bench zone proportions than the other five areas in this house. Although the range is much wider for House 5 areas, the mean zonal proportions are intermediate between those for Houses 1 and 2.

The small-diameter postmold/stake zonal proportions for each living area are presented by house floor in Figure 115. In House 1, (Figure 115A) the zonal proportions are within 30 percentage points of each other in all areas, and all contain less than 45% of their small-diameter postmold/stake density within the bench zone. In House 2 (Figure 115B), the small-diameter postmold/stake zonal proportions are all within 32 percentage points of each other. Only Area 18 contains greater than 36% of its small-diameter postmold/stake density in the bench zone. In both houses there is virtually no overlap between the artifact and small-diameter postmold zonal proportions for all areas. In the House 5 areas (Figure 115C) there is substantial overlap between the range of artifact and small-diameter postmold/stake distributions, mostly because of the low artifact bench zone proportions in Areas 22, 24, and 26. The small-diameter postmold/stake zonal proportions are within 37 percentage points of each other in all House 5 areas. The range in small-diameter postmold/stake zonal proportions is relatively constant among the areas within each house, with House 1 exhibiting the smallest range (30 percentage points) and House 5 the largest (37 percentage points).

Figure 116 displays a connection between artifact and small-diameter postmold/stake zonal proportions for each area using a "linkage line." The orientation of this line represents the direction of variation in mean zonal proportion between these two elements, while the length of the line portrays the degree of variation. If the proposals presented above concerning the derivation of artifact and small-diameter postmold/stake distributions are accepted, then it would be expected that the direction of the linkage line would represent the direction of change in location within an area from the source of activity to the place of deposition. In order to graphically portray this direction, a triangular tip has been added to the linkage line, forming an "arrow" which points from the small-diameter postmold/stake zonal proportion towards the artifact zonal proportion. The interpretation is proposed that the greater the length of this linkage line (or arrow), the greater the intensity of change introduced by cultural disturbance processes.

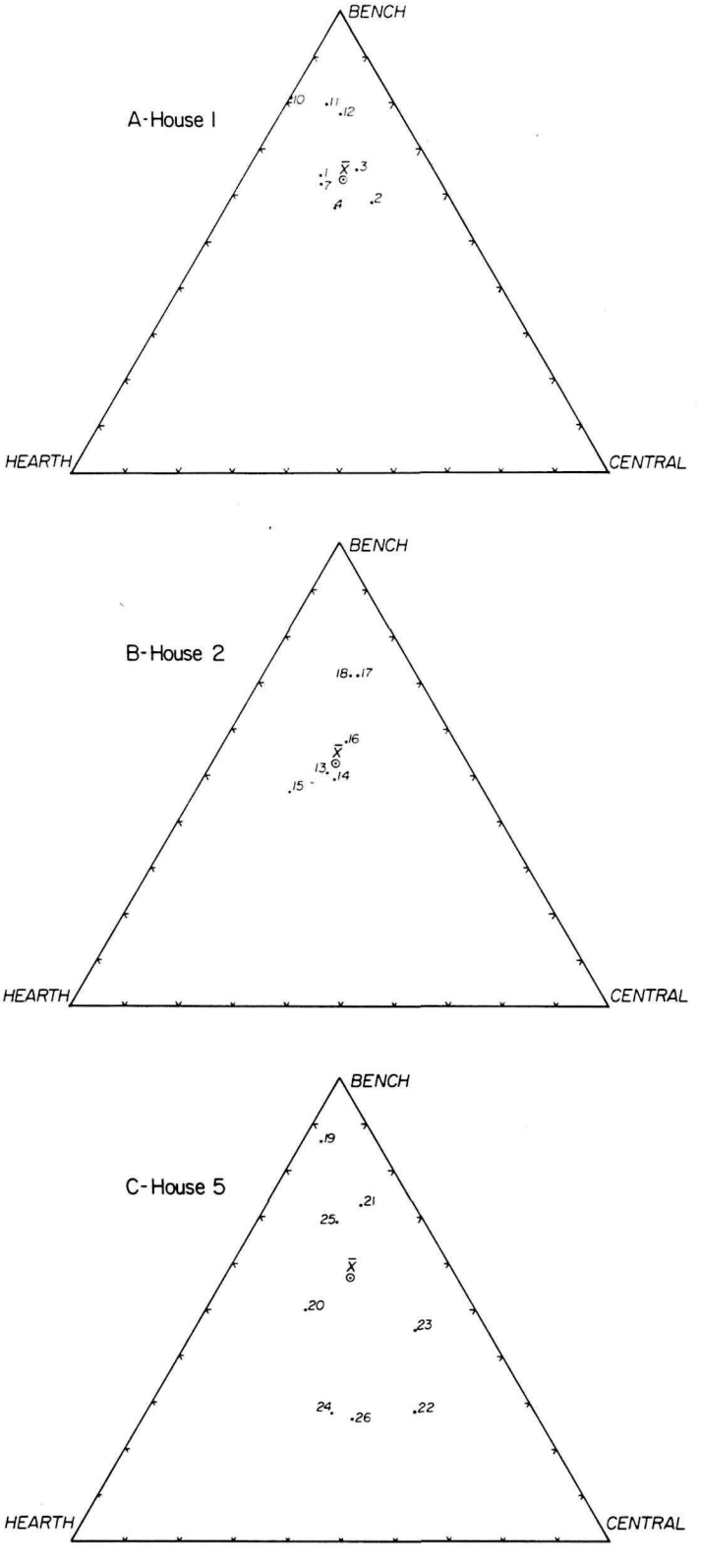


Figure 114. Ternary diagrams of artifact density by area in Houses 1, 2, and 5.

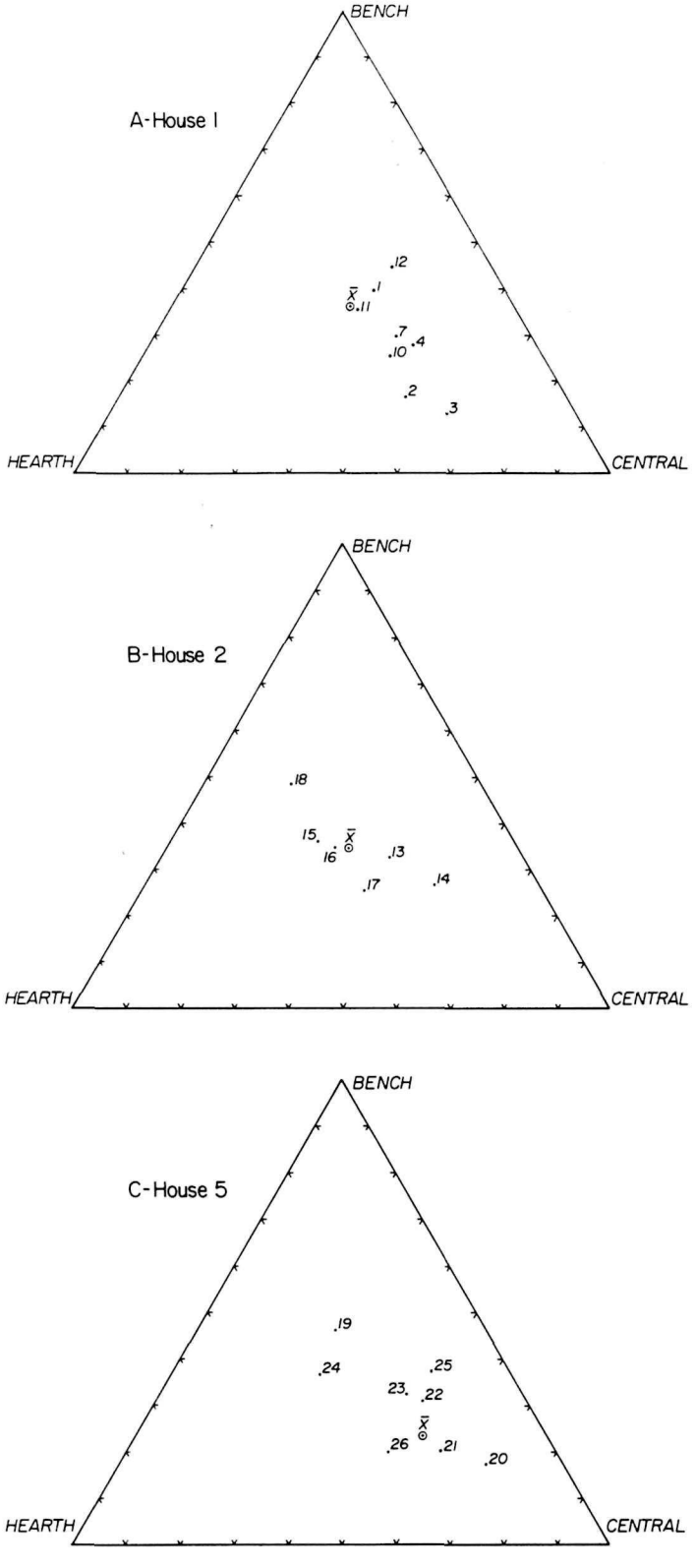


Figure 115. Ternary diagrams for small-diameter postmold/stake density by area in Houses 1, 2, and 5.

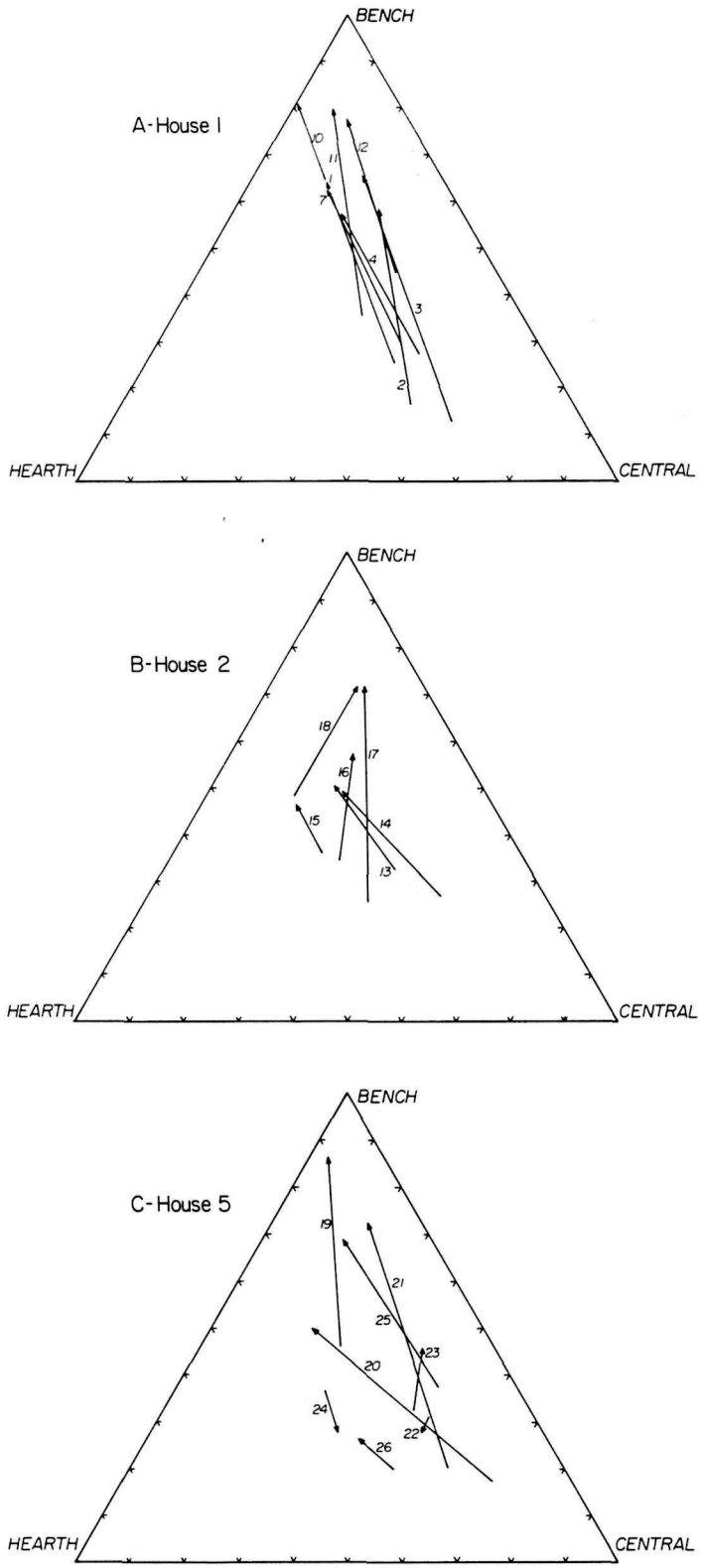


Figure 116. Ternary diagrams for artifact and small-diameter postmold/stake density linkage lines by area in Houses 1, 2, and 5.

The House 1 linkage lines for each area (Figure 116A) form a very consistent pattern. A major decrease is seen in the central zone proportion, and a smaller decrease in the hearth zone proportion, with the bench zone proportion increasing greatly. This pattern is consistent in all living areas in House 1. The smallest change (shortest line length) is 24 percentage points, the longest is 52 percentage points. The mean line length is 36.5 percentage points, while the range is 28 percentage points.

In House 2 (Figure 116B) the scatter of line directions is slightly less consistent than in House 1, although the same general direction of change is evident. Area 18 is the most different from this pattern. In this living area, all change is from the hearth to bench zones, with the central zone proportion remaining constant. The shortest line length is 10 percentage points, the longest 40 percentage points. The mean line length in House 2 is 23.2 percentage points, while the range is 30 percentage points. Thus, the range of line lengths is very similar to that in House 1 areas, while the mean length is about 13 percentage points less.

In House 5 (Figure 116C), the scatter of linkage lines appears much less consistent than in either House 1 or 2. Areas 22 and 24 are inconsistent with the general pattern, in that the bench zone proportion decreases for the artifacts. The House 5 linkage lines range from 3 to 47 percentage points in length, with a mean of 23.8 percentage points.

House 1 areas exhibited the longest average linkage line length (interpreted as intensity of locational disturbance) and the greatest consistency in both length and orientation. House 2 areas exhibit shorter and slightly less consistent orientation, although the range of line lengths is very similar to House 1 areas. The mean linkage line length in House 5 is very similar to that in House 2, but both the range of line lengths and the dispersion of line directions is much wider than in either Houses 1 or 2.

Drawing behavioral implications from these results, the occupants of House 1 would have produced the most consistent and intensive relocations for the artifacts, while the occupants of House 5 produced the least intensive and also most variable alterations. In House 2, the consistency of pattern is similar to that of House 1, while the intensity is similar to that of House 5.

These test results do not conflict with the proposal advanced earlier that consistency of pattern is dependent upon length of occupation, when such patterns are created by repetitive activities. However, these results also suggest that variation among the houses in intensity of locational disturbance cannot be ascribed primarily to variations in length of occupation. I propose that these differences are the result of interhouse variations in the nature or intensity of cultural disturbance processes (c-transforms). In this regard, Houses 2 and 5 exhibit similar patterns, while in House 1 these cultural disturbance processes were more consistently and intensively performed. This argument is examined further in tests using the faunal debris densities.

Absolute densities of artifact and small-diameter postmold/stakes were also examined. Results are presented in Table 17, and displayed using scatterplots. A positive relationship with a strong linear trend can be seen in Figure 117A, which portrays relationships among House 1 areas. As the density of small-diameter postmold/stakes increases, the density of artifacts also tends to increase. Both elements are rather tightly distributed about their respective means, as the relatively low coefficients of variation (CV) show. In House 2 (Figure 117B), a weaker but moderately strong linear relationship is expressed. However in this case it is a negative relationship. As the small-diameter postmold/stake density increases, the artifact density tends to decrease. This negative relationship may partially be due to the large differences in the CV for each element. The coefficient of variation for the artifacts is very low (0.121), while the CV for the small-diameter postmold/stakes is considerably greater (0.532). The density of small-diameter postmold/stakes varies among the

Table 17

Density of Artifact and Small-Diameter Postmold/Stakes by Area in Houses 1, 2, and 5.

House 1			House 2			House 5		
	Density			Density			Density	
Living Area	ART	Small PMSR	Living Area	ART	Small PMSR	Living Area	ART	Small PMSR
1	97.89	237.95	13	146.40	57.53	19	214.35	125.09
2	67.64	136.67	14	110.79	46.93	20	64.20	50.75
3	88.00	68.15	15	122.16	126.99	21	45.10	292.26
4	119.85	322.41	16	134.42	122.69	22	37.34	118.30
7	122.45	258.63	17	111.56	152.47	23	33.74	152.29
10	194.16	282.15	18	110.97	222.92	24	26.93	49.89
11	157.80	275.47				25	33.83	52.29
12	98.60	158.78				26	32.63	20.47
CV =	0.342	0.400	CV =	0.121	0.532	CV =	1.003	0.935
$r^2 = +0.681$			$r^2 = -0.448$			$r^2 = +0.101$		

areas slightly more than either element does in House 1, but the density of artifacts is very consistent among all six House 2 areas.

In House 5 (Figure 117C), almost no linear relationship exists between these two element densities. In large part this seems due to the great difference in artifact density between Area 19 and all other living areas. A large amount of variation is seen in both element densities, with both coefficients of variation around 1.000.

These results suggest some interpretations similar to those from the zonal proportion tests. The most consistent relationship between artifact and small-diameter postmold/stake densities is seen among areas in House 1, and the least among areas in House 5. In Houses 1 and 2 areas the artifact density values are more similar than are the small-diameter postmold/stake density values, both in terms of zonal proportion and absolute density. On the other hand, in House 5 areas the small-diameter postmold/stake density values are more similar than are the artifact density values in both sets of comparisons. As well as these similarities, several differences can be seen between results. Although the linkage lines for House 1 and 2 areas are of similar direction, the correlation coefficient in House 1 is positive, while in House 2 it is negative. The dispersion of artifact zonal proportions for Houses 1 and 2 are similar, but the variation in absolute density among areas is considerably less in House 2. This confirms the visual impression of the OZMAP plots that areas in House 2 have artifact densities more similar to each other than do those in House 1 (compare Figures 108 and 109).

In House 1, occupantion along the east and most of the south wall (Areas 1, 4, 7, 10, and 11) produced relationships between artifact and small-diameter postmold/stake densities which were similar, with the remaining areas (2, 3, and 12) exhibiting lower densities of both artifacts and small-diameter postmold/stakes. In House 5, Area 19 stands out from the others by its much greater density of artifacts, but its density of small-diameter postmold/stakes is only slightly higher than the mean for the house. Because of their low density values, the other seven areas do not appear to have the intensity of occupation evident in Area 19. Examination of the feature maps and stratigraphy suggest that many of these areas may not have functioned for long, if at all, as permanent household spaces, even considering the relatively short time span of House 5 occupation. Overall, the behavioral implications proposed on the basis of the zonal proportions are substantiated when absolute densities are compared.

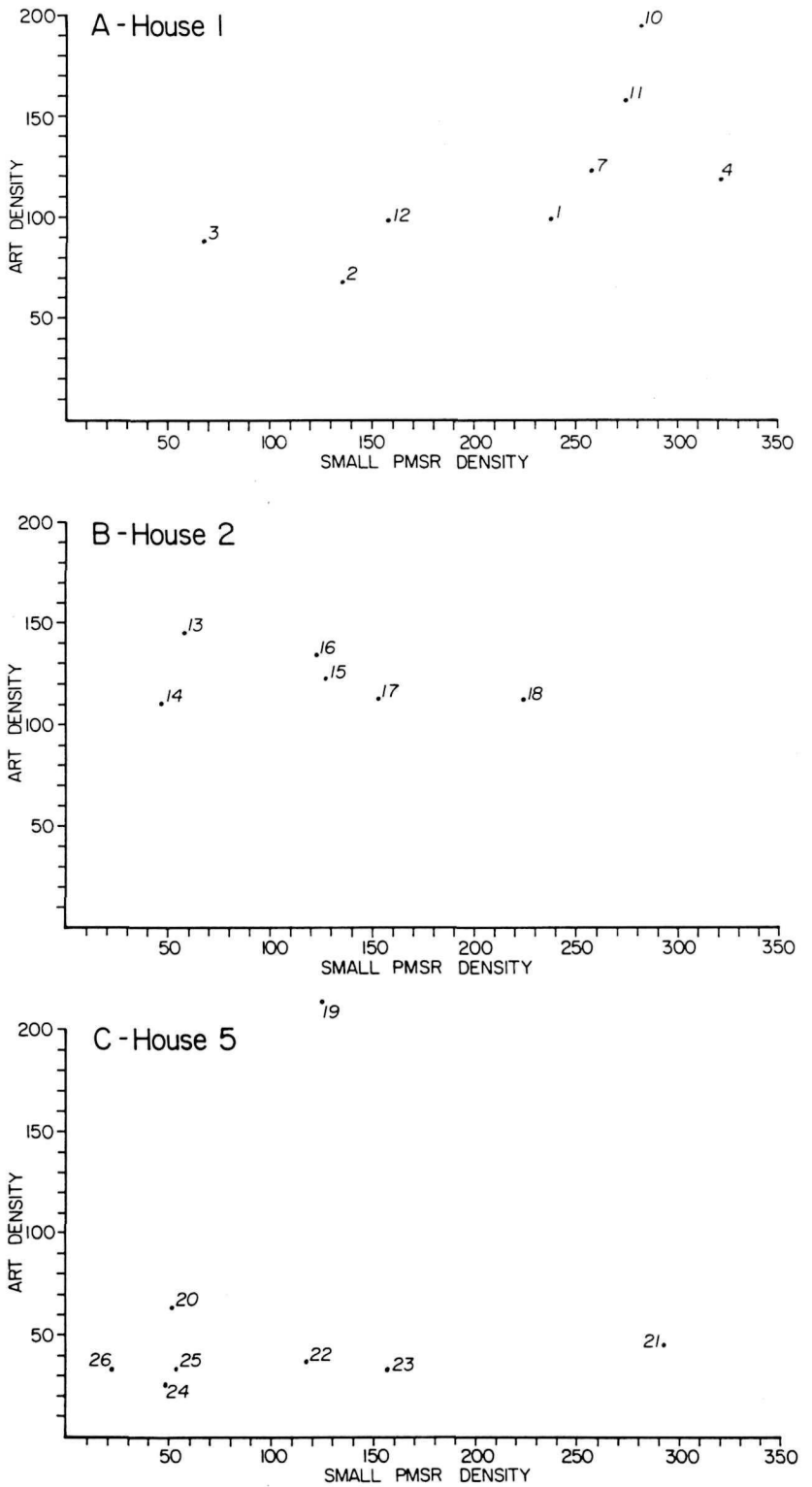


Figure 117. Artifact vs. small-diameter postmold/stake density scatterplots by area in Houses 1, 2, and 5.

Artifact Curation Testing

Curation can be viewed as another potential cultural disturbance process. It is first argued that curation should be more likely for certain artifacts than for fragments of bone or shell unsuitable for later use in making artifacts. This discussion utilizes variables recorded in the artifact field cataloguing system, and so is only preliminary to a full analysis of the artifact collection itself. It is further argued that whole tools, preforms, completed items, and raw materials would be more likely to have been curated than broken tools or debris fragments, as they more often would be reusable. Also, it is argued that curation within the house would be accomplished by storage of the item under or behind the benches. Following this reasoning, in Houses 1 and 2 the overall pattern resulting from curation processes should have acted to increase the proportion of whole artifacts deposited in the bench zone in comparison to the proportion of debris or fragments deposited in the bench zone. Since all areas in House 5 were not intensely occupied and because it was eventually abandoned, not as many reusable artifacts would be expected to have become incorporated into floor midden as compared with Houses 1 and 2.

In House 1 (Figure 118), relatively large variations between high-density clusters for whole tools and debris/fragments are seen along the north wall (Areas 1, 2, and 3) with much lower relative densities of whole tools. Along the east wall (Areas 4 and 7), high-density clusters are similar for both artifact subsets. Along the south wall (Areas 10, 11, and 12) high-density clusters vary somewhat in location, but are found for both whole tools and debris/fragments. Particularly in Areas 1, 11, and 12, larger high-density clusters of debris than whole tools are seen.

In House 2 (Figure 119), more variation in location of high density clusters is seen in the east side (Areas 13, 15, and 17) than in the west side (Areas 14, 16, and 18). High density clusters of both subsets of artifacts are found in all six areas.

In House 5 (Figure 120), little variation is seen between the two subsets of artifacts in location or intensity of high-density clusters. Area 19 contains the highest density of both whole tools and debris fragments; smaller clusters occur along the east wall (Areas 21 and 23) for both subsets. Area 25 shows a small high-density cluster of whole tools, but not of debris/fragments. Only Area 19 exhibits the kind of density pattern seen in most areas within the other two house floors. The other seven House 5 areas show very small or diffuse patterns of high-density clusters.

A ternary diagram examines the zonal proportions between whole tools and fragment/debris artifacts in each house (Figure 121). Houses 1 and 2 show a higher proportion of whole tools than debris in the bench zone (7.1 percentage points in House 1 and 9.5 percentage points in House 2) while the reverse is seen in House 5 (3.4 percentage points greater proportion of debris than whole tools in the bench zone). This result accords well with the differences in life history between Houses 1/2 and House 5. From these results, it appears that curation could have had some effect in producing overall artifact distribution patterns in Houses 1 and 2, but it was not the major factor, and the effect varied among areas.

Change Through Time in Artifact Deposition

So far in this study, the house-floor artifact distribution patterns have been considered to represent consistent deposition throughout the time of occupation. However, this may not have been the case. The three-dimensional provenience obtained for artifacts does allow investigation of diachronic variations within the period these houses were occupied. The relative height conversion, described below, is used in this investigation.

The use of relative height is based on the stratigraphic observation of laminae in the floor midden that are found deposited in high-traffic zones throughout the house floors. Evidence from

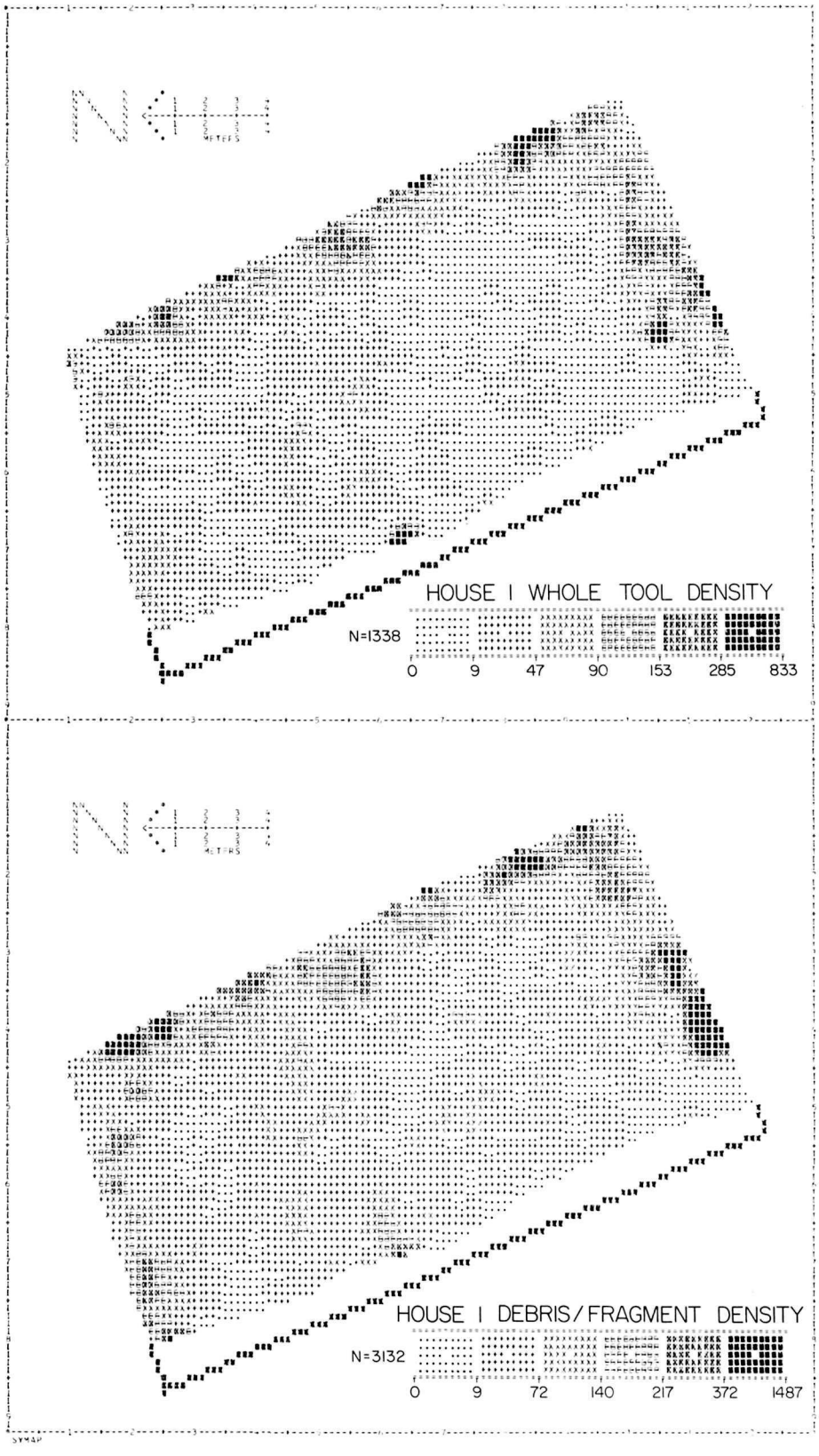


Figure 118. House 1 whole tool and debris/fragment artifact density maps.

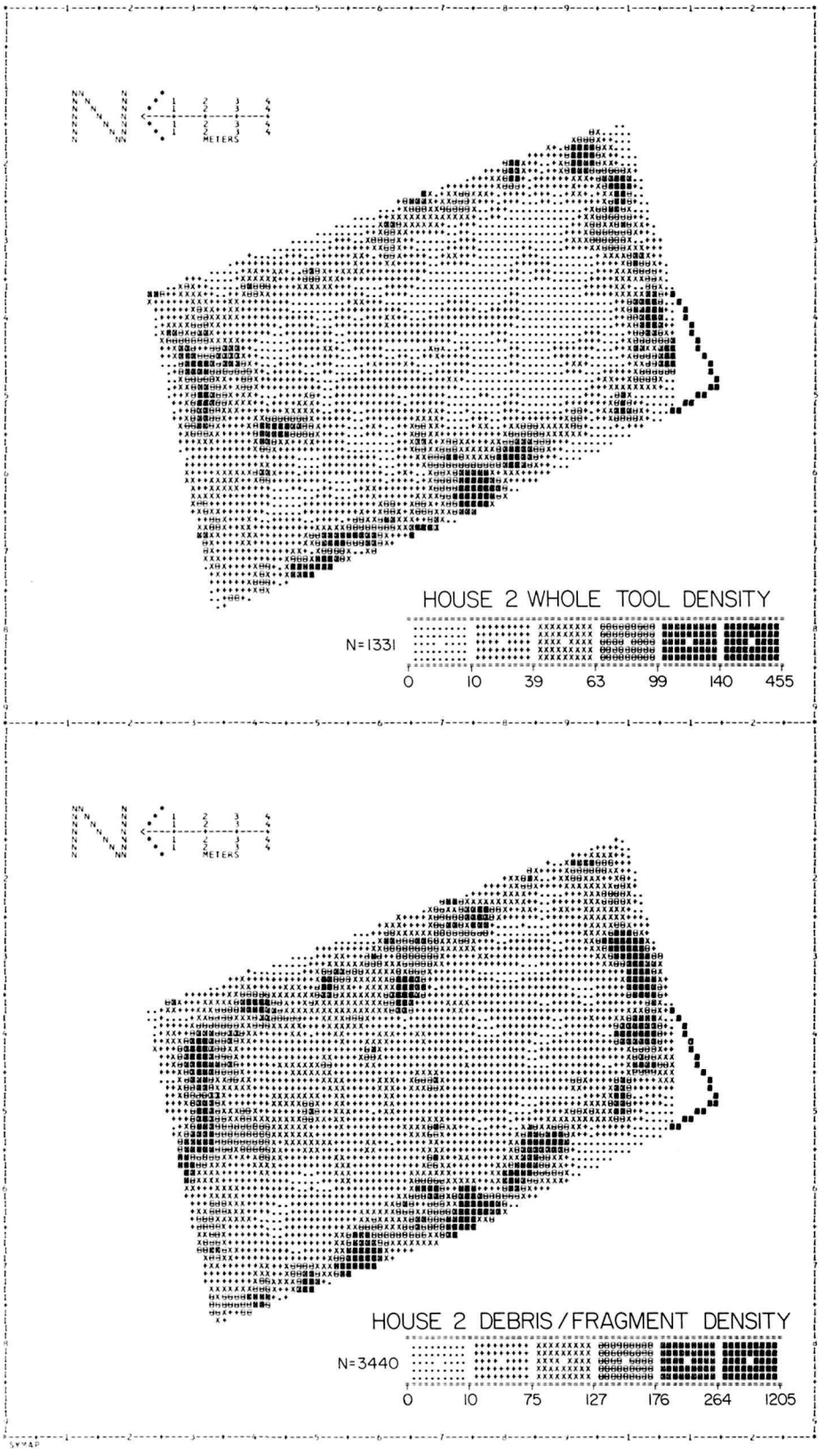


Figure 119. House 2 whole tool and debris/fragment artifact density maps.

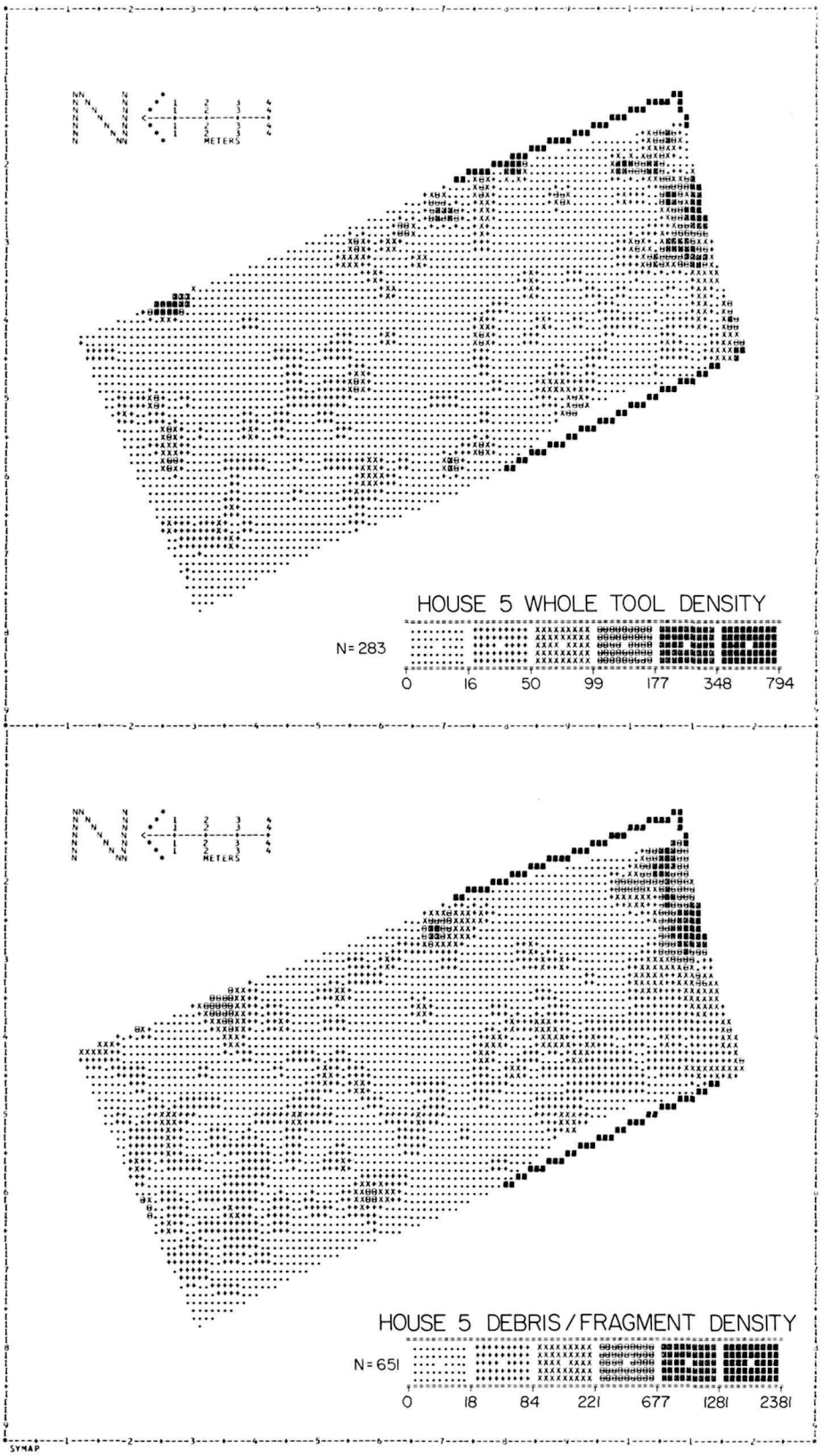


Figure 120. House 5 whole tool and debris/fragment artifact density maps.

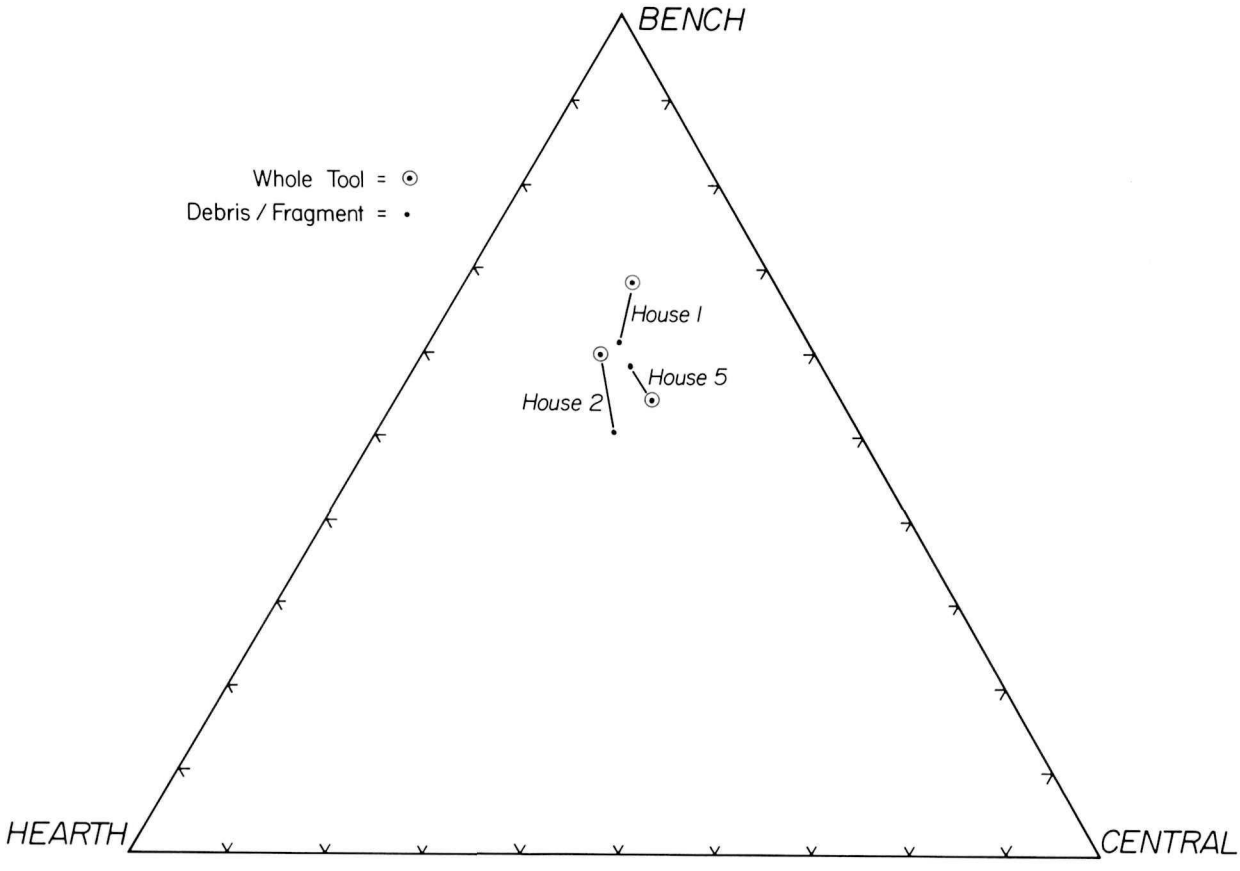


Figure 121. Ternary diagram for whole tool and fragment/debris densities in Houses 1, 2, and 5.

profile drawings shows these laminae are generally parallel, which suggests a generally consistent rate of floor midden deposition (see Figure 88). Therefore, it is argued that the relative position of objects vertically within the midden deposit is roughly indicative of the relative time of deposition during the history of house occupation. A limit to the exactness of the relative height in defining temporal change is desirable because small undulations are visible in these laminae across the floors. The thinner the vertical division (or "slice"), the greater the potential for error in artifact assignment, and a slice of midden at least 5 cm thick was considered necessary to maintain accuracy. Since in both House 1 and 2 the average midden depth is over slightly 20 cm, this allowed up to four vertical divisions to be created.

The relative height conversion was not applied at all in the House 5 floor because of its thin midden. In the southern portion of House 5 the total midden was less than 5 cm thick, often as thin as 2 cm or less. This precluded any meaningful vertical subdivision.

Contour maps were drawn based on microstratigraphy of all cross-walls exposed during excavation. These maps were used to create a series of top and bottom elevations, and these data were used in a computer program which allocated a "relative height" value to each artifact given three-dimensional provenience in the House 1 and House 2 floor middens.

This number ranged from 0.000 at the base of the midden to 1.000 at the top surface. Thus, 0.333 indicated a relative height $\frac{1}{3}$ of the way up from the base of the midden; likewise, a relative height of 0.750 indicated the object was deposited $\frac{3}{4}$ of the way up from the base. Results of subdividing the House 1 and 2 floor middens into two, three, and four slices was examined with the

Table 18

ANOVA Results for Vertical Subdivision of Artifact Counts into Relative Height Classes.

	Number of Divisions		
House	2	3	4
1	25.70	40.76	31.73
2	5.23	27.51	24.40

Note: Table numbers are F values

objective of creating the greatest variation between vertical divisions. ANOVA was used to assess potential subdivision schemes. Artifact counts (grouped by subsquare) were compared among slices, and the overall variance between slices was measured using the F statistic. The F statistic tested the hypothesis that the slice means were equal (Barr et al. 1979:125). The higher the F value, the greater the variation among the slice means. The results from these comparisons are presented in Table 18.

In both house floors, division into thirds produced the highest F value, slightly higher than division into quarters, with division into halves producing the least variance. These test results the suggest maximum variation among slices would be obtained using three divisions. OZMAP plots were created for both house floors using three vertical subdivisions of floor midden.

Figure 122 displays these for the House 1 artifacts. Each slice represents an average thickness of about 8 cm of floor midden. The hearth complexes displayed on these maps also are those associated with each vertical midden slice. Measurements of relative height for the **top** surface in each hearth area was obtained. Because it was the top surface, the relative height recorded the approximate ending point for utilization of that hearth. The beginning point of hearth use could seldom be determined, since creation of the hearth often involved digging into previously deposited midden. Since floor midden had been deposited above the top surface of capped (currently unused) hearth areas, the relative height of the ending point could be accurately determined. However, it also should be noted that because the beginning point for hearth use could not be determined for many areas, these could also have been utilized during earlier times. There is generally a consistent pattern of artifact distribution along the east and south walls of House 1, while along the north wall (especially Areas 2 and 3) more were deposited in the upper two slices than in the lowest slice.

House 2 maps are displayed in Figure 123. In this house, each slice is also composed of about 8 cm of floor midden. The House 2 maps show a more consistent pattern from slice to slice than do the House 1 maps. This visual impression is confirmed by statistical results in Table 18, as the F values obtained from House 2 slices all are lower than those for the corresponding number of slices from House 1 floor midden.

The general consistency in the artifact distribution patterns throughout the depth of floor midden suggests that a synchronic approach to evaluation of these patterns is acceptable for purposes of this initial examination. Other analysis does suggest changes in the types of artifacts do occur throughout time in portions of the floor midden (Gleeson et al. 1979:6).

In light of these test results, the proposal of greater consistency in pattern with increasing occupation time also can be evaluated. These two houses offer different patterns of change in use through time. House 2 shows more consistency among temporal slices than does House 1. In particular, the number of artifacts near the north wall in House 1 varied widely. The east and south wall artifact distributions in House 1 showed consistency similar to that seen throughout House 2.

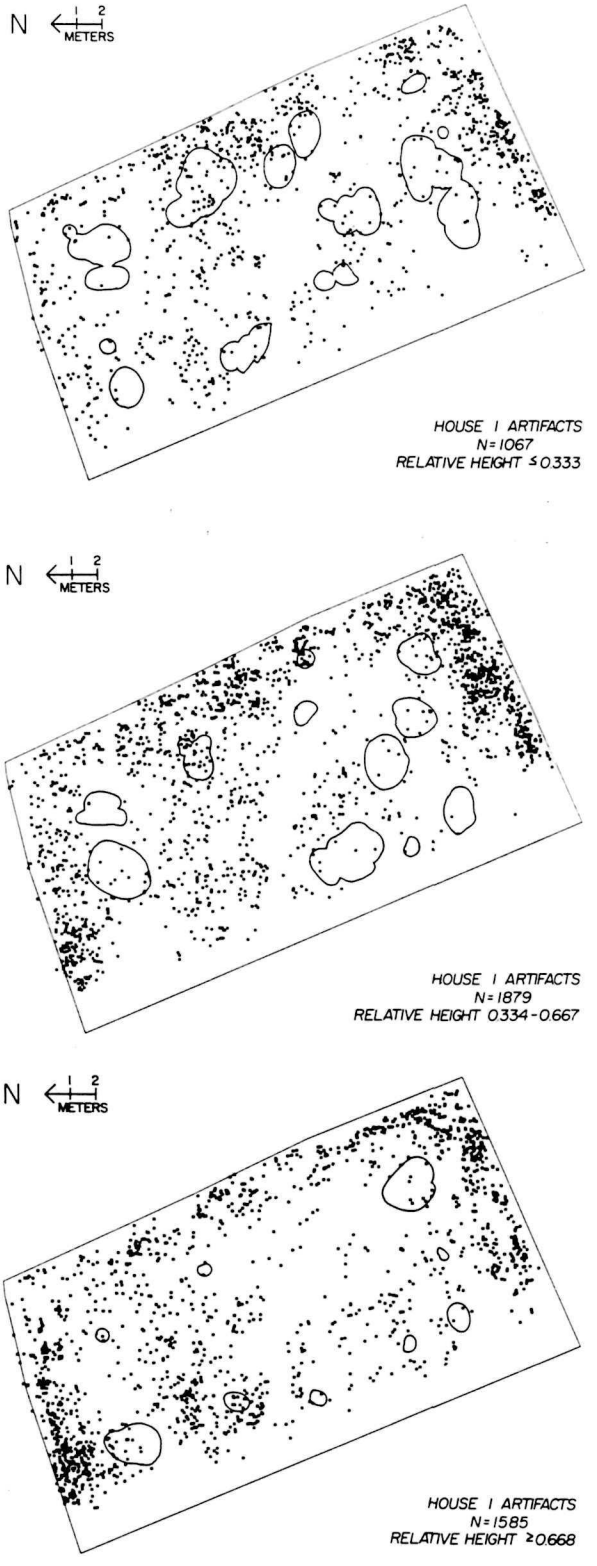


Figure 122. House 1 artifact maps, divided by relative height.

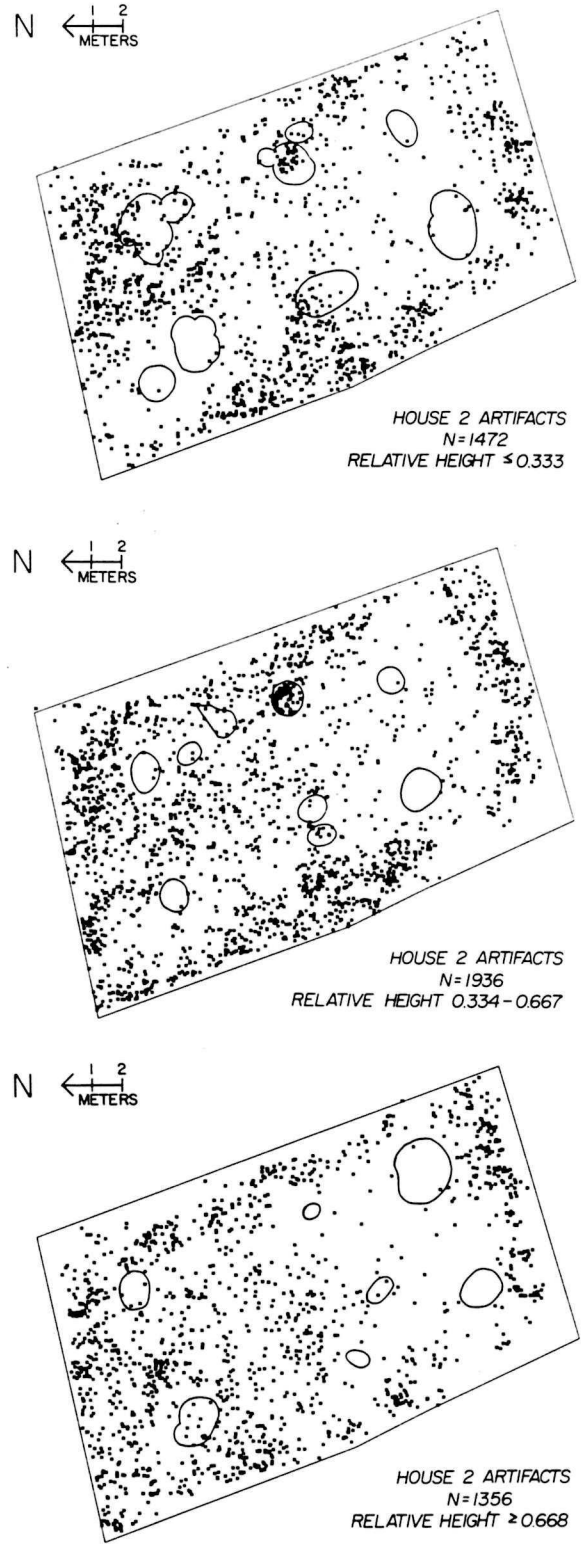


Figure 123. House 2 artifact maps, divided by relative height.

Table 19

Excavation Statistics for Faunal Debris Recovery Techniques in Houses 1, 2, and 5.

Recovery Type	Number of Units	Surface Area (Meters^2)	Volume (Meters^3)
House 1 W.S.	26	89.51	20.32
House 1 Rep.	44	108.00	25.55
House 1 Total	70	197.51	45.87
House 2 W.S.	31	88.73	21.52
House 2 Rep.	25	71.55	17.01
House 2 Total	56	160.28	38.53
House 5 W.S.	35	108.90	9.53
House 5 Rep.	20	60.08	7.74
House 5 Total	55	168.98	17.27

Overall, it can be argued that within a majority of areas from both houses there was a gradual and consistent build-up of artifacts over the time of house occupation.

Faunal Debris Densities and Distributions

Recovery Technique Corrections

Two recovery techniques have been employed for the quadrat (unit/level) provenience elements. In approximately half of the house-floor excavation units (Table 19), a hand-sorted "representative sample" (**Rep.**) of these elements was collected. The excavators used their judgment in saving a portion of all debris felt to be indicative of the type and quantity of the total debris material excavated. The rest of the excavation units were water-screened (**W.S.**). In this technique, all floor midden was washed through a $^1/_4$-in mesh screening and all material not passing through the screen was saved and analyzed. As would be expected, these variations in excavation technique resulted in a significantly greater amount of small items recovered by the screening method (Huelsbeck 1981a:5). Within each house floor, the proportion of each recovery technique differed, as did the relative location of excavation units using each technique.

In density comparisons within this section, variations in proportion and placement of units using each recovery technique are standardized by examining only the water-screened sample for all elements. The water-screened units also were used to calculate a correction factor, which equalized quantity differences between the "representative-sampled" units and the water-screened units in the following SYMAP plots. This correction factor is a multiplier which makes equivalent the mean density of representative and water-screened samples for each element, in each house floor. Representative sample means were always somewhat lower than were the water-screened sample means for the same element, so the correction factor always increases the value for the representative mean to become equal to the value for the water-screened mean (Table 20). The density for each

Table 20

Mean Density of Faunal Debris Elements in Houses 1, 2, and 5.

Element	W.S.	Rep.	Correction Factor
H1 small SHELL	61.51	27.17	2.264
H1 large SHELL	58.52	33.47	1.748
H1 Non-ID MBONE	186.62	83.30	2.240
H1 ID MBONE	113.34	76.76	1.477
H1 ID FBONE	128.40	28.42	5.994
H2 small SHELL	649.77	50.77	12.798
H2 large SHELL	193.75	42.39	4.571
H2 Non-ID MBONE	3560.81	131.00	27.182
H2 ID MBONE	174.10	121.24	1.441
H2 ID FBONE	892.54	92.26	9.674
H5 small SHELL	118.25	38.11	3.103
H5 large SHELL	24.13	18.99	1.271
H5 Non-ID MBONE	2095.17	122.97	17.038
H5 ID MBONE	500.60	74.40	6.728

representative-sampled unit is multiplied by its correction factor, while water-screened values remain unchanged. This combination is then plotted, using SYMAP.

The Kolmogorov-Smirnov (K-S) two-sample test was used to determine how similar are the value ranges for corrected representative-sample densities and the water-screened densities. The K-S test utilizes the null hypothesis that the cumulative proportions of the two samples are essentially similar (Thomas 1976:322). The density of debris elements was compared between the corrected representative sample and water-screened sample, as grouped by excavation unit. It was appropriate to use the K-S test to measure similarity between these two groups of values because it did not use the mean (which was generated for the corrected representative sample), but instead tested similarity by comparing cumulative frequencies for the two groups of samples. The results of this test show these two groups of data values have a high probability of belonging to the same population (Huelsbeck 1983:81). Since the two groups of samples were not shown to have come from different populations, I believe that this procedure corrected for differences in recovery rates between these two collection techniques.

Data Subset Definitions

Elements of shell (SHELL) were size-segregated using the taxon, size, and portion to allocate "small" ($<$ 1 in) or "large" ($\geq$ 1 in) to each shell record within the floor middens. A similar procedure could not be followed for the mammal bone data files, since absolute size had not been recorded. Instead, identified mammal bone (ID MBONE) was assumed to be greater than 1 in, while non-identifiable mammal bone (non-ID MBONE) fragments were assumed to be less than 1 in. This is consistent with the general pattern (D. Huelsbeck: personal communication), though not true in all cases.

In all three house floors, a greater variation between the two recovery techniques was seen in the small objects (small shell [small SHELL] , non-identifiable mammal bone [non-ID MBONE], and

Table 21

Mean Water-Screened Densities for Faunal Debris Elements in Houses 1, 2, and 5.

Element	Count	Density	%
H1 small SHELL	1,250	61.51	51.2
H1 large SHELL	1,189	58.52	48.8
H1 All SHELL	2,439	121.03	
H1 Non-ID MBONE	3,792	186.62	62.2
H1 ID MBONE	2,303	113.34	37.8
H1 All MBONE	6,095	299.96	
H1 ID FBONE	2,609	128.40	
H2 small SHELL	13,985	649.77	77.0
H2 large SHELL	4,170	193.75	23.0
H2 All SHELL	18,155	843.52	
H2 Non-ID MBONE	76,639	3,560.81	95.3
H2 ID MBONE	3,760	174.10	4.7
H2 All MBONE	80,399	3,734.91	
H2 ID FBONE	19,210	892.54	
H5 small SHELL	1,127	118.25	83.1
H5 large SHELL	230	24.13	16.9
H5 All SHELL	1,357	142.38	
H5 Non-ID MBONE	19,968	2,095.17	80.7
H5 ID MBONE	4,771	500.60	19.3
H5 All MBONE	24,739	2,595.77	

identifiable fish bone [ID FBONE]) than in the large objects (large shell [large SHELL] and identifiable mammal bone [ID MBONE]). This agrees with Huelsbeck's observation, and is as expected, since water-screening through a $^1/_4$-in mesh will often catch small objects which would otherwise not have been observed. Although the use of a water-screen requires extra time and effort, when archaeological analyses require collection of an accurate representation of all sizes of debris, the use of $^1/_4$-in mesh screen to collect debris material seems preferable to representative sampling.

As shown in Table 21, large intra and interhouse variations can be seen in the mean water-screened density values for all types of faunal debris. House 2 contained the highest mean density values for four of the five elements (House 5 had the highest density of identifiable mammal bone). House 1 contained the lowest mean density for four of the five elements (House 5 had the lowest density for large shell). Figure 124 presents these relationships in a histogram.

It can be seen in Table 21 that the three house floors differ widely in their density of faunal debris. House 2 contained about seven times the density of total shell as that of House 1, and about six times that of House 5. House 2 also contained over 12 times the density of total mammal bone as that of House 1, and nearly twice that of House 5. For identifiable fish bone, House 2 again contained the highest density, about seven times that of House 1. House 2 contained the greatest count and density of all faunal debris, House 1 the least and House 5 was intermediate.

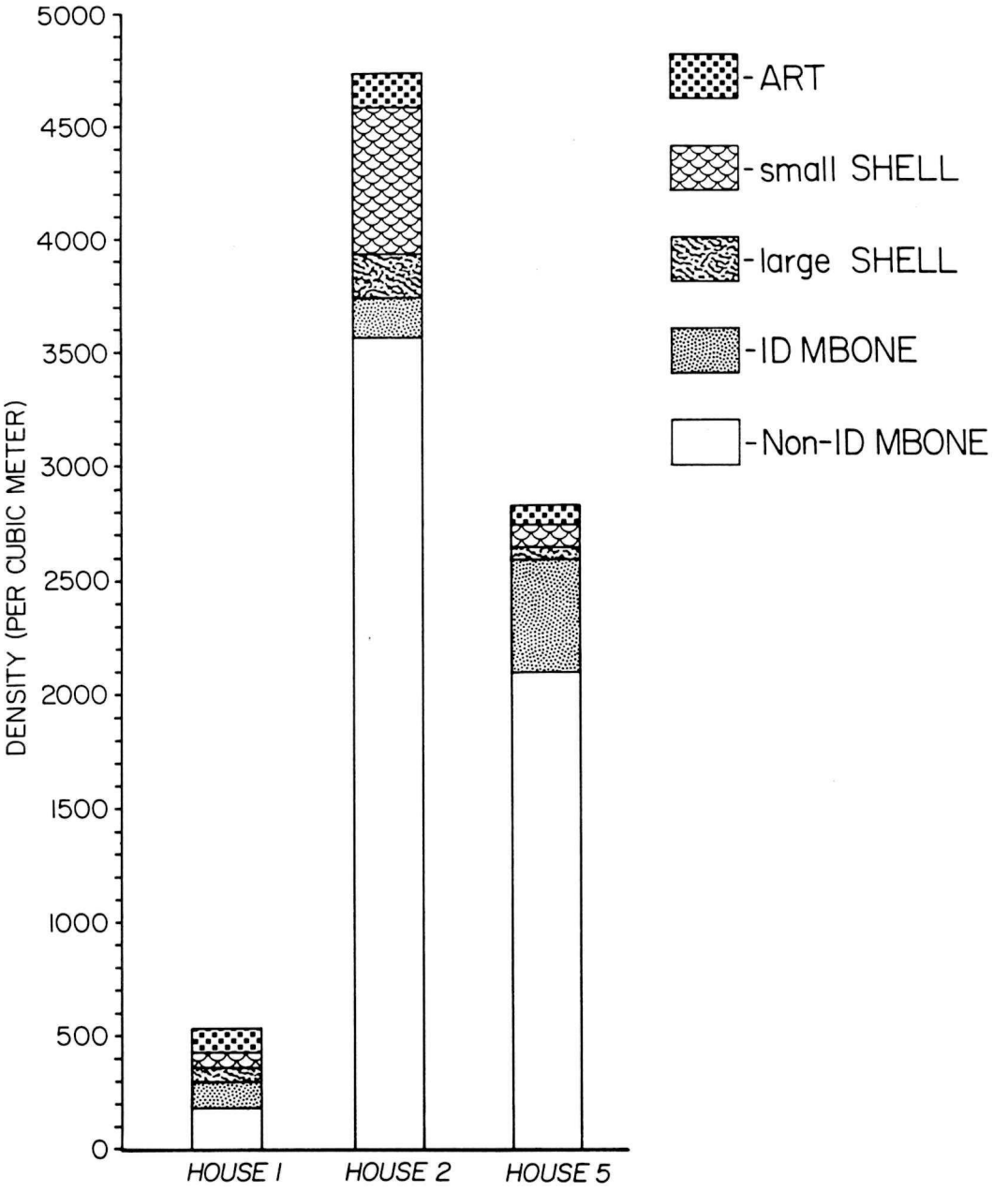


Figure 124. Faunal debris density histogram.

This is a somewhat unexpected result, based on the previous discussion of occupation length and density of small-diameter postmold/stakes. The variations among the house floors in density of artifacts and small-diameter postmold/stakes are much less extreme than are variations in faunal debris density. Two alternative explanations are proposed for this observation. First, there is the possibility that there was less similarity among these houses in type and intensity of processing/production activities than has been assumed. However, neither results from economic studies analyzing faunal remains nor the results detailed previously in this study (comparing artifact and small-diameter postmold/stake distributions) suggest such vast differences in processing/production activity among residents of these houses. An alternative explanation for the vast quantity differences in faunal debris among the house floors is that they are the result of variation in the type and

intensity of cultural disturbance processes affecting alteration or removal of debris. The following subsection attempts to evaluate the importance of such disturbance processes.

Trampling and Housecleaning Testing

Only two of the four proposed cultural disturbance processes—trampling and housecleaning—are expected to have had a major effect on the faunal debris. The faunal debris is not likely to have been affected to a major extent by curation, since the vast majority of this debris would not be considered worthy of saving for reuse. Raw materials may well have been curated, but when bundled together or otherwise associated these objects have been recognized and classified as artifacts, not faunal debris. As previously discussed, the effect of unintentional alteration processes has not be assessed, but there is no evidence to suggest they had a major effect, nor is it expected that major variations would occur among the houses in these processes. As well, both curation and unintentional relocation processes would have tended to relocate material within the houses rather than remove material from the floors to the exterior midden, and this would not explain the large density variations in faunal debris among floor middens.

Trampling would be likely to increase the numbers of small pieces (and reduce the numbers of large pieces) for fragile elements in the high-traffic zones of the houses (the hearth and central zones). Shell and fish bone are often fragile materials, though there are some exceptions. However, over 90% of all identifiable mammal bones are from the Northern Fur Seal (Huelsbeck 1981a:9), and these sturdy objects are much less likely to have fragmented by trampling activity than shell and fish bone. trampled objects would not have been removed or greatly relocated, but the number of pieces recovered would increase while the mean piece size would decrease.

Housecleaning activities would tend to remove objects entirely from the floors (to the exterior midden) or to relocate them within the structure. However, not all objects will be affected equally by housecleaning processes. Previous archaeological work (Schiffer 1978:224; Gifford 1980:102) has found that debris smaller than approximately one inch (2.5 cm) in any dimension is more likely to occur in a primary deposit, while objects larger than one inch are more likely to occur in a secondary deposit. In the present study this size distinction is applied to elements more likely to have been relocated by housecleaning processes (larger size) versus those less likely to have been affected by housecleaning (smaller size).

Following this reasoning, it is proposed that housecleaning processes would move larger objects more often than smaller objects out of high-traffic (hearth and central) zones. By the same logic, density comparisons among the house floors in size-segregated elements may be used to indicate the relative importance of housecleaning processes among the houses. More intense housecleaning would affect small objects as well as larger objects, whereas less intense housecleaning would be more likely to remove just the larger objects (although not completely).

For fragile elements, more trampling could also create more small objects in the high-traffic zones. Therefore, housecleaning and trampling processes would not be separable through examination of fragile-element densities alone, since their expected effects would be similar (increasing the proportion of small elements in the high-traffic zones). However, evaluation of the more sturdy elements (mammal bones) should allow the relative importance of trampling vs. housecleaning to be evaluated.

The following relationships are based on Table 21. While the large shell density in House 2 is 3.3 times that in House 1, the small shell density is 10.4 times that in House 1. The identifiable mammal bone density in House 2 is 1.5 times that in House 1, while the non-identifiable mammal bone density is 19.1 times that in House 1. Also, the identifiable fish bone density in House 2 is 7.0 times that in House 1. Comparisons between House 1 and House 5 show the large shell density in

House 5 to be only 41% of that in House 1, while the small shell density in House 5 is 1.9 times that in House 1. The identifiable mammal bone density in House 5 is 4.4 times that in House 1 and the non-identifiable mammal bone density in House 5 is 11.2 times that in House 1.

Although the mean density differences between House 5 and House 1 are less than the differences between House 2 and House 1, a similar pattern is seen. In all cases, the small elements vary much more between houses than do the larger elements. The small- and large-element density variation is less for the shells than for the mammal bones in all three houses. If trampling were the major process responsible for creating these density variations in size-segregated elements, less variation would be expected in the more sturdy mammal bones than in the more fragile shells, but this is not the case. It remains a possibility that household differences in the methods of shell and mammal bone processing were important in creating this pattern. However, based on results from faunal analyses, this appears unlikely. These results suggest that trampling was not the major cultural disturbance process acting on the faunal debris in these houses.

These arguments can also be examined using distribution maps. In the following SYMAP plots, the data-point spacing is at two meter excavation unit centers; this is the minimum grid size possible with these quadrat-provenienced elements. Figure 125 displays House 1 maps for the large- and small-size shell densities (corrected for excavation type). Figure 126 shows these maps for House 2, and Figure 127 presents these distributions for House 5. In the hearth and central zones of all three house floors, the high-density clusters for large shell are smaller than the clusters of small shell. The presence of relatively more small than larger shells in the high-traffic zones is the expected result if cultural disturbance processes (trampling and/or housecleaning) were important factors in creating these patterns.

In House 1, high-density clusters are seen against the wall in the northeast corner (Areas 1 and 4), with a secondary cluster in the southeast corner (Area 10). A band of moderately high density also is found between Areas 1 and 4 and Area 6 in the putative doorway along the west wall. It is proposed that this band represents the major sweeping direction for removal of faunal debris from the houses—from the major processing locality (in the northeast corner) to the doorway.

In House 2, the northern areas (13 and 14) contain most of the high-density clusters, with a secondary cluster in the southwest corner (Area 18). As discussed earlier, whether the House 2 doorway location was on the north or east walls was unclear. However, if the inference from the pattern in House 1 can be applied to House 2, the main doorway location was along the north wall, between the hearth complexes of Areas 13 and 14. In House 5, Areas 22, 24, and 26—all along the west wall—show the greatest high density clusters for both large and small shells.

House 1 mammal-bone maps are displayed in Figure 128. Both maps show the highest-density clusters in the northeast corner (Areas 1 and 4), as with the shell maps. The cluster in Area 10, the southeast corner, is in the same high-density class for the identifiable mammal bone, but has a lower relative density of non-identifiable mammal bone. The band between the northeast corner and the doorway (Area 6) is even more evident on both maps than with the shell distributions. In addition to this band, relatively high density clusters are found in the hearth zones of all areas. The relationship between non-identifiable mammal bone and identifiable mammal bone does not follow the pattern expected if housecleaning removed more large than small debris, since there are larger high-density clusters of large (identifiable) than small (non-identifiable) mammal bones. In the large shell map, most high-density clusters are located in the bench zone, whereas in the identifiable mammal bone map, most high density clusters are located in and around the hearth complexes. It is possible that the observed relationship between mammal bone distributions in House 1 is a result of their discard in the hearths, rather than removal by housecleaning processes.

In House 2 (Figure 129), the high-density clusters of non-identifiable mammal bone are found in the north half of the house; against the east wall in Area 14, between the hearth complexes

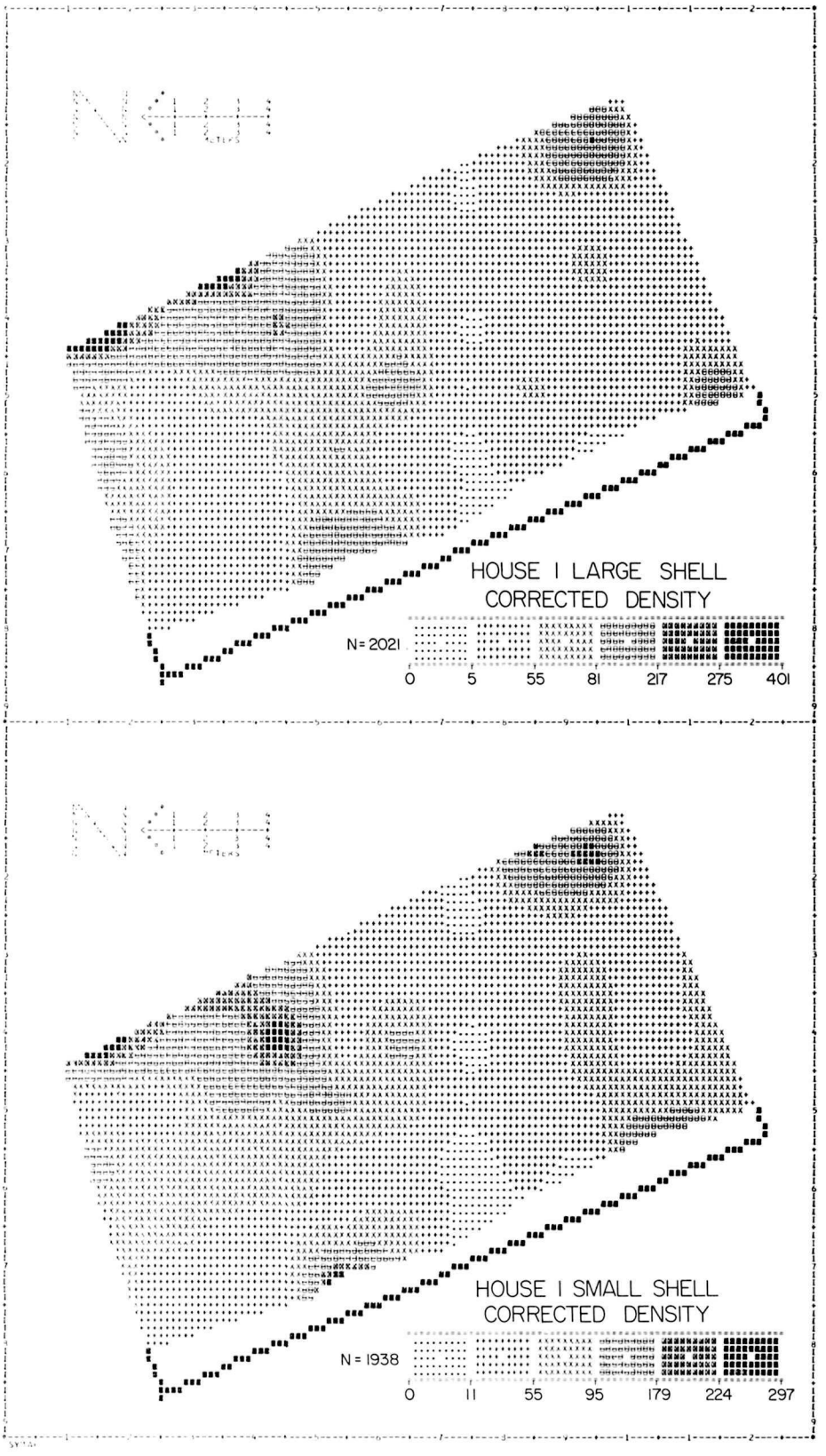


Figure 125. House 1 density maps for small and large shells.

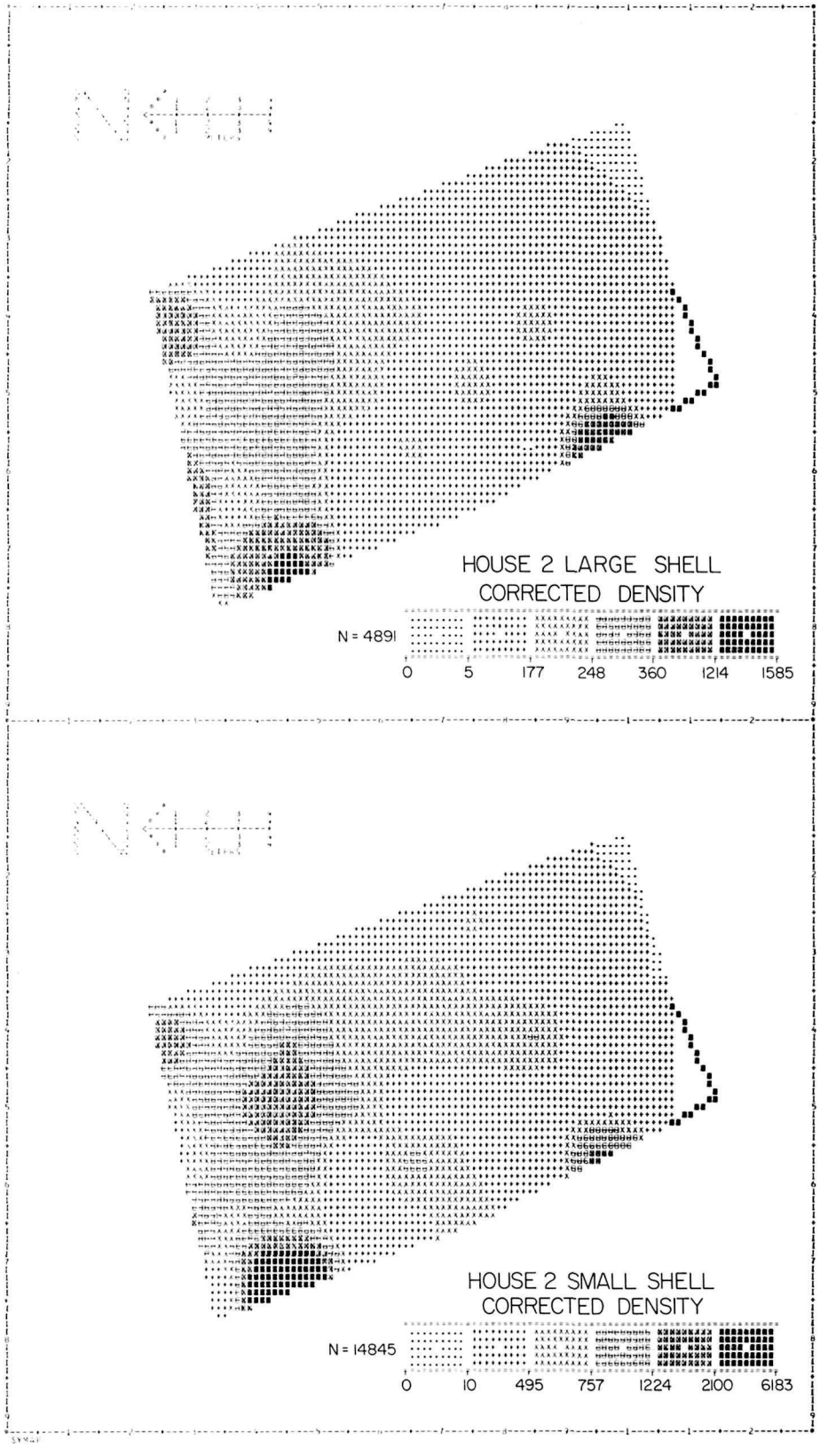


Figure 126. House 2 density maps for small and large shells.

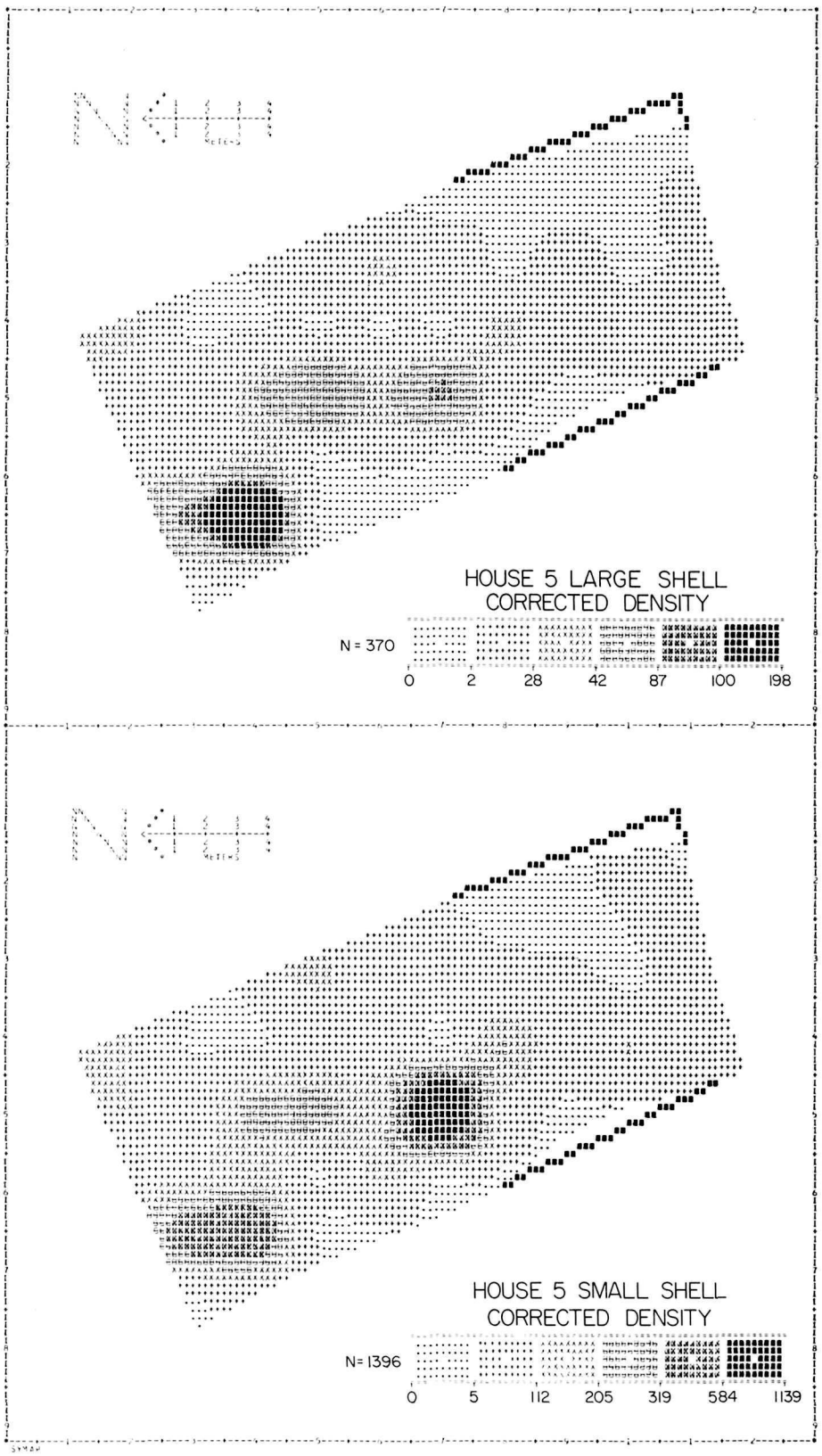


Figure 127. House 5 density maps for small and large shells.

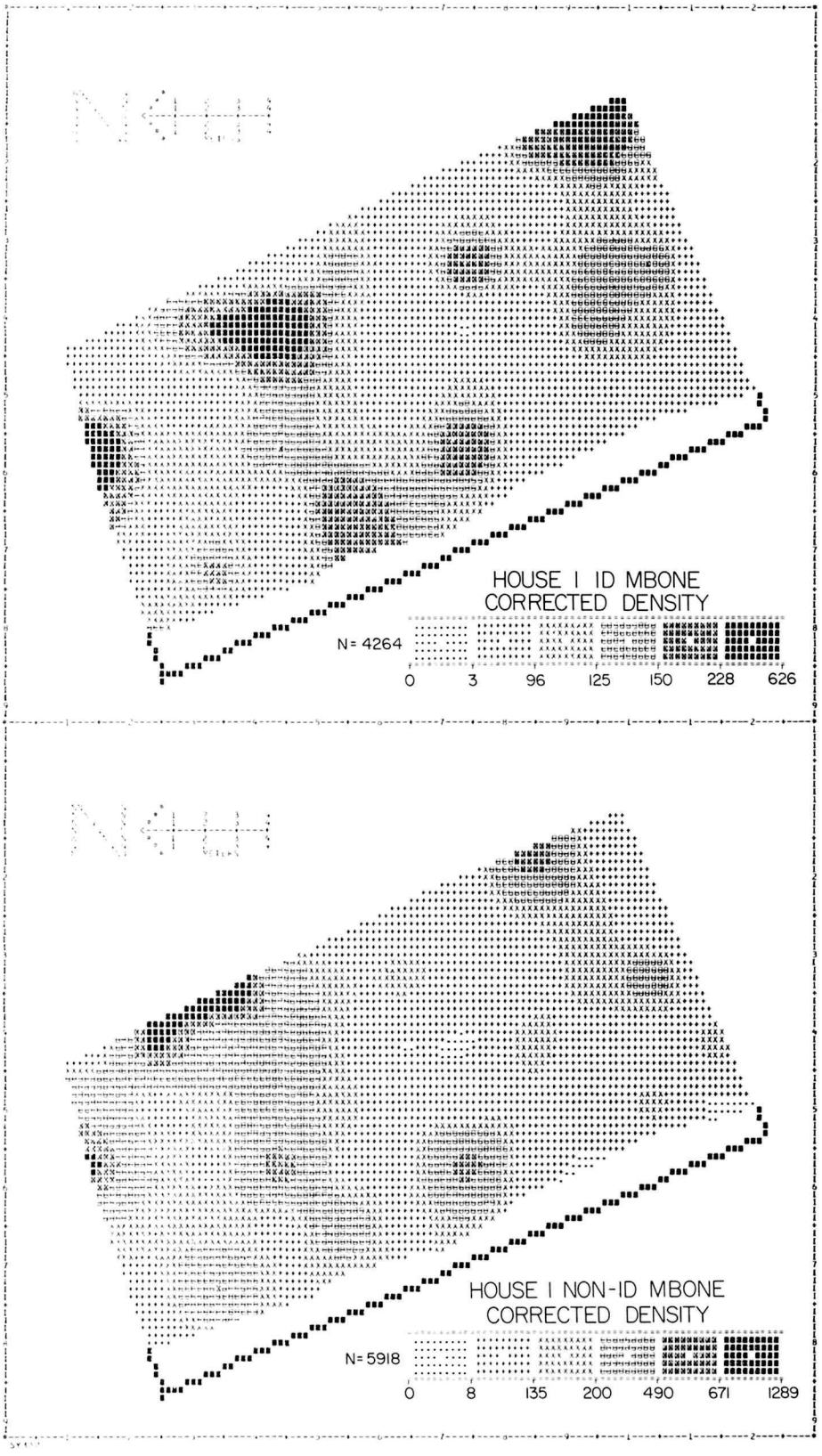


Figure 128. House 1 density maps for non-identifiable mammal bone and identifiable mammal bone.

of Areas 13 and 14, and continuing into the central zone. The identifiable mammal bone high-density clusters all are found against the walls, mostly in the north half of the house. The hearth and central zones show lower relative density of identifiable mammal bone than of non-identifiable mammal bone as was the pattern for all shell maps. For House 2 then, the pattern of size variation seen is understandable if housecleaning was a major process in its creation.

In House 5 (Figure 130), high-density clusters for both subsets of mammal bone are found in the north half of the floor, spread among all three zones. The relationship between identifiable and non-identifiable mammal bones in the high-traffic zones is not as clear in House 5 as in House 2. The identifiable mammal bone high-density clusters appear closer to the house walls than do the non-identifiable mammal bone high-density clusters; however clusters appear in all three zones for both maps. The north half of House 5 contains most clusters for both maps.

In all three houses, the mammal bone maps show more high-density clusters than do the shell maps. If the argument is accepted that small-size element high density cluster locations represent processing localities, this suggests that shell processing/consumption may have been more localized than mammal-bone processing in all houses. Differences in processing technology may account for these spatial variations. For example, meat is usually separated from bones at the time of consumption while most shellfish meat is removed from the shell prior to the time of consumption (for example, see recipes in Boas 1921).

In Houses 1 and 2, the fish bone analysis has been completed. Figure 131 shows the identifiable fish bone distribution maps for Houses 1 and 2. In House 1, the highest density is found in the southeast corner (Area 10), with a secondary cluster in the northeast (Area 4). The band from Area 4 to Area 6 is also outlined. Comparison of this map with the shell and mammal bone maps for House 1 shows general similarity, with a difference in emphasis. In shell and mammal bone maps, the cluster in the northeast corner is of greater intensity than the cluster in the southeast corner. In the identifiable fish bone map, the reverse is true. This may reflect differences in the economic orientation of the two family units resident in these areas.

In House 2, The identifiable fish bone map is similar to the non-identifiable mammal bone map, except for the lack of a cluster against the wall in the northwest corner (Area 14). The majority of the high-density clusters form a band stretching from the north wall (between the hearth complexes in Areas 13 and 14) to the center of the house floor. As proposed earlier, this band may represent the primary sweeping direction for removal of processing/production debris from this house.

The size segregation of these faunal elements appears to result in a greater consistency among the distribution patterns for the small elements (small shell, non-identifiable mammal bone, and identifiable fish bone) in each floor, than for the larger elements. In House 1, all faunal debris maps show high-density clusters in the northeast and southeast corners, and most also show a band stretching from Area 4 to Area 6. The mammal bone maps also show clusters in Areas 2, 3, and 11 which are not as evident on the shell and fish bone maps. In House 2, the southern two areas (17 and 18) are conspicuous by their lack of high-density clusters for any faunal debris. The other four areas contain clusters, with a band stretching from the center floor to the north wall prominent in several maps. In House 5, the shell clusters are confined to Areas 24 and 26, while the mammal bone maps also include Area 23 as well as secondary clusters in Areas 19 and 20.

SYMAP plots of the artifact and small-diameter postmold/stake densities are included for comparison with those representing faunal debris densities. These maps also use excavation unit (two-meter square) grid size for data points. The uniformity of grid size facilitates comparisons, but it also is apparent that the level of detail provided is much less using a two-meter grid than a 50-cm grid (compare artifact density maps in Figures 118 and 132). In all three floors, comparison between the artifact and small-diameter postmold/stake distributions show very different, almost mutually exclusive locations for high-density clusters. In House 1, the artifacts (Figure 132) are found in high-density clusters within the south and east wall bench zones, while the north wall bench zone

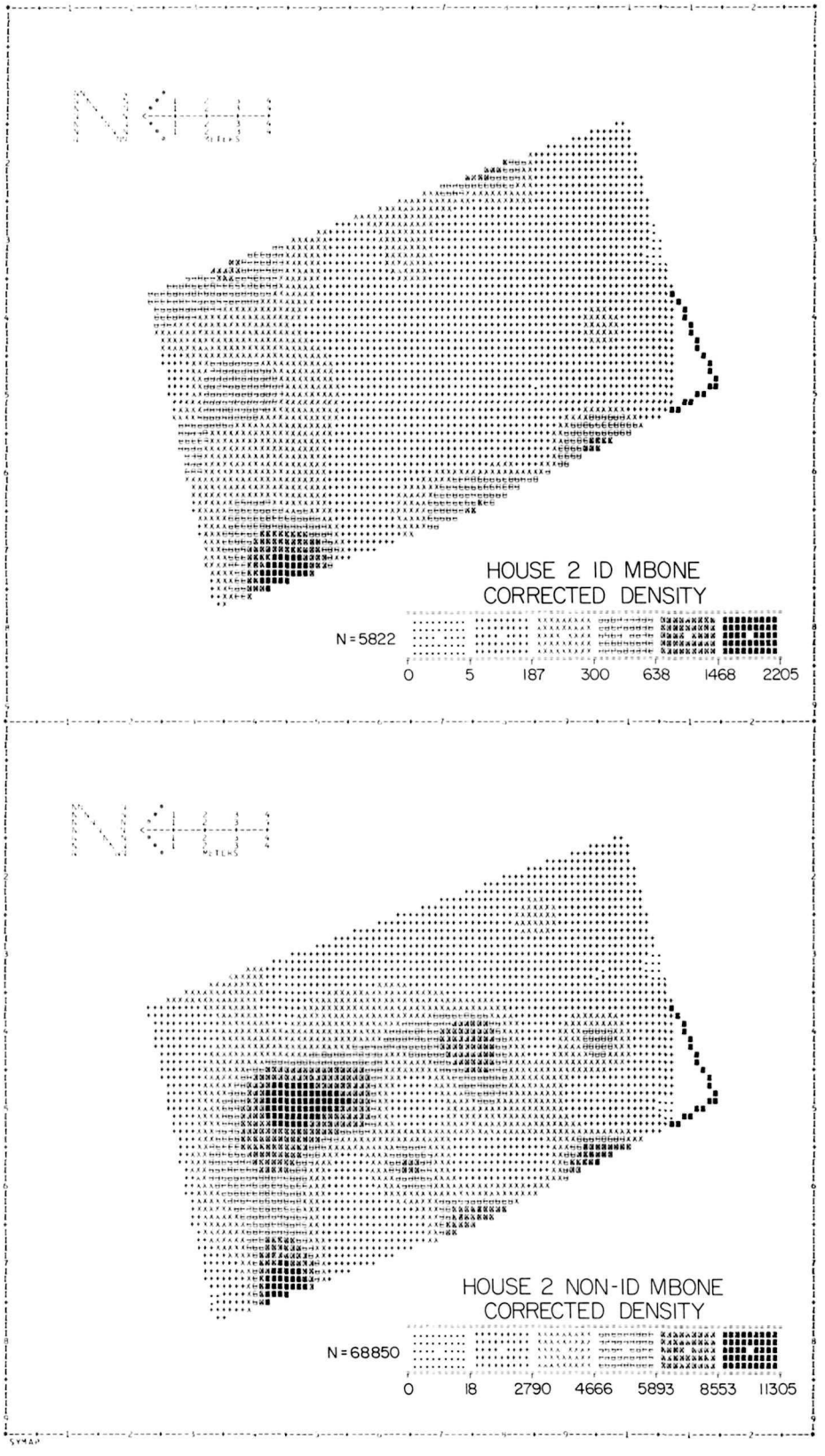


Figure 129. House 2 density maps for non-identifiable mammal bone and identifiable mammal bone.

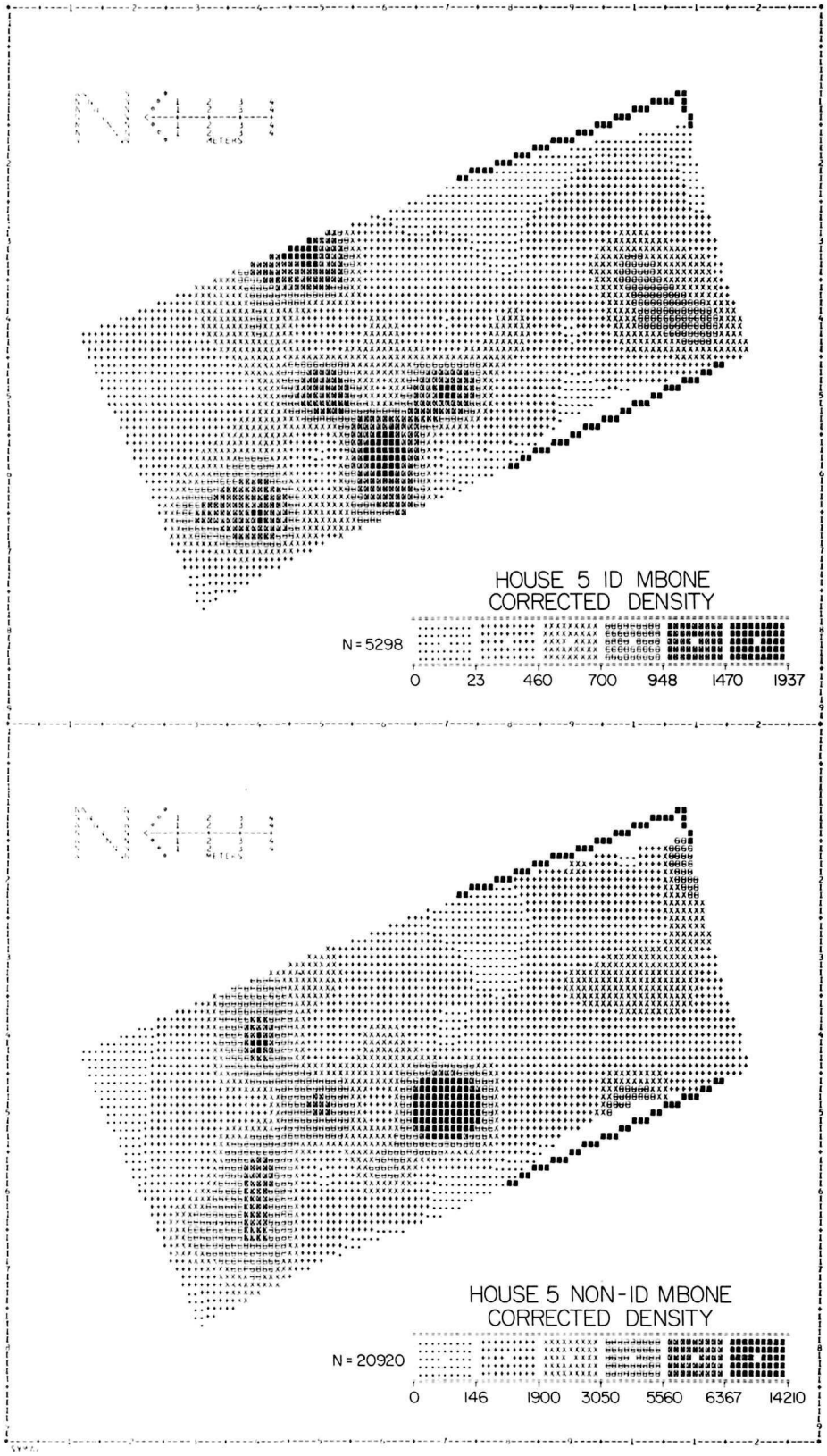


Figure 130. House 5 density maps for non-identifiable mammal bone and identifiable mammal bone.

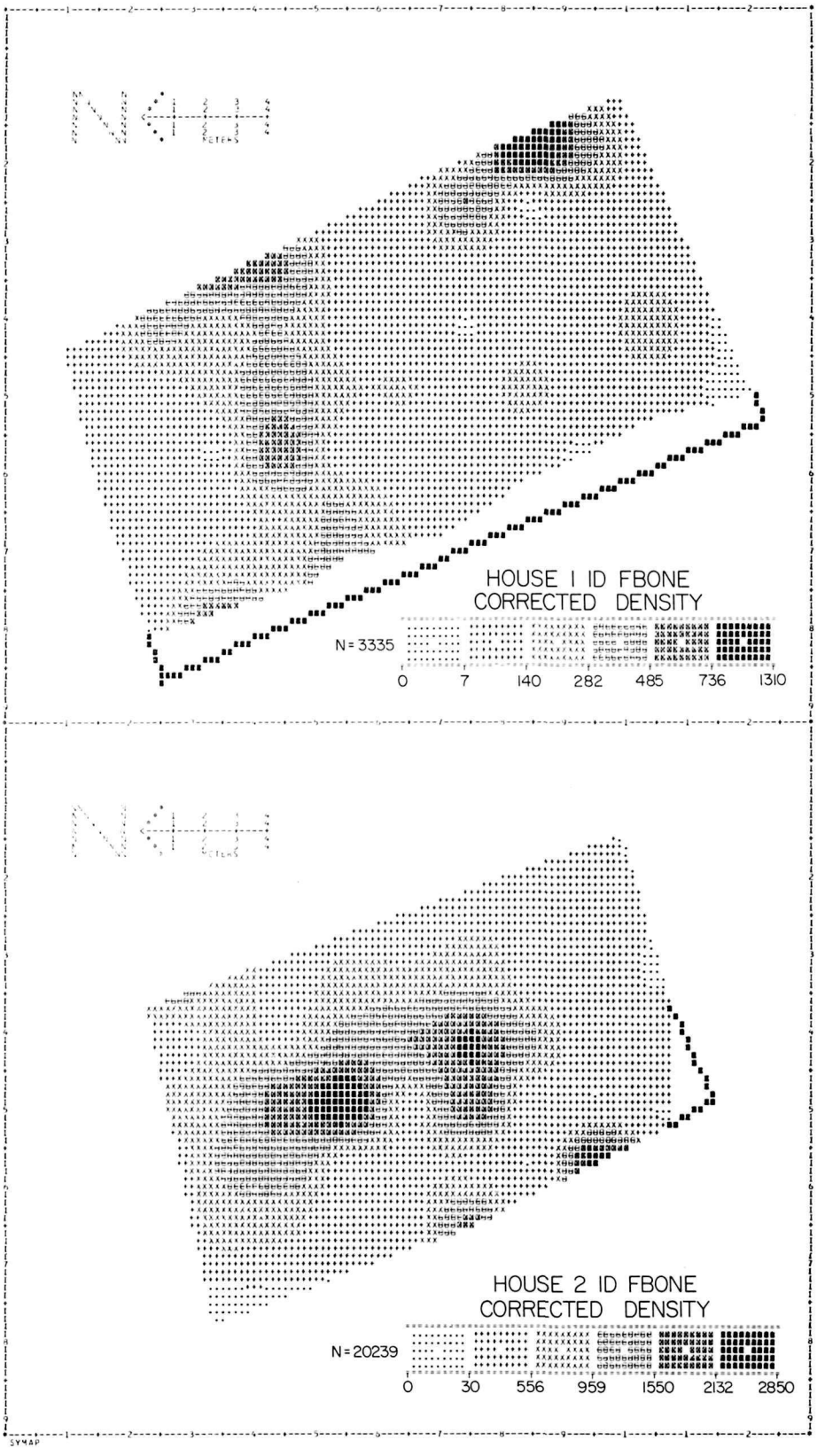


Figure 131. House 1 and 2 density maps for identifiable fish bone.

is considerably lower in density. Small-diameter postmold/stakes cluster in the northeast corner (Area 1), along the east wall (in Area 7), and in the northeast and southeast hearth and central zones (around the hearths in Areas 1, 4, 10, and 11).

In House 2, high-density clusters of artifacts (Figure 133) are found in five of the six areas (only Area 14 does not exhibit a distinct high-density cluster). Although high density clusters of small-diameter postmold/stakes also are found in all but the north wall areas (Areas 13 and 14), their locations within the southern four areas are the reverse of the artifact clusters.

In House 5 (Figure 134), only areas in the southern part of the house (Areas 19 and 21) show any high-density clusters of artifacts, with the cluster in Area 19 much larger than any other in the house. The small-diameter postmold/stakes cluster for the most part in the middle of the floor (Areas 21 through 24), with a secondary cluster in Area 19.

For each of the three houses Large variations exist between distribution patterns for artifacts and for all faunal debris in each floor. The small-diameter postmold/stake distributions appear more similar to the pattern created by faunal debris than that by artifacts. Following the argument that small-diameter postmold/stakes are indicative of actual processing locations in the houses, the similarity in distribution patterns leads to the conclusion that much of the faunal debris remaining in high-traffic zones of the house floors (especially the small-size debris) is a primary refuse deposit. The high-density patterns of faunal debris in the center of the floors appears to indicate sweeping direction for refuse removal from a house. In a contrasting pattern, the high bench zone proportion for artifacts suggest many were redeposited, thus they would not be classified as a primary deposit. This means that their excavated position would not necessarily indicate a related processing/production activity location.

Several other conclusions are proposed after considering variations among the floors in the number of items recovered in addition to their spatial patterning. The small-diameter postmold/stake concentration levels among the three floors roughly correspond to variations in occupation length among the houses. Density of the artifacts is relatively consistent among the floors, but density of faunal debris varies widely, in a pattern generally consistent with expectations, based on the principle of size sorting. In terms of the combined total density of shell and mammal bone debris, House 5 floor midden contained over five times more than did House 1, and House 2 contained over ten times more than did House 1. In both comparisons with House 1, much greater variation was seen in density of small than larger debris.

These results appear to be monitoring variations in the intensity with which faunal debris was removed from each house. In House 1, a very high proportion of all faunal debris was totally removed from the house, whereas in Houses 2 and 5 a lower proportion of all debris, and a much lower proportion of the small-size debris, was removed by housecleaning activities. The observed spatial pattern of high faunal-debris density in the high-traffic zones of these house floors can be linked to the actual location of processing activities within the structure, combined with the general sweeping direction to the doorway(s) during removal of debris from the houses. In contrast, the spatial pattern observed for high-density clusters of artifacts is linked to curation and housecleaning processes. However, it also seems probable that artifacts located in the bench zone are related to activities conducted within that area (rather than being moved from other areas in the house), so it is possible to meaningfully compare artifact contents among house areas.

The composite composition of each floor midden is shown with pie charts in Figure 135. House 1 shows a relatively equal contribution among artifact and faunal debris midden elements. In Houses 2 and 5, about 75% of all recovered objects were non-identifiable mammal bones. While the average artifact density of House 2 and House 5 midden was relatively similar to that of the House 1 midden (see Table 17), the artifact proportions (among all recovered elements) were much lower due to the high density of faunal debris in these two floors. The Houses 2 and 5 middens differed from each other in their proportion of shell, but in both over 75% of the shell debris was small shell, whereas

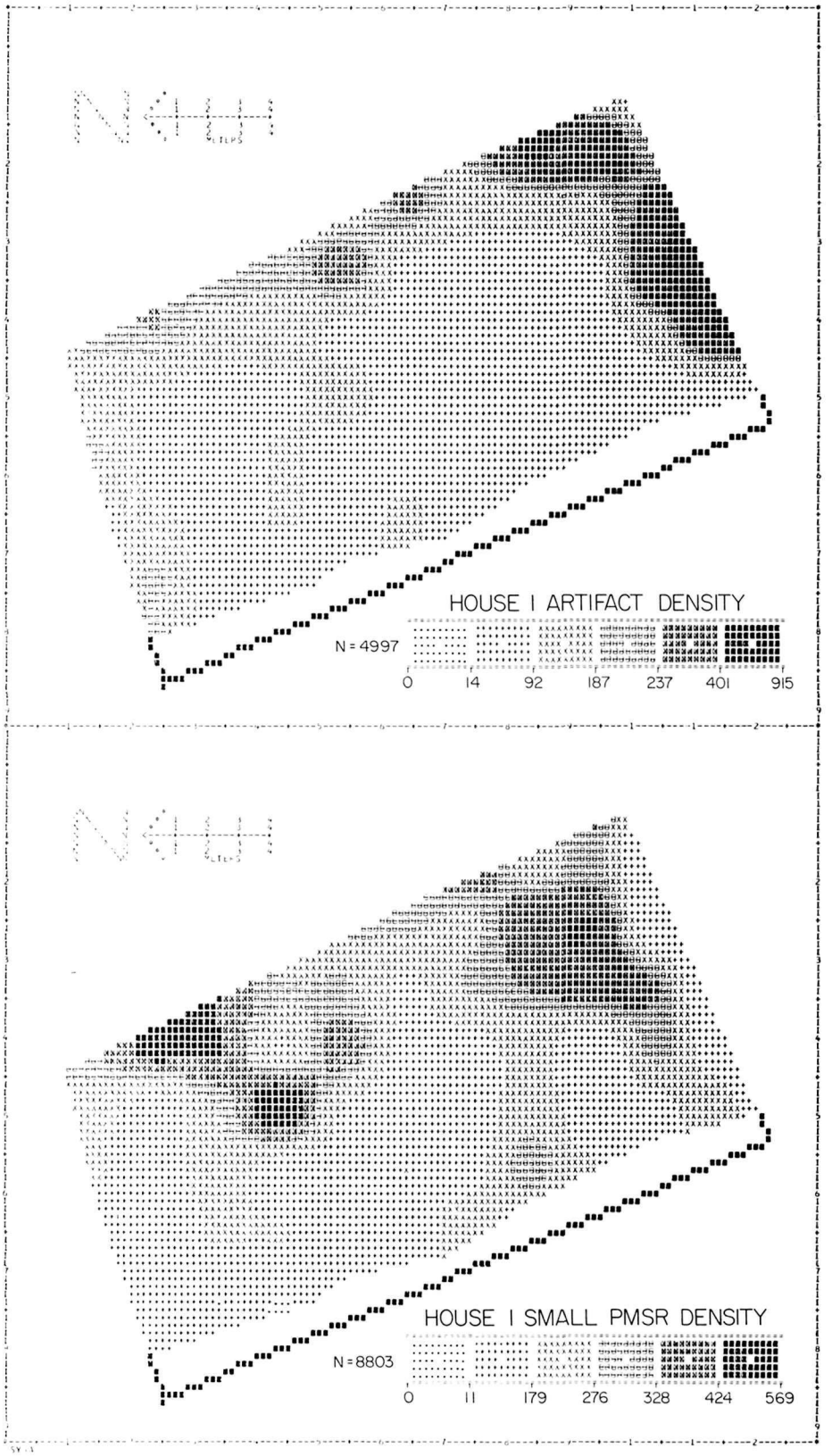


Figure 132. House 1 density maps for artifacts and small-diameter postmold/stakes.

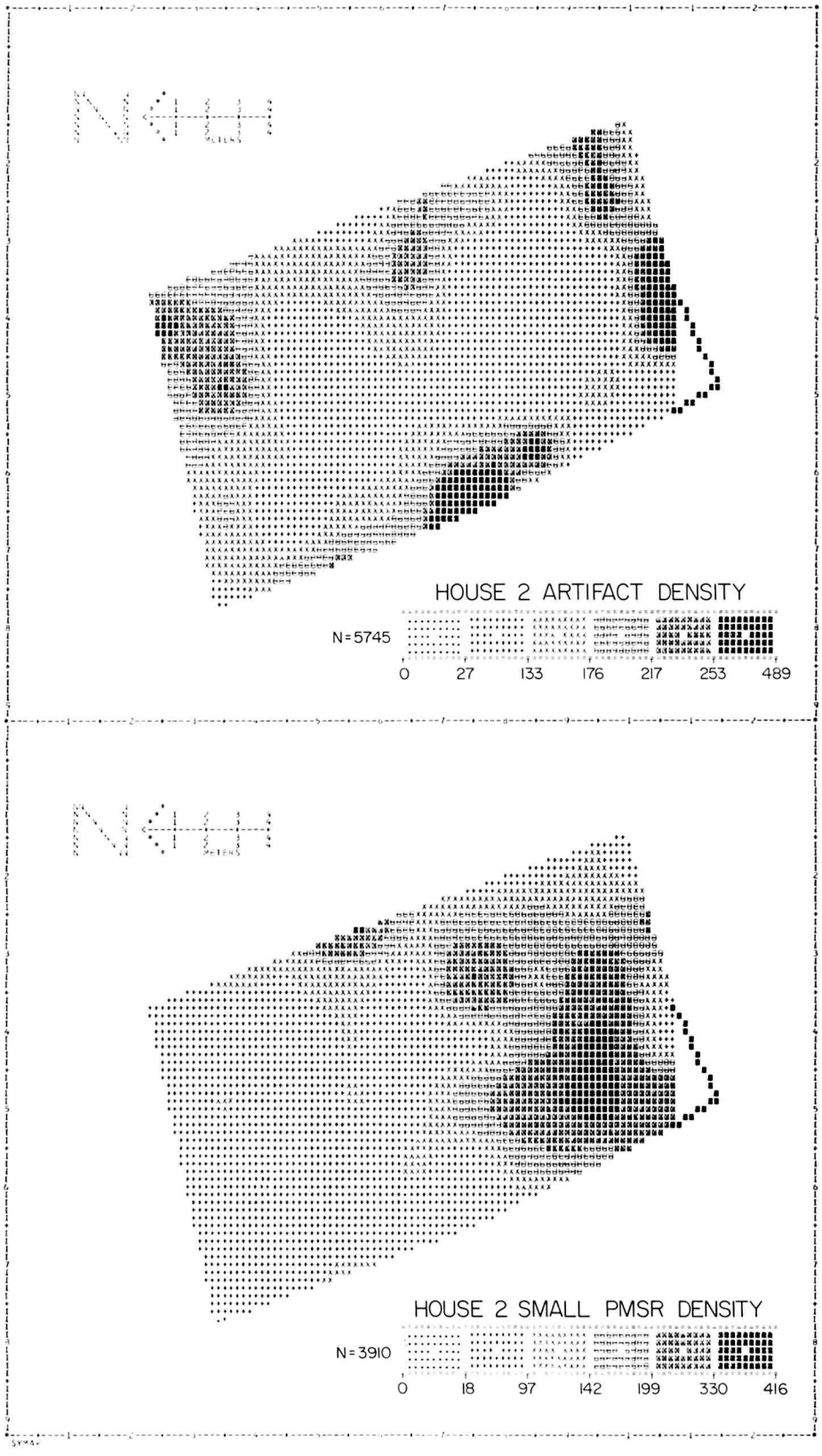


Figure 133. House 2 density maps for artifact and small-diameter postmold/stakes.

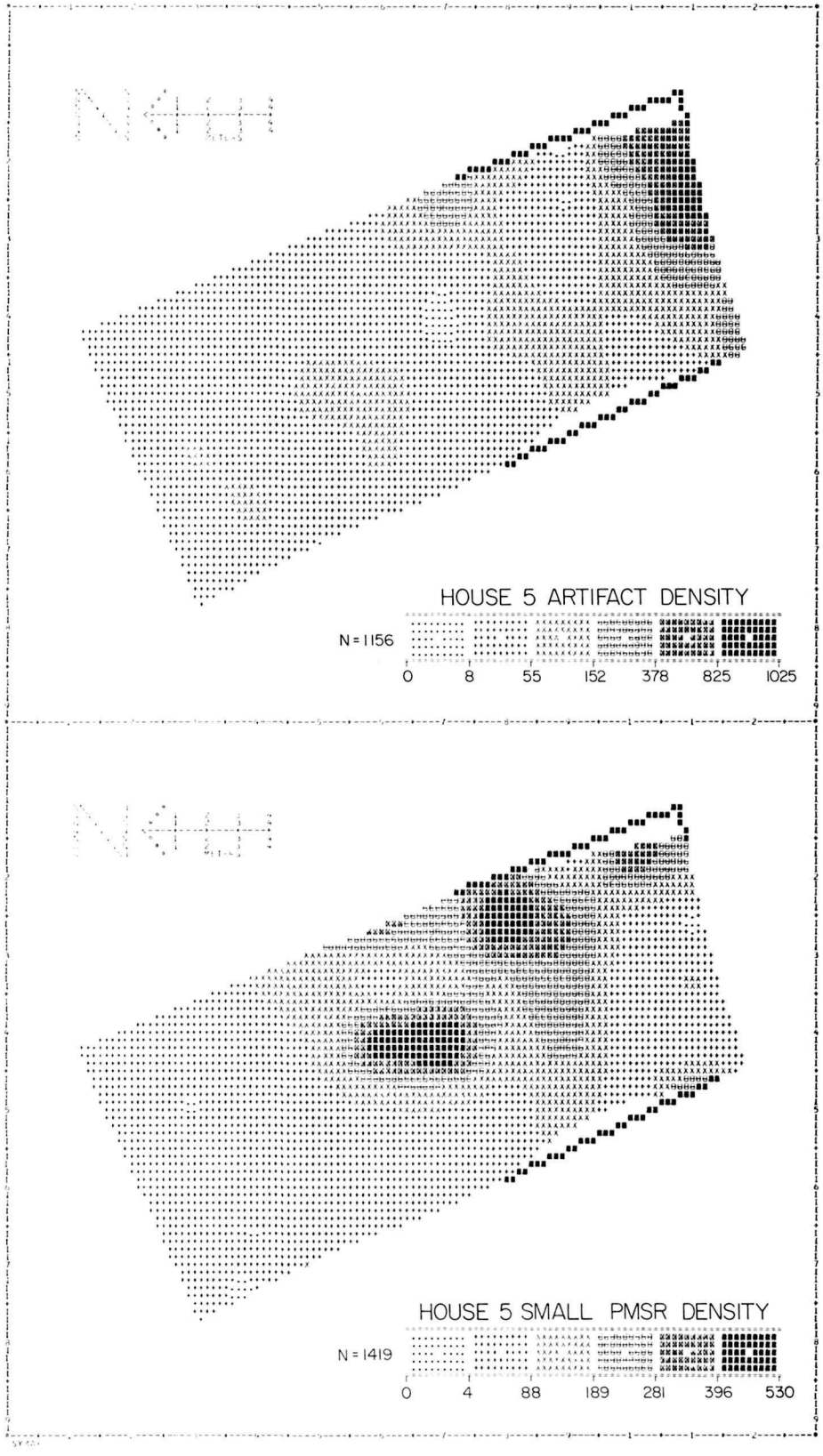


Figure 134. House 5 density maps for artifact and small-diameter postmold/stakes.

in House 1 midden there was a nearly equal representation of small and larger shell debris. A similar pattern was identified in the mammal bone debris. Houses 2 and 5 contained over 80% non-identifiable mammal bone fragments, while in House 1 the relationship between non-identifiable and identifiable mammal bones was more equal (non-identifiable mammal bone was 62% of the total). These relationships suggest that housecleaning practices of families in Houses 2 and 5 were more similar than either was to the housecleaning practices of families in House 1.

Indications of Status Distinctions

Faunal debris density differences suggest that variations among the house floors in midden composition correspond to social status differences among the occupants of the houses. I propose that House 1 was a higher-rank household, what Mozino (1970:19) called an "upper class" household, while Houses 2 and 5 were the homes of "commoners" (i.e., lower-ranking households). Other physical evidence suggestive of this social relationship includes:

- House 1 was located on the first row of houses, closest to the water, whereas Houses 2 and 5 were behind it on the upper row. Ethnographic literature cited in chapter three states that houses built closer to the water (at least at Opitsit, Nootka Sound, and Tealap) were occupied by higher-rank households;
- House 1 was the only house floor of the three completely excavated to contain a large "central" hearth complex. The central hearth is associated in the ethnographic literature with ceremonial occasions, and ceremonies were conducted in houses of higher-rank families (Drucker 1951:71);
- House 1 was the only one known to have contained large carved panels and inlaid bench planks (but see part II).

The combination of features, floor-midden element distributions, status-related artifact types, and ethnographic literature strongly suggest such a distinction between House 1 and Houses 2/5. However, further evaluations of artifact types and art styles should be able to refine the interpretations and expand behavioral information contained within the material record obtained from these floor middens.

Summary and Conclusion

In beginning this investigation of floor-midden patterns, I divided the house floors using two cross-cutting partitions—nuclear family "apartments" (areas) and depositional regions (zones). These partitions were located by reference to archaeological features and ethnographic reports on house use. These partitions form the groups into which midden element densities were examined for patterning. Results of randomness tests were mixed. The partitions were very effective in defining artifact distribution density variations in these house floor middens, but the postmold and stake distributions appeared more homogeneous. Subsequent analyses using partition-density values produced interpretations largely consistent with visual observations of distribution maps. This partitioning system is a useful basis for analyzing distribution patterns within shed-roof houses, since it allows examination of the proposition that the distribution patterns observed could have been produced by chance alone.

Comparisons of the distributions and densities of midden elements formed the second phase of investigation. These tests helped develop some understanding of the cultural disturbance processes at work in these houses during creation of the deposits. Two classes of midden elements—stationary and movable–were defined based on the ability of cultural disturbance processes to affect their

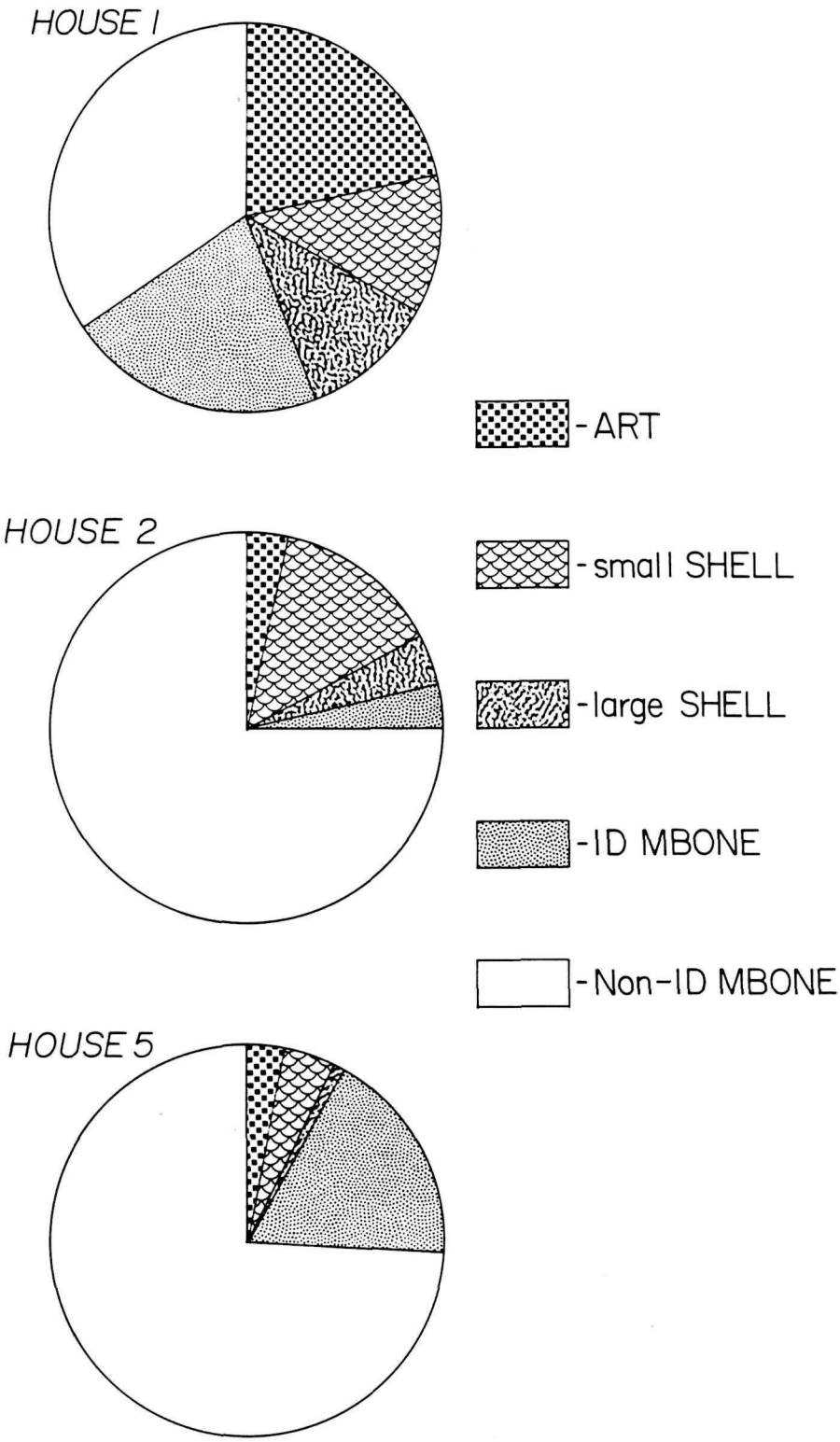


Figure 135. Pie charts of floor midden composition for Houses 1, 2, and 5.

location. Stationary elements are postmolds, features, and structural pieces. Movable elements include artifacts and various types of faunal debris. Testable elements from both classes were found

to have been distributed in clustered, generally nonrandom patterns. These tests of postmold and stake distributions led to the conclusion that variations were greater among areas than zones, while the results for the artifact distributions led to the reverse conclusion; zonal variations were much greater (in Houses 1 and 2) than differences between areas.

Comparisons of interhouse densities in these midden elements resulted in consistent variations. The smaller-diameter postmolds and stakes accumulated gradually during occupation, as they are the product of processing/production activities carried out relatively consistently during the occupation of the houses. The larger-diameter postmolds and stakes represent structural members associated with house construction and repair. These activities were carried out on a more occasional basis, and their densities varied with the amount of each structure recovered.

The artifacts were found to have been distributed in highly clustered, nonrandom patterns. Most were located in the bench zones of the houses, where low traffic intensity would have left deposited material relatively undisturbed by subsequent household activities. This is similar to the pattern reported by Hayden and Nelson (1981:895) for Mesoamerican houses, where "temporarily or permanently abandoned artifacts ... end up concentrated in out-of-the-way and difficult to sweep places."

Much of the relationship between the patterns of artifact and small-diameter postmold/stake distribution among the floors was seen to be consistent with factors of occupation length and cultural disturbance processes. For artifacts and small-diameter postmold/stakes both individually, and in their interrelationships, the consistency of relative density among house zones increased with increases in occupation length. Complementary results were obtained from all three houses in comparisons between artifact and small-diameter postmold/stake locations. These results suggest similar basic proxemic relationships in intrahouse activity/deposition patterns for these Ozette longhouses as reported for the contemporary highland Maya houses discussed by Hayden and Nelson. In these latter structures:

> all craft activity areas tend to be located in the center of structures near hearths, while wall and corner areas tend to be dark, asocial, and repositories of semidiscarded items, which often end up there by chance (Hayden and Nelson 1981:895).

Although a similar basic pattern is proposed, in the Ozette multiple-family longhouses this pattern created particular consequences which were not necessarily the same as in Mesoamerican houses. The hearths were not located in the exact center of the floors, but were found within each family living area. The location of storage and sleeping zones near the walls in each area of Ozette houses, however, forms a basis for depositional similarity between the two cases.

The tests presented in this paper suggest a method for evaluation of consistency and variation among intra and interhouse areas, by comparison of stationary and movable elements from the same suite of activities. The model of cultural disturbance processes which affected the artifacts supports evaluation of the total artifact collection found within each area as representative of the craft and processing activities which were conducted in that area. Although there was clear evidence of cultural disturbance processes which moved artifacts from zone to zone within an area, there was no evidence to suggest that these processes also generally resulted in movement of artifacts from area to area. Therefore the total collection from each area should be representative of the past activities conducted within that part of the house, and comparisons among areas can provide a measure of the similarity in their use.

The results of faunal debris tests do not suggest a pattern similar to that described for the artifacts. Here, sweeping seems to have often moved elements from area to area, on their way out the door. Thus, interarea comparisons which include high-traffic zones must be made with care.

An evaluation of the consistency in artifact deposition patterns over time was conducted for Houses 1 and 2. The majority of areas in the two houses had relatively consistent deposition for the three temporal periods, although House 2 had greater consistentency than House 1.

The third part of this study centered on the nature of cultural disturbance processes. Curation was seen as a probable factor (although not the major one) in production of the observed artifact distributions. Trampling was indicated for the fragile faunal debris (shells and fish bones), although, it was not the major factor either. Housecleaning activities affected all movable elements. Two major effects were proposed:

1. The objects classified as artifacts (including both tools and debris) were subject to inadvertent loss, housecleaning, and curation processes, all of which tended to relocate them into the low-traffic bench zone prior to their incorporation into the midden.
2. Faunal debris was subject to housecleaning, which differentially affected both their location and the quantities remaining in the house floors. Additionally, fragile debris (such as shell and fish bones) were subject to trampling which fragmented but did not relocate them.

These results suggest that all three potential cultural disturbance processes (breakage, relocation within the house, and relocation to exterior midden) were operating during the use of these houses, and that each process affected a particular suite of movable elements. These tests were successful in detailing some of the complex cultural formation and disturbance processes which resulted in the observed patterns of variation in floor-midden densities. Interpretation of these patterns provides a basic spatial framework for developing a detailed understanding of the social and economic life of the protohistoric Ozettes.

The vast differences among houses in the amount of total debris material recovered from each structure floor has been attributed to variations in the relative intensity of housecleaning. On the other hand, the distribution patterns created by variations in faunal debris density were relatively similar among all houses.

The formation processes documented in this research are relevant to other Northwest Coast floor-midden excavations and analyses. Few other complete excavations have been conducted of house-floor middens on the Northwest Coast. Much of the previous work has instead concentrated on a test-pit sampling approach, from which characterizations of whole sites have been proposed. If this excavation procedure had been utilized at Ozette, it certainly would not have produced a sample adequate for characterizations of internal variations within floor middens. Considering the distinct distribution pattern and quantity variations between artifacts and faunal debris, test pits located near house walls would likely have recovered many artifacts and little faunal debris. Likewise, test pits placed into the center of a house floor would have recovered the reverse, or little diagnostic material at all. Until the dynamics of past longhouse use and deposition are much more completely understood, complete excavation with accurate provenience and detailed collection procedures would seem to be necessary to obtain adequate spatial characterizations of floor middens. Jermann (1982) reported similar conclusions in an experimental study of sampling strategies for detection of spatial patterning. He determined that because of the normally complicated spatial patterning found in archaeological sites, a very high sampling proportion is needed to accurately replicate spatial patterns (Jermann 1982:33). Although costly in both time and money, excavation and analysis such as conducted at Ozette do provide additional valuable insights into past behavioral systems that are otherwise unobtainable.

The inferential arguments generated and tested in this study concerned the relationship between past activities and past depositional locations in these Northwest Coast floor middens. This has allowed the archaeological patterns of density variations documented through excavations to be related to the past activity structure. The conclusion is proposed that density and distribution debris within floor middens is not only indicative of the intensity and nature of processing and production activities conducted within a structure, but also is a reflection of the intensity and

nature of housecleaning processes. The results of this study provide a spatial framework within which other work can be articulated that is more specifically directed towards developing a more complete understanding of the Ozette economy.

REFERENCES CITED

Aldrich, Frank T.
1979 Comments on Computer Graphics Applications in Archaeology. In *Computer Graphics in Archaeology*, edited by S. Upham, pp. 145–148. Anthropological Research Papers 15. Arizona State University, Tempe.

Alexander, John W., and George A. Zahorchak
1943 Population-Density Maps of the United States: Techniques and Patterns. *The Geographical Review* 33:457–466.

Armstrong, R. W.
1969 Standardized Class Intervals and Rate Computation in Statistical Maps of Mortality. *Annals of the Association of American Geographers* 59:382–390.

Arnold, J. Barto III
1982 Archaeological Applications of Computer Graphics. In *Advances in Archaeological Method and Theory* 5, edited by M. B. Schiffer, pp.179–216. Academic Press, New York.

Barnett, Homer G.
1955 *The Coast Salish of British Columbia.* University of Oregon Monographs, Studies in Anthropology 4. Eugene.

Barr, Anthony J., James H. Goodnight, and John P. Sall
1979 *SAS Users Guide 1979 Edition.* SAS Institute Inc. Raleigh, N.C.

Beaglehole, J. C.
1967 *The Journals of Captain James Cook on His Voyages of Discovery.* Hakluyt Society Works Extra Series 36, Cambridge University Press, Cambridge.

Binford, Louis R.
1968 Archeological Perspectives. In *New Perspectives in Archeology*, edited by S. R. Binford and L. R. Binford, pp. 5–32. Aldine, Chicago.

1981 Behavioral Archaeology and the "Pompeii Premise." *Journal of Anthropological Research* 37:195–208.

Blinman, Eric
1980 Stratigraphy and Depositional Environment. In *Hoko River: A 2,500 Year Old Fishing Camp on the Northwest Coast of North America*, edited by Dale R. Croes and Eric Blinman, pp. 64–68. Laboratory of Anthropology Reports of Investigations 58, Hoko River Archaeological Project Contributions 1, Washington State University, Pullman.

Boas, Franz
1890 *Second General Report on the Indians of British Columbia: The Lku'ngen.* Report of the British Association for the Advancement of Science 60:563–582.

1909 *The Kwakiutl of Vancouver Island.* American Museum of Natural History, Memoir 8:301–522. New York.

1921 *Ethnology of the Kwakiutl.* Bureau of American Ethnology, 35th Annual Report, 1913-1914, 1:43–794. Washington D.C.

Boit, John
1919 *Log of the Columbia, 1790–1792*. Proceedings of the Massachusetts Historical Society 53:Oct., 1919–June, 1920.

Bushnell, David I.
1928 *Drawings by John Webber of Natives of the Northwest Coast of America, 1778*. Smithsonian Miscellaneous Collections 20:10. Washington D.C.

Carlson, Frank
1903 *Chief Sealth*. Bulletin of the University of Washington 3:2. Seattle.

Chalcraft, Edwin
1903 Letter to the Commissioner of Indian Affairs. United States Department of the Interior, Document 52186.

Clarke, David L.
1968 *Analytical Archaeology*. Methuen and Co., London.

1977 *Spatial Archaeology*. Academic Press, London.

Colson, Elizabeth
1953 *The Makah Indians: A Study of an Indian Tribe in Modern American Society*. Manchester University Press, Manchester.

Cook, Warren
1973 *Flood Tide of Empire*. Yale University Press, New Haven.

Costello, J. A.
1895 *The Siwash, Their Life, Legends, and Tales; Puget Sound and Pacific Northwest*. The Calvert Company, Seattle.

Cowgill, George L.
1967 Computers and Prehistoric Archaeology. In *Computers in Humanistic Research*, edited by E. Bowles, pp. 47–56. Prentice-Hall, Englewood Cliffs.

Croes, Dale R. (editor)
1976 *The Excavation of Water-Saturated Archaeological Sites (Wet Sites) on the Northwest Coast of North America*. National Museum of Man Mercury Series: Archaeological Survey of Canada, Paper 50. Ottawa.

Croes, Dale R.
1977 *Basketry from the Ozette Village Archaeological Site: A Technological, Functional, and Comparative Study*. Ph.D. dissertation, Washington State University. University Microfilms International, Ann Arbor.

1980 *Cordage from the Ozette Village Archaeological Site: A Technological, Functional, and Comparative Study*. Washington Archaeological Research Center Project Report 9, Washington State University, Pullman.

Croes, Dale R. and Eric Blinman (editors)
1980 *Hoko River: A 2,500 Year Old Fishing Camp on the Northwest Coast of North America*. Laboratory of Anthropology Reports of Investigations 58, Hoko River Archaeological Project Contributions 1, Washington State University, Pullman.

Curtis, Edward S.
1913 *The North American Indian (Vol. IX) Salishan Tribes of the Coast*. Johnson Reprint Company, New York.

1916 *The North American Indian (Vol. XI) The Nootka*. Johnson Reprint Company, New York.

Cutter, Donald C.
1963 Early Spanish Artists on the Northwest Coast. *Pacific Northwest Quarterly* 54:150–157.

Dacey, Michael F.
1973 Statistical Tests of Spatial Association in the Locations of Tool Types. *American Antiquity* 38:320–328.

Daugherty, Richard D.
1948 Survey of the Washington Coast from Cape Flattery to Cape Disappointment. Ms. on file, Department of Anthropology, University of Washington, Seattle.

Daugherty, Richard D., and Roald Fryxell
1967 Archaeological, Geochronological, and Ecological Investigations of the Ozette Village Site Complex on the Northwest Coast of Washington: II. Ms. on file, Department of Anthropology, Washington State University, Pullman.

Daugherty, Richard D., and R. Kirk
1976 Ancient Indian Village Where Time Stood Still. *Smithsonian Magazine* 7(2):68–75.

Densmore, Frances
1939 *Nootka and Quileute Music.* Bureau of American Ethnology Bulletin 124. Washington D.C.

DePuydt, Raymond T.
1983a *Cultural Implications of Avifaunal Remains from the Ozette Site.* Unpublished M.A. thesis, Department of Anthropology, Washington State University, Pullman.

1983b *Cultural Implications of Avifaunal Remains from the Ozette Site.* Report to Interagency Archaeological Services, National Park Service. Laboratory of Anthropology, Washington State University, Pullman.

Dohm, K. M.
1981 *Similarities in Spatial Characteristics of Several Basketmaker II Sites on Cedar Mesa, Utah.* Unpublished M.A. thesis, Department of Anthropology, Washington State University, Pullman.

Dougnenik, James A., and David E. Sheehan
1975 *SYMAP Users Reference Manual.* Laboratory for Computer Graphics and Spatial Analysis, Graduate School of Design, Harvard University, Boston.

Drucker, Philip
1951 *The Northern and Central Nootkan Tribes.* Smithsonian Institution Bureau of American Ethnology Bulletin 144. Washington, D.C.

1963 *Indians of the Northwest Coast.* The Natural History Press, New York.

1965 *Cultures of the North Pacific Coast.* Chandler Publishing Company, San Francisco.

Duff, Wilson
1953 *The Upper Stalo Indians of the Fraser Valley, British Columbia.* Anthropology in British Columbia, Memoir 1. British Columbia Provincial Museum, Victoria.

1969 *The Indian History of British Columbia, Volume 1: The Impact of the White Man.* Anthropology in British Columbia, Memoir 5. British Columbia Provincial Museum, Victoria.

Dunnell, Robert C., and Dennis E. Lewarch
1974 *Archaeological Remains in Home Valley Park, Skamania County, Washington.* Portland district, U. S. Army Corps of Engineers.

Edwards, Allen L.
1966 *Statistical Methods for the Behavioral Sciences.* Holt, Rinehart and Winston, New York.

Eells, Myron
1887 *The Twana, Chemakum and Klallam Indians, of Washington Territory.* Smithsonian Annual Reports for 1887, pp 605–681. Washington D.C.

Ellison, Jeffrey
1977 *The Ozette Petroglyphs.* Unpublished M.A. thesis, Department of Anthropology, Washington State University, Pullman.

Elmendorf, W. W.
1960 *The Structure of Twana Culture With Comparative Notes on the Structure of Yurok Culture by A. L. Kroeber.* Washington State University Research Studies, Monograph Supplement. Washington State University, Pullman.

Espinosa y Tello, Joseph
1930 *A Spanish Voyage to Vancouver and the North-West Coast of America; Being the Narritive of the Voyage Made in the Year 1792 by the Schooners Sutil and Mexicana to Explore the Strait of Fuca,* (translated from Spanish by Cecil Jane). The Argonaut Press, London.

Fagan, Brian M.
1988 *Quest for the Past: Great Discoveries in Archaeology.* Waveland Press, Prospect Heights, Illinois.

Fladmark, Knut
1974 *A Paleological Model for Northwest Coast Prehistory.* Unpublished Ph.D. dissertation, University of Alberta.

Flenniken, John J.
1980 *Replicative Systems Analysis: A Model Applied to the Vein Quartz Artifacts from the Hoko River Site.* Ph.D. dissertation, Washington State University. University Microfilms International, Ann Arbor.

Fraser, Simon
1889 Journal of a Voyage from the Rocky Mountains to the Pacific Coast, 1808. In *Les Bourgeois de la Compagne de Nord-Ouest. Récits de Voyages, Lettres et Rapports inédits Relatifs au Nord-Ouest Canadien; Publiés avec une Esquisse Historique et des Annotations,* by L. R. Masson. Cote, Quebec.

Friedman, Edward
1976 *An Archaeological Survey of Makah Territory: A Study in Resource Utilization.* Ph.D. dissertation, Washington State University. University Microfilms International, Ann Arbor.

Friedman, Janet
1975 *The Prehistoric Uses of Wood at the Ozette Archaeological Site.* Ph.D. dissertation, Washington State University. University Microfilms International, Ann Arbor.

Fritz, John M.
1972 Archaeological Systems for Indirect Observation of the Past. In *Contemporary Archaeology,* edited by M. Leone, pp. 135–157. Southern Illinois University Press, Carbondale.

Gaston, J., and J. V. Jermann
1975 *Salvage Excavations at Old Man House (45-KP-2), Kitsap County, Washington.* Institute for Environmental Studies, Office of Public Archaeology Reconnaissance Reports 4. University of Washington, Seattle.

Gibbs, George
1967 *Indian Tribes of Washington Territory.* Ye Galleon Press, Fairfield.

1970 *Tribes of Western Washington and Northwestern Oregon.* Contributions to North American Ethnology 1(2):161–241. 1st edition of facsimile reprint. Shorey Book Store, Seattle.

Gibbs, James A.
1971 *Shipwrecks of the Pacific Coast.* Binfords and Mort, Portland.

Gifford, Diane P.
1980 Ethnoarchaeological Contributions to the Taphonomy of Human Sites. In *Fossils in the Making*, edited by A. K. Behrensmeyer and A. P. Hill, pp. 93–106. University of Chicago Press, Chicago.

Gill, Steven J.
1983a *Ethnobotany of the Makah and Ozette People, Olympic Peninsula, Washington.* Ph.D. dissertation, Washington State University. University Microfilms International, Ann Arbor.

1983b *Plant Utilization by the Makah and Ozette People, Olympic Peninsula, Washington.* Report to Interagency Archaeological Services, National Park Service. Laboratory of Anthropology, Washington State University, Pullman.

Gleeson, Madge
1973 *Ozette Project Summary of Stratigraphic Work (6/72–8/73).* Unpublished project report, on file, Department of Anthropology, Washington State University, Pullman.

Gleeson, Paul F.
1973a *Ozette Archaeological Project Interim Final Report, Phase I.* Washington Archaeological Research Center Project Report 1. Washington State University, Pullman.

1973b *Ozette Archaeological Project Interim Final Report, Phase II-A.* Washington Archaeological Research Center Project Report 2. Washington State University, Pullman.

1974a *Ozette Archaeological Project Interim Final Report, Phase II-B.* Washington Archaeological Research Center Project Report 3. Washington State University, Pullman.

1974b *Ozette Archaeological Project Interim Final Report, Phase IV.* Washington Archaeological Research Center Project Report 5. Washington State University, Pullman.

1974c *Ozette Archaeological Project Interim Final Report, Phase V.* Washington Archaeological Research Center Project Report 6. Washington State University, Pullman.

1980a *Ozette Archaeological Project, Interim Final Report, Phase XIII.* Washington Archaeological Research Center Project Report 97. Washington State University, Pullman.

1980b *Ozette Woodworking Technology.* Ph.D. dissertation, Washington State University. University Microfilms International, Ann Arbor.

1980c *Ozette Woodworking Technology.* Laboratory of Archaeology and History Project Report 3. Washington State University, Pullman.

1983 *Phase XV Excavations.* Report to Interagency Archaeological Services, National Park Service. Laboratory of Anthropology, Washington State University, Pullman.

Gleeson, Paul F. and Marian Fisken
1977 *Ozette Archaeological Project Interim Final Report, Phase X.* Washington Archaeological Research Center Project Report 51. Washington State University, Pullman.

Gleeson, Paul F., Mark S. Fleisher, and Geoff Gamble
1979 *Economic Roles of Nootkan Intrahouse Ranked Positions.* Paper presented at the 44th Annual Meeting of the Society for American Archaeology, Vancouver, B.C.

Gleeson, Paul F., M. Flynn, and S. Mauger
1980 Ozette Artifacts—Field Typology. In *Ozette Archaeological Project Interim Final Report, Phase XIII*, compiled by P. Gleeson, pp. 109–158. Washington Archaeological Research Center Project Report 97, Washington State University, Pullman.

Gleeson, Paul F., and Gerald H. Grosso
1976 Ozette Site. In *The Excavation of Water-Saturated Archaeological Sites (Wet Sites) on the Northwest Coast of North America*, edited by D. Croes, pp. 13–44. National Museum of Man Mercury Series: Archaeological Survey of Canada, Paper No. 50. Ottawa.

Gleeson, Paul F., Jeffrey Mauger, and Marian Fisken
1976 *Ozette Archaeological Project Interim Final Report, Phases VIII and IX.* Washington Archaeological Research Center Project Report 34. Washington State University, Pullman.

Goddard, Pliny Earle
1925 *Indians of the Northwest Coast.* American Museum of Natural History, Handbook Series No. 10. New York.

Grosso, Gerald H.
1975 Wood, Textile, and Leather Conservation Techniques for the Archaeologist. *Northwest Anthropological Research Notes* 9(1):180–197.

1976 *Pacific Northwest Wet Site Wood Conservation Conference* (two volumes). Makah Graphic Arts, Neah Bay, Washington.

Guinn, Stanley
1962 White Rock Archaeological Site: A Preliminary Report of Investigations. Ms. on file, Department of Anthropology, Washington State University, Pullman.

Gunther, Erna
1927 *Klallam Ethnography.* University of Washington Publications in Anthropology 1(5):173–314. University of Washington Press, Seattle.

1972 *Indian Life on the Northwest Coast of North America, as Seen by the Easrly Explorers and Fur Traders During the Last Decades of the Eighteenth Century.* University of Chicago Press, Chicago.

Gustafson, Carl E.
1968 Prehistoric Use of Fur Seals: Evidence from the Olympic Coast of Washington. *Science* 161:49–51.

Haeberlin, Hermann, and Erna Gunther
1952 *The Indians of Puget Sound.* University of Washington Publications in Anthropology 4(1):1–84. University of Washington Press, Seattle.

Harper, J. Russel
1971 *Paul Kane's Frontier.* University of Texas Press, Austin.

Haswell, Robert
1880 A Voyage Round the World on Board the Ship 'Columbia Rediviva' and Sloop 'Washington,' in 1787–9. In *History of the Northwest Coast, Volume I* by Hubert Howe Bancroft, pp. 703–735. The Bancroft Company, New York.

Hayden, Brian, and Margaret Nelson
1981 The Use of Chipped Lithic Material in the Contemporary Maya Highlands. *American Antiquity* 46:885–898.

Hietala, Harold J., and Paul A. Larson, Jr.
1979 SYMAP Analysis in Archaeology: Intrasite Assumptions and a Comparison With TREND Analysis. *Norwegian Archaeological Review* 12:57–64.

Hill-Tout, C.
1907 *British North America: I. The Far West, the Home of the Salish and Dene.* A. Constable, London.

Hodder, Ian, and Clive Orton
1976 *Spatial Analysis in Archaeology.* Cambridge University Press, Cambridge.

Hoonan, Charles E.
1964 *Neah Bay, Washington: A Brief Historical Sketch.* Crown Zellerbach.

Hoskins, J.
n.d. The Narrative of a Voyage to the North West Coast of America and China in Trade and Discoveries by John Hoskins Performed in the Ship Columbia Rediviva, 1790–1793. Typescript on file, University of Washington library, Seattle.

Howes, Donald W.
1982 *Spatial Analysis at a Northwest Coast Fishing Camp: the Hoko River Site.* Unpublished M.A. thesis, Department of Anthropology, Washington State University, Pullman.

Huelsbeck, David R.
1981a *Faunal Remains, Social Units, and Activity Areas at Ozette.* Paper presented at the 46th Annual Meeting of the Society for American Archaeology, San Deigo.

1981b *Utilization of Fish at the Ozette Site.* Laboratory of Archaeology and History Project Reports No. 11, Washington State University, Pullman.

1983a *Mammals and Fish in the Subsistence Economy of Ozette.* Ph.D. dissertation, Washington State University. University Microfilms International, Ann Arbor.

1983b *Mammals and Fish in the Subsistence Economy of Ozette.* Report to Interagency Archaeological Services, National Park Service. Laboratory of Anthropology, Washington State University, Pullman.

1983c *The Utilization of Whales at Ozette.* Report to Interagency Archaeological Services, National Park Service. Laboratory of Anthropology, Washington State University, Pullman.

1988a Faunal Remains and the Identification of Social Groups in the Archaeological Record. In *Recent Developments in Environmental Analyses in the Old and New World*, edited by R. Esmee Webb, pp. 131–149. BAR International Series 416. Oxford.

1988b The Surplus Economy of the Central Northwest Coast. In *Research in Economic Anthropology, Supplement* 3, edited by Barry Isaac, pp. 149–177. JAI Press, Greenwich, Conn.

1988c Whaling in the Precontact Economy of the Central Northwest Coast. *Arctic Anthropology* 25(1):1–15.

1989 Food Consumption, Resource Exploitation, and Relationships Within and Between Households at Ozette. In *Households and Communities, Proceedings of the 21st Chacmool Conference*, edited by Scott MacEachern, David Archer, and Richard Garvin, pp. 157–167. University of Calgary. Calgary.

Irving, Albert
1921 *How the Makah Obtained Possession of Cape Flattery*, (translated by Luke Markistun). Indian Notes and Monographs 6. Museum of the American Indian, Heye Foundation, New York.

Iverson, Gudmund R., and Helmut Norpoth
1976 Analysis of Variance. *Sage University Paper Series on Quantitative Applications in the Social Sciences, Series No.* 07-001, Beverly Hills.

Jenks, George F.
1963 Generalization in Statistical Mapping. *Annals of the Association of American Geographers* 53:15–26.

Jenks, George F., and Fred C. Caspall
1971 Error on Choroplethic Maps: Definition, Measurement, Reduction. *Annals of the Association of American Geographers* 61:217–244.

Jenness, Daimond
1955 *The Faith of a Coast Salish Indian, edited by Wilson Duff*. Anthropology in British Columbia Memoir 3. British Columbia Provincial Museum, Victoria.

Jermann, Jerry V.
1978 *Archaeological Investigations at Home Valley, Skamania County, Washington*. Office of Public Archaeology, Institute for Environmental Studies, University of Washington, Reconnaissance Report 18. Seattle.

1982 *Sampling and Spatial Autocorrelation: Problems in Replicating Spatial Pattern From Sample Data*. Paper presented at the 47th Annual Meeting of the Society for American Archaeology, Minneapolis.

Jermann, Jerry V., and Robert C. Dunnell
1979 Some Limitations of Isopleth Mapping in Archaeology. In *Computer Graphics in Archaeology*, edited by S. Upham, pp. 31–60. Anthropological Research Papers 15. Arizona State University, Tempe.

Jewitt, John
1967 *Narrative of the Adventures and Sufferings of John R. Jewitt, Only Survivor of the Crew of the Ship Boston, During a Captivity of Nearly Three Years Among the Savages of Nootka Sound*. Ye Galleon Press, Fairfield.

Jozsa, L. A., M. L. Parker, S. G. Johnson, and P. A. Bramhall
1982 Chronology Building for the Olympic Peninsula for Tree-Ring Dating at Ozette. In *Ozette Dendrochronological Studies*, edited by Paul F. Gleeson, pp. 26–56. Report to Interagency Archaeological Services, National Park Service, Laboratory of Anthropology, Washington State University, Pullman.

Kane, Paul
1925 *Wanderings of an Artist Among the Indians of North America, From Canada to Vancouver's Island and Oregon, Through the Hudson's Bay Company's Territory and Back Again*. The Radisson Society of Canada, Limited. Toronto.

Kent, Susan
1975 *An Analysis of Northwest Coast Combs With Special Emphasis on Those From Ozette*. Unpublished M.A. thesis, Department of Anthropology, Washington State University, Pullman.

Kirk, Ruth
1974 *Hunters of the Whale*. William Morrow and Company, New York.

1975 Ozette: The Search Goes On. *Pacific Search* 9(5):2–8.

1978 *Exploring Washington Archaeology*. University of Washington Press, Seattle.

Kirk, Ruth, and Louis Kirk
1980 The Pompeii of the Northwest. *Historic Preservation* 32(2):2–9.

Koch, Jennifer
1975 *Miniatures from the Archaeological Inventory at the Ozette Village Site.* Unpublished M.A. thesis, Department of Anthropology, Washington State University, Pullman.

Koppert, Vincent A.
1930 *Contributions to Clayoquot Ethnography.* Catholic University of America, Anthropological Series 1. Washington, D.C.

Krause, Richard A., and R. M. Thorne
1971 Toward a Theory of Archaeological Things. *Plains Anthropologist* 16:245–257.

Lane, Barbara
1972 Makah Economy Circa 1855 and the Makah Treaty: A Cultural Analysis. Unpublished manuscript in possession of Jeffrey Mauger.

Lyon, Jerry
1976 *A Preliminary Analysis of House Floor Sediments From the Ozette Site (45CA24).* Class paper (Anthropology 571), Department of Anthropology, Washington State University, Pullman.

Mackay, J. Ross
1955 An Analysis of Isopleth and Choropleth Class Intervals. *Economic Geography* 31:71–81.

Makah Language Program
1979 *Makah Alphabet Book.* Makah Language Program, Makah Cultural and Research Center, Neah Bay, Washington.

Marshall, James A.
1969 Engineering Principles and the Study of Prehistoric Structures: A Substantive Model. *American Antiquity* 34:166–171.

Marshall, Yvonne
1989 The House in Northwest Coast, Nuu-chah-nulth, Society: The Material Structure of Political Action. In *Households and Communities, Proceedings of the 21st Chacmool Conference*, edited by Scott MacEachern, David Archer and Richard Garvin, pp. 15–21. University of Calgary, Calgary.

Masson, Louis R.
1889 *Les Bourgeois de la Compagne de Nord-Ouest. Récits de Voyages, Lettres et Rapports inédits Relatifs au Nord-Ouest Canadien; Publiés avec une Esquisse Historique et des Annotations.* Cote, Quebec.

Mauger, Jeffrey E.
1974 *Ozette Archaeological Project Interim Final Report, Phase III.* Washington Archaeological Research Center Project Report 4. Washington State University, Pullman.

1975a *Ozette Archaeological Project Interim Final Report, Phase VI.* Washington Archaeological Research Center Project Report 12. Washington State University, Pullman.

1975b *Ozette Archaeological Project Interim Final Report, Phase VII.* Washington Archaeological Research Center Project Report 13. Washington State University, Pullman.

1977 *House Architecture and the Seasonal Round: A Makah Example.* Paper presented at the 30th Annual Meeting of the Northwest Anthropological Conference, Victoria.

1978a *Shed Roof Houses at the Ozette Archaeological Site: A Protohistoric Architectural System.* Ph.D. dissertation, Washington State University. University Microfilms International, Ann Arbor.

1978b *Shed Roof Houses at the Ozette Archaeological Site: A Protohistoric Architectural System.* Washington Archaeological Research Center Project Report 73. Washington State University, Pullman.

1979 *Ozette Archaeological Project Interim Final Report, Phase XI.* Washington Archaeological Research Center Project Report 68. Washington State University, Pullman.

1980 *Ozette Archaeological Project Interim Final Report, Phase XII.* Washington Archaeological Research Center Project Report 96. Washington State University, Pullman.

1982 Ozette Kerf-Corner Boxes. *American Indian Art Magazine* 8(1):72–79.

Mauger, Jeffrey E., and Richard D. Daugherty
1974 *Ozette Archaeological Project Interim Final Report, Phase VI.* Washington Archaeological Research Center Project Report 12. Washington State University, Pullman.

Meany, Edmond S.
1957a *Vancouver's Discovery of Puget Sound; Portraits and Biographies of the Men Honored in the Naming of Geographic Features of Northwestern America.* Binfords & Mort, Portland.

1957b *A New Vancouver Journal.* Binfords & Mort, Portland.

Meares, John
1790 *An Introductory Voyage of the Nootka; -Capt. Meares from Calcutta, to the North West Coast of America, in the Years 1786, and 1787.* London.

Monmonier, Mark S.
1972 Contiguity-Biased Class-Interval Selection: A Method for Simplifying Patterns on Statistical Maps. *The Geographic Review* 63:203–208.

Mozino, José M.
1970 *Noticias de Nutka; An Account of Nootka Sound in 1792.* The American Ethnological Society Monograph 50. University of Washington Press, Seattle.

Nie, Norman H., C. Hadlai Hull, Jean G. Jenkins, Karin Steinbrenner, and Dale H. Bent
1975 *Statistical Package for the Social Sciences, Second Edition.* McGraw Hill Inc., New York.

Olson, Ronald
1967 *The Quinault Indians. Adze, Canoe and House Types of the Northwest Coast.* University of Washington Publications in Anthropology 6:1–194. University of Washington Press, Seattle.

Pascua, Maria Parker
1991 Ozette. *National Geographic* 180(4):38–53.

Pettitt, George A.
1950 *The Quileute of La Push, 1775–1945.* University of California Anthropological Records 14(1):1–128. Berkeley.

Phillips, Earl L., and Wallace R. Donaldson
1972 *Washington Climate For These Counties, Clallam, Grays Harbor, Jefferson, Pacific, and Wahkiakum.* Cooperative Extension Service, College of Agriculture, Washington State University, Pullman.

Puecker, Thomas K.
1972 *Computer Cartography.* Association of American Geographers, Commission on College Geography, Resource Paper 17. Washington D. C.

Reagen, Albert B.
1917 *Archaeological Notes on Western Washington and Adjacent British Columbia.* Proceedings of the California Academy of Sciences, 4th Ser., Vol. 7(1). San Francisco.

1928 Ancient Sites and Burial Grounds in the Vicinity of Queets, Washington. *El Palacio* 25(19):296–299.

Redman, Charles L., and Patty Jo Watson
1970 Systematic, Intensive Surface Collection. *American Antiquity* 35:279–291.

Riley, Carroll
1968 The Makah Indians: A Study of Political and Economic Organizations. *Ethnohistory* 15:57–95.

Robinson, Authur H., and Randall D. Sale
1969 *Elements of Cartography, Third Edition.* John Wiley and Sons, Inc. New York.

Rossman, Abraham, and Paula G. Rubel
1971 *Feasting With Mine Enemy: Rank and Exchange Amongst Northwest Coast Societies.* Columbia University Press, New York.

Ruby, Robert H., and John A. Brown
1976 *Myron Eells and the Puget Sound Indians.* Superior Publishing Company, Seattle.

Samuels, Stephan R.
1978 *Analysis of House Floor Midden from the Ozette Site, 45CA24/B70 - House 2.* Class paper (Anthropology 571), Department of Anthropology, Washington State University, Pullman.

1980a *Analysis of Longhouse Floor Midden Spatial Distributions.* Paper presented at the 33rd Annual Meeting of the Northwest Anthropological Conference, Bellingham, Wa.

1980b Data Management and Computer Applications. In *Ozette Archaeological Project, Interim Final Report, Phase XIII*, compiled by P. Gleeson, pp. 38–43. Washington Archaeological Research Center Project Report 97, Washington State University, Pullman.

1980c Stratigraphy and features. In *Ozette Archaeological Project, Interim Final Report, Phase XIII*, compiled by P. Gleeson, pp. 44–51. Washington Archaeological Research Center Project Report 97, Washington State University, Pullman.

1983a *Spatial Patterns and Cultural Processes in Three Northwest Coast Longhouse Floor Middens from Ozette.* Ph.D. dissertation, Washington State University. University Microfilms International, Ann Arbor.

1983b *Spatial Analysis of Ozette House Floor Deposits.* Report to Interagency Archaeological Services, National Park Service. Laboratory of Anthropology, Washington State University, Pullman.

1989 Spatial Patterns in Ozette Longhouse Floor Middens. In *Households and Communities, Proceedings of the 21st Chacmool Conference*, edited by Scott MacEachern, David Archer and Richard Garvin, pp. 143–156. University of Calgary, Calgary.

Schiffer, Michael B.
1972a Archaeological Context and Systemic Context. *American Antiquity* 37:156–165.

1972b Cultural Laws and the Reconstruction of Past Lifeways. *Kiva* 37:148–157.

1975 Behavioral Chain Analysis: Activities, Organization, and the Use of Space. *Fieldiana: Anthropology* 65:103–119.

1978 Methodological Issues in Ethnoarchaeology. In *New Directions in Ethnoarchaeology*, edited by R. A. Gould, pp. 229–247. University of New Mexico Press, Albuquerque.

Schiffer, M. B., and W. L. Rathje
1973 Efficient Exploitation of the Archeological Record: Penetrating Problems. In *Research and Theory in Current Archeology*, edited by C. L. Redman, pp. 169–179. John Wiley and Sons, New York.

Scripter, Morton W.
1970 Nested-Means Map Classes for Statistical Maps. *Annals of the Association of American Geographers* 60:385–393.

Sendey, John
1977 *The Nootkan Indian—A Pictorial.* Alberni Valley Museum, Port Alberni B.C.

Smith, Marian
1940 *The Puyallup-Nisqually.* Columbia University Contributions to Anthropology 32. New York.

1947 House Types of the Middle Fraser River. *American Antiquity* 12(4):255–267.

Snyder, Warren A.
1956 *Archaeological Sampling at "Old Man House" on Puget Sound.* State College of Washington Research Studies 24:1–35. Pullman.

Spaulding, A. L.
1968 Explanation in Archeology. In *New Perspectives in Archaeology*, edited by S. R. Binford and L. R. Binford, pp. 33–39. Aldine, Chicago.

1971 The Dimensions of Archaeology. In *Man's Imprint from the Past*, edited by J. Deetz, pp. 23–39. Little, Brown and Co., Boston.

Sproat, Gilbert M.
1868 *Scenes and Studies of Savage Life.* Smith, Elder and Co., London.

Stallard, Bruce, and Clayton Denman
1955 An Archaeological Survey of the Coast of Washington. Ms. on file, Olympic National Park Library, Port Angeles, Washington.

Stern, Bernhard J.
1934 *The Lummi Indians of Northwest Washington.* Columbia University Contributions to Anthropology 17, Columbia University Press, New York.

Suttles, Wayne P.
1974 *Economic Life of the Coast Salish of Haro and Rosario Straits.* Garland Publishing, Inc. New York.

Swan, James G.
1870 *The Indians of Cape Flattery.* Smithsonian Contributions to Knowledge 16:220, Facsimile reproduction SJS#24 (1972), The Shorey Book Store, Seattle.

Swanton, John R.
1969 *The Indian Tribes of North America.* Smithsonian Institution Bureau of American Ethnology Bulletin 145. Smithsonian Institution Press, Washington, D.C.

Swindell, Edward Jr.
1941 Transcript of a Meeting with Makah Senior Citizens and the Special Representative of the Office of Indian Affairs.

Thomas, David H.
1976 *Figuring Anthropology*. Holt, Reinhart, and Winston, New York.

Thompson, R. H., and W. A. Longacre
1966 The University of Arizona Archaeological Field School at Grasshopper, East Central Arizona. *Kiva* 31(1):255–275.

Tugby, Donald J.
1965 Archaeological Objectives and Statistical Methods: A Frontier in Archaeology. *American Antiquity* 30(1):1–16.

Tuggle, H. David, A. H. Townsend, and T. J. Riley
1972 Laws, Systems, and Research Designs: A Discussion of Explanation in Archaeology. *American Antiquity* 37:3–12.

Waterman, T. T.
1920 *The Whaling Equipment of the Makah Indians*. University of Washington Publications in Anthropology 1(1):1–67. Seattle.

n.d. *Geography of the Makah*. Bureau of American Ethnology Manuscript No. 1864. Washington D.C.

Waterman, T. T., and R. Greiner
1921 *Indian Houses of Puget Sound*. Indian Notes and Monographs, Museum of the American Indian, Heye Foundation, New York.

Waterman, T. T., and collaborators
1921 *Native Houses of Western North America*. Indian Notes and Monographs, Museum of the American Indian, Heye Foundation, New York.

Weisenborn, A. E., and P. Snavely
1968 *Summary and Report on the Geology and Mineral Resources of Flattery Rocks, Quillayute Needles and Copalis National Wildlife Refuges, Washington*. U.S. Geological Survey Bulletin 1260. Washington, D.C.

Wessen, Gary C.
1982 *Shell Middens as Cultural Deposits: A Case Study From Ozette*. Ph.D. dissertation, Washington State University. University Microfilms International, Ann Arbor.

1983 *Subsistence Patterns as Reflected by Invertebrate Remains Recovered at the Ozette Site*. Report to Interagency Archaeological Services, National Park Service. Laboratory of Anthropology, Washington State University, Pullman.

1988 *The Use of Shellfish Resources on the Northwest Coast: The View from Ozette*. In Research in Economic Anthropology, Supplement 3, edited by Barry Isaac, pp. 179–207. JAI Press, Greenwich, Conn.

1990 Prehistory of the Ocean Coast of Washington. In *Handbook of North American Indians, Vol. 7, Northwest Coast*, edited by Wayne Suttles, pp. 412–421. Washington, D.C.

Whallon, Robert Jr.
1973 Spatial Analysis of Occupation Floors I: Application of Dimensional Analysis of Variance. *American Antiquity* 38:266–277.

Whitlam, Robert

1975 *The FaRm 8 SYMAP project: the Application of a Computer Mapping Technique to the Analysis of Archaeological Data.* Paper presented to the 28th Annual Northwest Anthropological Conference, March 1975.

1980 *Archaeological Investigations at Cache Creek (EeRh 3).* Occasional Papers of the Archaeological Sites Advisory Board of British Columbia 5. Government of the Province of British Columbia, Victoria, B.C.

Wilcox, David R.

1975 A Strategy for Perceiving Social Groups in Puebloan Sites. In *Fieldiana: Anthropology* 65:120–174.

Willoughby, Charles C.

1886 *Indians of the Quinaielt Agency; Washington Territory.* Annual Report of the Smithsonian Institution, 1886, pp. 267–282. Washington D.C.

Wilson, George

n.d. Diary of George Wilson, 1849–1857. Copy on file, University of Washington Library, Seattle.

Continued from back cover . . .

28 1964 Ackerman, Robert E., *Archaeological Survey, Glacier Bay National Monument, Southeastern Alaska, Part 1.* (Out of Print; $3.70 xerox).

29 1964 Combes, John D., *Excavations at Spokane House-Fort Spokane Historic Site, 1962-1963.* (Out of Print; $10.30 xerox).

30 1964 Combes, John D., *A Preliminary Investigation at Old Military Fort Spokane, Washington.* (Out of Print; $6.60 xerox).

31 1964 Fryxell, Roald, and Richard D. Daugherty, *Demonstration of Techniques for Preserving Archaeological Stratigraphy: A Report to the Wenner-Gren Foundation.* (Out of Print; $2.40 xerox).

32 1965 Sprague, Roderick, *The Descriptive Archaeology of the Palus Burial Site, Lyons Ferry, Washington.* (Out of Print; $6.50 xerox).

33 1965 Rice, David G., *Archaeological Test Excavation in Fryingpan Rockshelter, Mount Rainier National Park.* (Out of Print; $1.70 xerox).

34 1965 Nelson, Charles M., *Archaeological Reconnaissance in the Lower Monumental and Little Goose Dam Reservoir Areas, 1964.* (Out of Print; $3.20 xerox).

35 1966 Kenaston, Monte Ray, *The Archaeology of the Harder Site, Franklin County, Washington.* (Out of Print; $14.50 xerox).

36 1965 Ackerman, Robert E., *Archaeological Survey: Glacier Bay National Monument, Southeastern Alaska. Part II.* (Out of Print; $8.00 xerox).

37 1966 Sprague, Roderick, and John D. Combes, *Excavations in the Little Goose and Lower Granite Dam Reservoir, 1965.* (Out of Print; $5.40 xerox).

38 1966 Larabee, Edward McM., and Susan Kardas, *Archaeological Survey of Grand Coulee Dam National Recreation Area. Part I: Lincoln County Above Normal Pool.* (Out of Print; $5.80 xerox).

39-I 1966 Nelson, Charles M., *A Preliminary Report on 45C01, A Stratified Open Site in the Southern Columbia Plateau.* (Out of Print; $10.40 xerox).

39-II 1966 Rice, David G., *An Archaeological Reconnaissance of the Wynochee Dam Reservoir, Greys Harbor County, Washington.* (Out of Print; $1.10 xerox).

40 1967 Daugherty, Richard, Barbara A. Purdy, and Roald Fryxell, *The Descriptive Archaeology and Geochronology of the Three Springs Bar Archaeological Site, Washington.* (Out of Print; $12.30 xerox).

41 1967 Walker, Deward E., Jr., *Mutual Cross-Utilization of Economic Resources in the Plateau: An Example from Aboriginal Nez Perce Fishing Practices.* (Out of Print; $7.60 xerox).

42 1967 Chance, David H., *Archaeological Survey of Coulee Dam National Recreation Area. Part II: Spring Draw-Down of 1967.* (Out of Print; $8.70 xerox).

43 1967 Sprague, Roderick, *A Preliminary Bibliography of Washington Archaeology.* (Out of Print; $9.10 xerox).

44 1968 Ackerman, Robert E., *The Archaeology of the Glacier Bay Region, Southeastern Alaska, Part III.* (Out of Print; $13.00 xerox).

45 1968 Rice, David G., *Archaeological Investigations in the Coulee Dam National Recreation Area, Spring 1968.* (Out of print; $5.30 xerox).

46 1969 Bernard, Russell, editor, *Los Otomies: Papers from the Ixmiquilpan Field School.* $3.00.

47 1969 Nelson, Charles M., *The Sunset Creek Site (45-KT-28) and Its Place in Plateau Prehistory.* (Out of Print; $43.60 xerox).

48-I 1971 Bernard, H. Russell, and Michael Kenny, editors, *The Inland Empire: Papers from the Spokane Area Field School in Cultural Anthropology and Linguistics.* (Out of Print; $16.90 xerox).

48-II 1971 Irwin, H.T., D.J. Hurd, and R.M. LaJeunesse, *Description and Measurement in Anthropology. Computer Series I.* (Out of Print; $1.80 xerox).

49 1971 Leonhardy, Frank C., Gerald Schroedl, Judith Bense, and Seth Beckerman, *Wexpusnime (45-GA-61): Preliminary Report.* $2.00.

50 1972 Rice, David G., *The Windust Phase in Lower Snake River Region Prehistory.* (Out of print; $22.50 xerox).

51 1973 Schroedl, Gerald F., *The Archaeological Occurrence of Bison in the Southern Plateau.* $4.00.

52 1974 Croes, Dale, Jonathon Davis, and H.T. Irwin, *The Use of Computer Graphics in Archaeology: A case Study from the Ozette Site, Washington.* $2.00.

53 1975 Adams, William H., Linda Gaw, and Frank C. Leonhardy, *Archaeological Excavations at Silcott, Washington: The Data Inventory.* (Out of Print; $28.00 xerox).

Continued inside front cover . . .

Reports of Investigations

1 1957 Stallard, Bruce, *An Archaeological Survey in the Wells Reservoir in the State of Washington.* (Out of Print; $1.50 xerox).

2 1958 Stallard, Bruce, *Preliminary Surveys for Highway Salvage Archaeology in the State of Washington: A Final Report.* (Out of Print; $3.50 xerox).

3 1959 Daugherty, Richard D., *Archaeological Excavations in the Ice Harbor Reservoir, 1959 Progress Report.* (Out of Print; $1.20 xerox).

4 1959 Newman, Thomas Stell, *Toleak Point - An Archaeological Site on the North Central Washington Coast.* (Out of Print; $13.80 xerox).

5 1959 Osborne, Douglas, *Archaeological Tests in the Lower Grand Coulee, Washington.* (Out of Print; $28.90 xerox).

6 1960 Sprague, Roderick, *Archaeology in the Sun Lakes Area of Central Washington.* Appendix by Roald Fryxell. (Out of Print; $5.80 xerox).

7 1961 Clinehens, Stephen S., *Further Archaeological Excavations in the Lower Grand Coulee of Central Washington.* (Out of Print; $7.80 xerox).

9 1961 Fryxell, Roald, *Geologic Field Examination of the Park Lake Housepit Site (45-GR-90), Lower Grand Coulee, Washington.* (Out of Print; $.90 xerox).

10 1961 Daugherty, Richard D., *Excavations in the Ice Harbor Reservoir, 1957-1960: A Preliminary Report.* (Out of Print; $1.90 xerox).

12 1961 Mallory, Oscar L., *An Archaeological Survey of Pacific Gas Transmission Company's Alberta to California Pipeline System: MP 108.0 to MP 722.0.* (Out of Print; $5.70 xerox).

13 1961 Combes, John D., *An Archaeological Survey of Pacific Gas Transmission Company's Alberta to California Pipeline System: MP 108.0 to MP 722.0. Phase II.* (Out of Print; $3.20 xerox).

14 1962 Mallory, Oscar L., *Continued Archaeological Appraisal of the Lower Coulee, Central Washington.* (Out of Print; $9.80 xerox).

15 1962 Ice, Dannie M., *Archaeology of the Lava Butte Site, Deschutes County, Oregon.* (Out of Print; $7.20 xerox).

16 1962 Guinn, Stanley J., *White Rock Village Archaeological Site: A Preliminary Report of Investigations.* (Out of Print; $3.20 xerox).

18–I 1963 Combes, John D., *A Report on the Excavations of a Late Indian Burial Site in the Ice Harbor Reservoir Region, Washington. Section 1.* (Out of Print; $6.10 xerox).

18-II 1962 Fryxell, Roald, *Geologic Examination of the Ford Island Archaeological Site (45-FR-47), Washington. Section II.* (Out of Print; $2.70 xerox).

19 1962 Daugherty, Richard D., *Archaeological Research in the Boundary Dam Reservoir Area. Final Report.* (Out of Print; $.60 xerox).

20 1962 Combes, John D., *Excavations at Fort Spokane, Summer of 1962: A Preliminary Report.* (Out of Print; $1.90 xerox).

21 1962 Fryxell, Roald (in cooperation with Richard D. Daugherty), *Interim Report: Archaeological Salvage in the Lower Monumental Reservoir, Washington.* (Out of Print; $3.90 xerox).

22 1963 Guinn, Stanley J., *A Maritime Village on the Olympic Peninsula of Washington.* (Out of Print; $7.80 xerox).

23 1963 Fryxell, Roald (in cooperation with Richard D. Daugherty), *Late Glacial and Post Glacial Geological and Archaeological Chronology of the Columbia Plateau, Washington: An Interim Report to the National Science Foundation, 1962-1963.* (Out of Print; $2.70 xerox).

24 1963 Steen, Virginia, *A Study of the Chemical and Physical Characteristics of Pumice from Glacier Peak, Washington and Mt. Mazama (Crater Lake), Oregon: Report of Progress, June 16 to September 7, 1963.* (Out of Print; $.90 xerox).

25 1964 Barnes, Paul L., *Archaeology of the Dean Site: Twin Falls County, Idaho.* (Out of Print; $9.70 xerox).

26 1964 Ackerman, Robert E., *Prehistory in the Kuskokwim-Bristol Bay Region, Southwestern Alaska.* (Out of Print; $5.20 xerox).

27 1964 Fryxell, Roald, and Earl F. Cook, editors, *A Field Guide to the Loess Deposits and Channeled Scablands of the Palouse Area, Eastern Washington.* (Out of Print; $3.60 xerox).

Continued inside back cover . . .