The Anzick Clovis assemblage was first discovered in the late 1960's near Livingston, Montana. More than 100 stone and bone artifacts were found in association with the remains of two subadults proven to be the earliest radiocarbon-dated human burial in North America. Although human remains are notoriously absent, similar artifact assemblages have been found in Utah, Idaho, Washington State, and Colorado. These assemblages were recovered as discrete groups of artifacts with no evidence of associated habitation or economic activities. A number of hypotheses have been offered concerning the function or meaning of these assemblages despite the lack of a complete, detailed analysis of any of these assemblages. Hypotheses offered include projectile point "blueprint" of production, functional tools in various stages of reduction cached for future use, tools made specifically for mortuary purpose, and tools meant to be heirlooms and handed down through generations. Each of these hypotheses presents behavioral implications that may be tested with different levels of analyses. Raw material, shape, technology, and use-wear are addressed in the Anzick assemblage in order to test each hypotheses. Initial results of the analyses suggest that the Anzick assemblage is composed of a number of tool types that (1) were not produced specifically for mortuary purposes, (2) suggest relationships between raw material context and technological organization, and (3) were not intended to be recovered for future use. Furthermore, the artifacts appear to be functional tools reflecting a highly formalized toolkit. Similar contexts of the Anzick and other assemblages indicate a comparable function for all these assemblages.
The Anzick Site: Analysis of a Clovis Burial Assemblage

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# Table of Contents

1. Introduction and Problem of the Anzick Clovis Discovery ........................................ 1
   1.1 Organization of Report ..................................................................................... 3
   1.2 Orientation and Approach to the Problem of the Anzick Assemblage ................... 3
   1.3 The Clovis Cultural Complex .......................................................................... 4

2. Research Design .................................................................................................... 12
   2.1 Introduction .................................................................................................... 12
   2.2 Discovery and Content of Unique Clovis Assemblages ..................................... 12
   2.3 Working Hypotheses ..................................................................................... 20

3. History of the Discovery and Work ....................................................................... 27
   3.1 Introduction .................................................................................................... 27
   3.2 History of Anzick Discovery ........................................................................... 27

4. Physical and Environmental Context of the Anzick Site ....................................... 32
   4.1 Introduction .................................................................................................... 32
   4.2 Regional Record ............................................................................................ 32
   4.3 Local Record ................................................................................................ 39
   4.4 Summary ....................................................................................................... 43

5. Methodologies and Systematics for Artifact Classification and Analysis .............. 44
   5.1 Introduction .................................................................................................... 44
   5.2 Classification ................................................................................................ 44
   5.3 Raw Material Analysis ................................................................................ 48
   5.4 Shape Analysis ............................................................................................. 50
   5.5 Technological Analysis and Imaging Methods ................................................ 55
   5.6 Use-Wear/Functional Analysis ....................................................................... 68
   5.7 Comparative Content Analysis ..................................................................... 70
   5.8 Bone Implements .......................................................................................... 71
Table of Contents (Continued)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.9. Economic and Adaptive Strategies</td>
<td>74</td>
</tr>
<tr>
<td>6. Lithic Raw Material Analysis</td>
<td>75</td>
</tr>
<tr>
<td>6.1 Introduction</td>
<td>75</td>
</tr>
<tr>
<td>6.2 Raw Material Types</td>
<td>75</td>
</tr>
<tr>
<td>6.3 Raw Material Composition of the Lithic Assemblage</td>
<td>77</td>
</tr>
<tr>
<td>6.4 Raw Material Sources</td>
<td>79</td>
</tr>
<tr>
<td>6.5 Summary</td>
<td>81</td>
</tr>
<tr>
<td>7. Projectile Points</td>
<td>83</td>
</tr>
<tr>
<td>7.1 Introduction</td>
<td>83</td>
</tr>
<tr>
<td>7.2 Raw Material Analysis</td>
<td>83</td>
</tr>
<tr>
<td>7.3 Shape Analysis</td>
<td>84</td>
</tr>
<tr>
<td>7.4 Technological Analysis</td>
<td>89</td>
</tr>
<tr>
<td>7.5 Use-wear Analysis</td>
<td>97</td>
</tr>
<tr>
<td>7.6 Discussion</td>
<td>101</td>
</tr>
<tr>
<td>8. Bifaces</td>
<td>102</td>
</tr>
<tr>
<td>8.1 Introduction</td>
<td>102</td>
</tr>
<tr>
<td>8.2 Raw Material Analysis</td>
<td>102</td>
</tr>
<tr>
<td>8.3 Shape Analysis</td>
<td>106</td>
</tr>
<tr>
<td>8.4 Technological Analysis</td>
<td>119</td>
</tr>
<tr>
<td>8.5 Use-Wear Analysis</td>
<td>134</td>
</tr>
<tr>
<td>8.6 Discussion</td>
<td>142</td>
</tr>
<tr>
<td>9. Unifacial Tools, Flake Tools, and Flakes</td>
<td>146</td>
</tr>
<tr>
<td>9.1 Introduction</td>
<td>146</td>
</tr>
<tr>
<td>9.2 Raw Material Analysis</td>
<td>146</td>
</tr>
<tr>
<td>9.3 Shape/Stylistic Analysis</td>
<td>147</td>
</tr>
</tbody>
</table>
Table of Contents (Continued)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.4 Technological Analysis</td>
<td>150</td>
</tr>
<tr>
<td>9.5 Use-wear Analysis</td>
<td>152</td>
</tr>
<tr>
<td>9.6 Discussion</td>
<td>154</td>
</tr>
<tr>
<td>10. Bone Implements</td>
<td>155</td>
</tr>
<tr>
<td>10.1 Introduction</td>
<td>155</td>
</tr>
<tr>
<td>10.2 Assemblage Contents</td>
<td>155</td>
</tr>
<tr>
<td>10.3 Raw Material and Manufacturing Techniques</td>
<td>156</td>
</tr>
<tr>
<td>10.4 Stylistic Analysis</td>
<td>156</td>
</tr>
<tr>
<td>10.5 Use and Function of Bone Implements</td>
<td>160</td>
</tr>
<tr>
<td>10.6 Discussion</td>
<td>162</td>
</tr>
<tr>
<td>11. Conclusions</td>
<td>163</td>
</tr>
<tr>
<td>11.1 Introduction</td>
<td>163</td>
</tr>
<tr>
<td>11.2 Testing the Clovis Hypotheses</td>
<td>163</td>
</tr>
<tr>
<td>11.3 The Anzick Clovis Assemblage within the Context of the Clovis “Cache” Phenomenon</td>
<td>166</td>
</tr>
<tr>
<td>11.4 Clovis Lithic Technological Organization and Adaptive Strategies: A View from the Anzick Assemblage</td>
<td>167</td>
</tr>
<tr>
<td>11.5 Conclusions</td>
<td>170</td>
</tr>
<tr>
<td>Bibliography</td>
<td>172</td>
</tr>
<tr>
<td>Appendix A: Projectile Point Images</td>
<td>186</td>
</tr>
<tr>
<td>Appendix B: Biface Images</td>
<td>203</td>
</tr>
<tr>
<td>Appendix C: Unifacial, Flake Tool, and Flake Images</td>
<td>342</td>
</tr>
<tr>
<td>Appendix D: Bone Foreshaft Images</td>
<td>358</td>
</tr>
</tbody>
</table>
List of Figures

Figure | Page
-------|------
1.1. Location of the Anzick Clovis site in Montana (adapted from Davis 1993) | 2
2.1. Location of Clovis sites consisting of unique assemblages discussed in text: 1.) Simon site, 2.) Anzick site, 3.) Drake site, 4.) East Wenatchee site, 5.) Fenn (after Frison 1991) | 13
2.2. Classes of artifact defined in Anzick Assemblage | 19
4.1. Location of the Anzick site within the Shields River Valley, Montana (map courtesy of R. Bonnichsen) | 34
4.2. Location and elevation of the Anzick site along Flathead Creek, Montana (map courtesy of R. Bonnichsen) | 35
4.3. Anzick site stratigraphic profile, west wall (courtesy of R. Bonnichsen) | 41
5.1. Branch diagram illustrating levels of classification of the Anzick assemblage | 45
5.2. Fluted point in orientation position of artifacts for measurements (letters correspond with Table 5.4) | 50
5.3. Artifact section form types: Top row - base forms, A. concave, B. convex, C. pointed, D. straight, E. assymetrical; Middle row - blade forms, A. incurvate, B. excurvate, C. straight, D. assymetrical; Bottom row - tip forms, A. triangular excurvate, B. triangular incurvate, C. triangular straight, D. assymetrical | 54
5.4. Relationships between terms utilized in the cognitive approach | 58
5.5. Sample technology attribute coding sheet | 65
5.6. Examples of technological attributes defined above: A. size: 1. very substantial, 2. substantial, 3. moderate, 4. minimal, 5. very minimal; B. spacing; C. form: 1. 1/3 overlap, 2. 1/2 overlap, 3. no overlap; D. angle | 66
5.7. Examples of flake scar thinning patterns; Row 1, Blade thinning patterns: (A) diagonal parallel thinning; (B) diagonal harlequin thinning; (C) resharpened thinning; (D) collateral substantial thinning; (E) pressure retouch; Row 2, Tip creating: (F) pressure thinning flakes, needle nose; (G) collateral pressure flakes, triangular; (H) tranchet, assymetrical; Row 3, Base shape: (I) pressure thinning; (J) fluting; (K) pressure retouch | 67
5.8. Bone implements attributes (see Table 5.6 for corresponding letter) | 73
6.1. Raw material composition of the Anzick assemblage by percentages | 78
6.2. Raw material compositions of the Anzick assemblage by artifact class | 78
6.3. Approximate source areas for Phosphoria chert and Porcellanite (locations after 1976; Francis 1991; base map after Davis 1993) | 82
7.1. Paradigmatic classification of the projectile points by shape | 88
<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2 Anzick projectile point flow diagram (after Young and Bonnichsen 1984)</td>
<td>90</td>
</tr>
<tr>
<td>7.3 Revised projectile point production flowchart</td>
<td>96</td>
</tr>
<tr>
<td>7.4 Clovis point use-wear; A.) extensive polish, basal margin #69; B.) moderate polish, basal margin #70; C.) slight polish, basal margin #25</td>
<td>100</td>
</tr>
<tr>
<td>8.1 Means and standard deviations of biface length measurements</td>
<td>109</td>
</tr>
<tr>
<td>8.2 Means and standard deviations of biface distal width measurements</td>
<td>109</td>
</tr>
<tr>
<td>8.3 Means and standard deviations of biface mid-width measurements</td>
<td>110</td>
</tr>
<tr>
<td>8.4 Means and standard deviations of biface proximal width measurements</td>
<td>110</td>
</tr>
<tr>
<td>8.5 Means and standard deviations of biface thickness measurements</td>
<td>110</td>
</tr>
<tr>
<td>8.6 Biface Length: Distal Width scatterplot graph (all measurements in mm)</td>
<td>113</td>
</tr>
<tr>
<td>8.7 Biface Length: Mid-width scatterplot diagram (all measurements in mm)</td>
<td>114</td>
</tr>
<tr>
<td>8.8 Biface Length: Proximal Width scatterplot diagram (all measurements in mm)</td>
<td>115</td>
</tr>
<tr>
<td>8.9 Grammatical structure flowchart, Group 1 agate bifaces</td>
<td>132</td>
</tr>
<tr>
<td>8.10 Outre passe reduction flowchart, Group 2 and 3 and remaining agate bifaces</td>
<td>133</td>
</tr>
<tr>
<td>8.11 Chalcedony grammatical structure flowchart</td>
<td>134</td>
</tr>
<tr>
<td>8.12 Agate biface use-wear examples: A., biface #71, moderate-extensive polish; B. biface #84, moderate polish</td>
<td>140</td>
</tr>
<tr>
<td>8.13 Anzick chalcedony biface use-wear examples: A., biface #10, moderate polish; B., biface #78, slight polish</td>
<td>141</td>
</tr>
<tr>
<td>8.14 Proposed hafting technique of typical Anzick biface</td>
<td>145</td>
</tr>
<tr>
<td>9.1 Microflaking present on working face of sidescraper #100</td>
<td>153</td>
</tr>
<tr>
<td>10.1 Proposed method of hafting Clovis projectile points with bone foreshafts (from Lahren and Bonnichsen 1974)</td>
<td>161</td>
</tr>
</tbody>
</table>
List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1. Artifact inventories of assemblages discussed in text.</td>
<td>16</td>
</tr>
<tr>
<td>2.2. Artifact definitions for classification purposes</td>
<td>17</td>
</tr>
<tr>
<td>2.3. Assemblage composition of the Anzick Clovis assemblage</td>
<td>18</td>
</tr>
<tr>
<td>2.4. Clovis assemblage hypotheses and implicative characteristics of each</td>
<td>26</td>
</tr>
<tr>
<td>4.1. Radiocarbon dates derived from human skull fragments associated with the Anzick assemblage (after Stafford 1994)</td>
<td>42</td>
</tr>
<tr>
<td>5.1. Attribute definitions for classification purposes</td>
<td>46</td>
</tr>
<tr>
<td>5.2. Assemblage composition of the Anzick Clovis assemblage</td>
<td>47</td>
</tr>
<tr>
<td>5.3. Attribute definitions utilized for lithic raw material analysis</td>
<td>49</td>
</tr>
<tr>
<td>5.4. Definitions of metric attributes used in shape/size analysis</td>
<td>51</td>
</tr>
<tr>
<td>5.5 Qualitative definitions of biface section forms</td>
<td>53</td>
</tr>
<tr>
<td>5.6. Attribute definitions for technological analysis</td>
<td>62</td>
</tr>
<tr>
<td>5.7. Use-wear attribute definitions</td>
<td>69</td>
</tr>
<tr>
<td>5.8. Bone tool attribute definitions</td>
<td>72</td>
</tr>
<tr>
<td>6.1. Composition of the Anzick assemblage by artifact class and raw material</td>
<td>76</td>
</tr>
<tr>
<td>7.1. Munsell color designations and luster of Anzick projectile points</td>
<td>83</td>
</tr>
<tr>
<td>7.2. Anzick projectile point attribute measurements</td>
<td>85</td>
</tr>
<tr>
<td>7.3. Ranges and means of Anzick projectile point attribute measurements</td>
<td>85</td>
</tr>
<tr>
<td>7.4. Technological coding of Anzick projectile points</td>
<td>91</td>
</tr>
<tr>
<td>7.5. Anzick projectile point use-wear analysis</td>
<td>98</td>
</tr>
<tr>
<td>8.1. Munsell color designations, luster, and variation type of chalcedony bifaces</td>
<td>104</td>
</tr>
<tr>
<td>8.2. Munsell color designations, luster, and other attributes of Anzick agate bifaces and porcellanite biface #48</td>
<td>105</td>
</tr>
<tr>
<td>8.3. Anzick biface assemblage metric measurements (all measurements in mm)</td>
<td>107</td>
</tr>
<tr>
<td>8.4. Ranges and means of biface assemblage by raw material type</td>
<td>108</td>
</tr>
<tr>
<td>8.5. Pearson’s correlation coefficients for Anzick biface metric measurements</td>
<td>111</td>
</tr>
</tbody>
</table>
List of Tables (Continued)

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.6. Compositions and comparison of biface scatterplots</td>
<td>112</td>
</tr>
<tr>
<td>8.7. biface group composition, raw material types, and shape types</td>
<td>117</td>
</tr>
<tr>
<td>8.8. Technological units, Group 1</td>
<td>120</td>
</tr>
<tr>
<td>8.9. Technological units, Group 2</td>
<td>120</td>
</tr>
<tr>
<td>8.10. Technological units, Group 3</td>
<td>121</td>
</tr>
<tr>
<td>8.11. Technological units, Group 4</td>
<td>121</td>
</tr>
<tr>
<td>8.12. Technological units, Group 5</td>
<td>122</td>
</tr>
<tr>
<td>8.13. Technological units, Group 6</td>
<td>123</td>
</tr>
<tr>
<td>8.14. Summary of the results of the use-wear analysis of the Anzick agate biface assemblage</td>
<td>136</td>
</tr>
<tr>
<td>8.15. Summary of the results of the use-wear analysis of the Anzick chalcedony biface assemblage</td>
<td>137</td>
</tr>
<tr>
<td>9.1. Munsell color designations of Anzick unifacial and flake tools</td>
<td>147</td>
</tr>
<tr>
<td>9.2. Anzick uniface attribute measurements</td>
<td>149</td>
</tr>
<tr>
<td>9.3. Anzick flake tool attribute measurements</td>
<td>150</td>
</tr>
<tr>
<td>9.4. Technological attributes of unifacial and flake tools</td>
<td>151</td>
</tr>
<tr>
<td>9.5. Uniface and flake tool use-wear analysis results</td>
<td>152</td>
</tr>
<tr>
<td>10.1. Bone implement attribute measurements (in mm except for angle attributes)</td>
<td>157</td>
</tr>
<tr>
<td>10.2. Comparison of metric data from complete bone tool implements from the Anzick, Agate Basin, and East Wenatchee sites (in mm)</td>
<td>159</td>
</tr>
</tbody>
</table>
Appendix A List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1. Anzick Clovis point #6, A. ventral, B. dorsal</td>
<td>187</td>
</tr>
<tr>
<td>A.2. Anzick Clovis point #25, A. ventral, B. dorsal</td>
<td>189</td>
</tr>
<tr>
<td>A.3. Anzick Clovis point #36, A. ventral, B. dorsal</td>
<td>191</td>
</tr>
<tr>
<td>A.4. Anzick Clovis point #68, A. ventral, B. dorsal</td>
<td>193</td>
</tr>
<tr>
<td>A.5. Anzick Clovis point #69, A. ventral, B. dorsal</td>
<td>195</td>
</tr>
<tr>
<td>A.6. Anzick Clovis point #70, A. ventral, B. dorsal</td>
<td>197</td>
</tr>
<tr>
<td>A.7. Anzick Clovis point #82, A. ventral, B. dorsal</td>
<td>199</td>
</tr>
<tr>
<td>A.8. Anzick Clovis point #83, A. ventral, b. dorsal</td>
<td>201</td>
</tr>
</tbody>
</table>
# Appendix B List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1</td>
<td>204</td>
</tr>
<tr>
<td>B.2</td>
<td>206</td>
</tr>
<tr>
<td>B.3</td>
<td>208</td>
</tr>
<tr>
<td>B.4</td>
<td>210</td>
</tr>
<tr>
<td>B.6</td>
<td>212</td>
</tr>
<tr>
<td>B.7</td>
<td>214</td>
</tr>
<tr>
<td>B.8</td>
<td>216</td>
</tr>
<tr>
<td>B.9</td>
<td>218</td>
</tr>
<tr>
<td>B.10</td>
<td>220</td>
</tr>
<tr>
<td>B.11</td>
<td>222</td>
</tr>
<tr>
<td>B.12</td>
<td>224</td>
</tr>
<tr>
<td>B.13</td>
<td>226</td>
</tr>
<tr>
<td>B.14</td>
<td>228</td>
</tr>
<tr>
<td>B.15</td>
<td>230</td>
</tr>
<tr>
<td>B.16</td>
<td>232</td>
</tr>
<tr>
<td>B.17</td>
<td>234</td>
</tr>
<tr>
<td>B.18</td>
<td>236</td>
</tr>
<tr>
<td>B.19</td>
<td>238</td>
</tr>
<tr>
<td>B.20</td>
<td>240</td>
</tr>
<tr>
<td>B.21</td>
<td>242</td>
</tr>
<tr>
<td>B.22</td>
<td>244</td>
</tr>
<tr>
<td>B.23</td>
<td>246</td>
</tr>
<tr>
<td>B.24</td>
<td>248</td>
</tr>
<tr>
<td>B.24</td>
<td>250</td>
</tr>
<tr>
<td>Figure</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>B.25. Anzick biface #32; A. ventral, B. dorsal</td>
<td>252</td>
</tr>
<tr>
<td>B.26. Anzick biface #33; A. ventral, B. dorsal</td>
<td>254</td>
</tr>
<tr>
<td>B.27. Anzick biface #34; A. ventral, B. dorsal</td>
<td>256</td>
</tr>
<tr>
<td>B.28. Anzick biface #35; A. ventral, B. dorsal</td>
<td>258</td>
</tr>
<tr>
<td>B.29. Anzick biface #41; A. ventral, B. dorsal</td>
<td>260</td>
</tr>
<tr>
<td>B.30. Anzick biface #42; A. ventral, B. dorsal</td>
<td>262</td>
</tr>
<tr>
<td>B.31. Anzick biface #43; A. ventral, B. dorsal</td>
<td>264</td>
</tr>
<tr>
<td>B.32. Anzick biface #44; A. ventral, B. dorsal</td>
<td>266</td>
</tr>
<tr>
<td>B.33. Anzick biface #45; A. ventral, B. dorsal</td>
<td>268</td>
</tr>
<tr>
<td>B.34. Anzick biface #46; A. ventral, B. dorsal</td>
<td>270</td>
</tr>
<tr>
<td>B.35. Anzick biface #47; A. ventral, B. dorsal</td>
<td>272</td>
</tr>
<tr>
<td>B.36. Anzick biface #48; A. ventral, B. dorsal</td>
<td>274</td>
</tr>
<tr>
<td>B.37. Anzick biface #49; A. ventral, B. dorsal</td>
<td>276</td>
</tr>
<tr>
<td>B.38. Anzick biface #50; A. ventral, B. dorsal</td>
<td>278</td>
</tr>
<tr>
<td>B.39. Anzick biface #51; A. ventral, B. dorsal</td>
<td>280</td>
</tr>
<tr>
<td>B.40. Anzick biface #5/29; A. ventral, B. dorsal</td>
<td>282</td>
</tr>
<tr>
<td>B.41. Anzick biface #53; A. ventral, B. dorsal</td>
<td>284</td>
</tr>
<tr>
<td>B.42. Anzick biface #59; A. ventral, B. dorsal</td>
<td>286</td>
</tr>
<tr>
<td>B.43. Anzick biface #60; A. ventral, B. dorsal</td>
<td>288</td>
</tr>
<tr>
<td>B.44. Anzick biface #61; A. ventral, B. dorsal</td>
<td>290</td>
</tr>
<tr>
<td>B.45. Anzick biface #71; A. ventral, B. dorsal</td>
<td>292</td>
</tr>
<tr>
<td>B.46. Anzick biface #72; A. ventral, B. dorsal</td>
<td>294</td>
</tr>
<tr>
<td>B.47. Anzick biface #73; A. ventral, B. dorsal</td>
<td>296</td>
</tr>
<tr>
<td>B.48. Anzick biface #74; A. ventral, B. dorsal</td>
<td>298</td>
</tr>
<tr>
<td>B.49. Anzick biface #75; A. ventral, B. dorsal</td>
<td>300</td>
</tr>
</tbody>
</table>
## Appendix B List of Figures (Continued)

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.49. Anzick biface #77; A. ventral, B. dorsal.</td>
<td>302</td>
</tr>
<tr>
<td>B.50. Anzick biface #78; A. ventral, B. dorsal.</td>
<td>304</td>
</tr>
<tr>
<td>B.51. Anzick biface #79; A. ventral, B. dorsal.</td>
<td>306</td>
</tr>
<tr>
<td>B.52. Anzick biface #80; A. ventral, B. dorsal.</td>
<td>308</td>
</tr>
<tr>
<td>B.53. Anzick biface #84; A. ventral, B. dorsal.</td>
<td>310</td>
</tr>
<tr>
<td>B.54. Anzick biface #85; A. ventral, B. dorsal.</td>
<td>312</td>
</tr>
<tr>
<td>B.55. Anzick biface #86; A. ventral, B. dorsal.</td>
<td>314</td>
</tr>
<tr>
<td>B.56. Anzick biface #88; A. ventral, B. dorsal.</td>
<td>316</td>
</tr>
<tr>
<td>B.57. Anzick biface #89; A. ventral, B. dorsal.</td>
<td>318</td>
</tr>
<tr>
<td>B.58. Anzick biface #90; A. ventral, B. dorsal.</td>
<td>320</td>
</tr>
<tr>
<td>B.59. Anzick biface #91; A. ventral, B. dorsal.</td>
<td>322</td>
</tr>
<tr>
<td>B.60. Anzick biface #92/93; A. ventral, B. dorsal.</td>
<td>324</td>
</tr>
<tr>
<td>B.61. Anzick biface #96; A. ventral, B. dorsal.</td>
<td>326</td>
</tr>
<tr>
<td>B.62. Anzick biface #97; A. ventral, B. dorsal.</td>
<td>328</td>
</tr>
<tr>
<td>B.63. Anzick biface #98; A. ventral, B. dorsal.</td>
<td>330</td>
</tr>
<tr>
<td>B.64. Anzick biface #101; A. ventral, B. dorsal.</td>
<td>332</td>
</tr>
<tr>
<td>B.65. Anzick biface #103; A. ventral, B. dorsal.</td>
<td>334</td>
</tr>
<tr>
<td>B.66. Anzick biface #104; A. ventral, B. dorsal.</td>
<td>336</td>
</tr>
<tr>
<td>B.67. Anzick biface #105; A. ventral, B. dorsal.</td>
<td>338</td>
</tr>
<tr>
<td>B.68. Anzick biface #106; A. ventral, B. dorsal.</td>
<td>340</td>
</tr>
</tbody>
</table>
Appendix C List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.1. Anzick convergent sidescraper #11, A. dorsal, B. ventral.</td>
<td>343</td>
</tr>
<tr>
<td>C.2. Anzick “classic” unifacial endscraper #19, A. unmodified ventral, B. dorsal.</td>
<td>345</td>
</tr>
<tr>
<td>C.3. Anzick endscraper #99, A. dorsal, B. ventral.</td>
<td>347</td>
</tr>
<tr>
<td>C.4. Anzick sidescraper #100, A. dorsal, B. ventral.</td>
<td>349</td>
</tr>
<tr>
<td>C.5. Anzick flake tool #52, A. dorsal, B. ventral.</td>
<td>351</td>
</tr>
<tr>
<td>C.6. Anzick blade-like flake #66, A. ventral, B. dorsal. Arrow points to area of retouch along margin.</td>
<td>353</td>
</tr>
<tr>
<td>C.7. Anzick flake tool #81, A. dorsal, B. ventral.</td>
<td>355</td>
</tr>
<tr>
<td>C.8. Small flakes associated with the Anzick assemblage (#’s 114-116).</td>
<td>357</td>
</tr>
</tbody>
</table>
### Appendix D List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.1. Anzick bone tool #37, A. ventral, B. dorsal</td>
<td>359</td>
</tr>
<tr>
<td>D.2. Anzick bone tool fragments #38, A. ventral, B. dorsal; and #120, C. ventral, D. side</td>
<td>360</td>
</tr>
<tr>
<td>D.3. Anzick bone tool #39, A. ventral, B. dorsal</td>
<td>361</td>
</tr>
<tr>
<td>D.5. Anzick bone tool #94, A. ventral, B. dorsal, C. side</td>
<td>363</td>
</tr>
<tr>
<td>D.6. Anzick bone tool #95, A. ventral, B. dorsal, C. side</td>
<td>364</td>
</tr>
<tr>
<td>D.7. Anzick bone tool #118/119, A. ventral, B. dorsal, C. side. Arrows point to impact fractures</td>
<td>365</td>
</tr>
<tr>
<td>D.8. Anzick bone tool fragments #122, A. ventral, B. dorsal; and #123, C. ventral, D. dorsal</td>
<td>366</td>
</tr>
</tbody>
</table>
The Anzick Site: Analysis of a Clovis Burial Assemblage

Chapter 1: Introduction and Problem of the Anzick Clovis Discovery

The Anzick Clovis site, Park County, Montana (24Pa506) was fortuitously discovered in 1968 during construction-related activities (Figure 1.1). In this regard, the serendipitous discovery of this site is not unlike other significant archaeological discoveries. However, among the artifactual materials recovered were incredibly well-made projectile points and stone tools as well as bone implements in association with human remains. These projectile points are identical to others diagnostic of the cultural tradition known as the Clovis complex. What separates this discovery from other Clovis finds is the fact that the artifact assemblage was not associated with a camp, kill, quarry, or any other site type associated with the Clovis complex. Instead, it consists only of a large number of well-made artifacts deposited as a discrete group or cluster. Aside from the Anzick discovery, a number of other finds with similar contexts and artifact types have been discovered. Unfortunately, no complete, detailed report has been produced for any of these unique assemblages to date. While aspects of the Anzick site have been reported (Jones and Bonnichsen 1994; Lahren and Bonnichsen 1975; Young and Bonnichsen 1984, 1985; Young et al. 1994), this study is the first detailed report of the Anzick site.
Figure 1.1. Location of the Anzick Clovis site in Montana (adapted from Davis 1993).
1.1 Organization of Report

In Chapter 1, the problem represented by the Anzick discovery and a review of the Clovis complex is introduced. This review is meant to provide a background for the current understanding of the Clovis complex so that the Anzick assemblage may be better understood within this broader context. The following chapter (chapter 2) is a detailed research design that discusses how interpretations of the Anzick assemblages are derived and the manner in which the interpretations may be addressed. A detailed history of the discovery and institutional involvement in the Anzick assemblage from its initial discovery to the development of this report is provided in Chapter 3. The palaeoecological and geological conditions of the site area at the time of the Anzick assemblage deposition including geomorphology and radiocarbon dating is summarized in Chapter 4. Chapter 5 consists of the methodologies and systematics for the artifact analyses and how each provides information essential to the development of interpretations. The results of the lithic raw material analysis is presented in Chapter 6. The results of the analyses of projectile point assemblage are provided in chapter 7 while the results of the biface analyses are presented in chapter 8. Due to the small sample sizes, the unifacial tool, flake tool, and flake classes are addressed together in chapter 9. The bone implements also associated with the Anzick assemblage are discussed in chapter 10. Comparisons with other Clovis assemblages, discussion of economic and adaptive strategies, and final conclusions are presented in chapter 11.

1.2 Orientation and Approach to the Problem of the Anzick Assemblage

The Anzick assemblage represents one of a number of unique types of Clovis complex sites that are beset by a number of conflicting interpretations. These unique sites and interpretations are described in greater detail in Chapter 2. The conflicting interpretations are hypotheses derived from single lines of evidence with associated implications that are testable. Resolution of these conflicting hypotheses is dependent upon the development of a wholistic, standardized analysis that can produce data to test the
implications associated with each hypothesis. Nothing short of such an approach that also will allow
differences or similarities with other assemblages to be recognized is required to resolve the conflicting
interpretations.

A wholistic approach must involve the “sum total of the overall morphology of a piece of worked
stone” (Clark 1989:31). The “overall morphology” of worked stone is expressed by its technological
organization. Technological organization in this study is defined as the total cultural decision-making
process represented in an assemblage from acquisition of raw materials, to production and manufacture of
tools and waste, use, and final discard of artifacts. Taken together, raw materials, artifact shape, production
technology, and use or function constitute the entirety of the technological organization (i.e. overall
morphology) of an assemblage. Patterns in the organization of these constituents and their attributes reflect
choices made by the craftsman. These choices reflect cultural behaviors that require explanation. Thus,
integration of multiple lines of evidence may provide more accurate interpretations of prehistoric behavior
than dependence upon single lines evidence. Integration of multiple levels of analysis in this study will help
resolve the controversy surrounding the role or function of the Anzick assemblage and aid in inferring
patterns of Paleoindian economic adaptations.

1.3 The Clovis Cultural Complex

The first widely reported occurrence of a Clovis site was the discovery of fluted projectile points in
association with extinct mammoth remains at Dent, Colorado (Figgens 1933). Soon after the Dent
discovery, the recovery of similar projectile points, once again in association with mammoth remains,
resulted in the naming of this cultural complex after the nearby town of Clovis, New Mexico (Hester 1972;
Sellards 1955). Since that time, the Clovis complex has become a center of attention in North American
archaeology and has generated a tremendous amount of information concerning early human habitation in
the New World. A comprehensive review along with discussion of implications associated with various
interpretations is provided below.
1.3.1 The Clovis Toolkit

A number of researchers in recent years have attempted to define the Clovis complex toolkit or certain aspects of the toolkit (Haynes 1980, 1987; Stanford 1991). They have developed a list of common traits which they believe characterize Clovis assemblages throughout North and Central America. These traits are based upon generalization of manufacturing processes (Callahan 1979; Collins 1990), or definition of diagnostic artifact types without incorporation of regional variability (Howard 1990). This approach has resulted in a view of Clovis as a single, pan-continental cultural complex. This normative view can be traced to early arguments presenting Clovis as a rapid, colonizing population in North America (Martin 1967, 1973) which shared a common set of beliefs, adaptive strategies, and a common artifact inventory.

Others have attempted to account for the variability evident in the Clovis archaeological record. Haynes (1964) recognized stylistic variation within and between Clovis assemblages that has not been incorporated in the above studies. Studies concerned with production processes (e.g. Bonnichsen 1977; Young and Bonnichsen 1984, 1985) has led to alternative interpretations of the development and diffusion of Clovis. Climatic changes in the Pleistocene-Holocene transition greatly affected the environments supporting these groups (Bonnichsen et al. 1987). As populations of extinct Pleistocene fauna became stressed under these conditions, technologies such as fluting spread rapidly as humans struggled to maintain a certain lifestyle (Bonnichsen 1991). This interpretation views Clovis as a diffusing technology rather than human beings rapidly expanding in virgin territory. Variability in the material record of the Clovis complex is not hard to accept within the view of Bonnichsen’s (1991) model. Assuming that fluting was innovated in North America south of the ice sheets due to the fact that no fluted points have been recovered from Siberia (Bryan 1991; Haynes 1987), it should be expected that this technology diffused through the Western Hemisphere at differing rates resulting in geographical discrepancies in the age of the fluted point horizon (Bonnichsen 1991).

Despite the variation in point morphology, the common denominator of all Clovis points is the removal of a flute or “flute” from either or both faces. The flute originates from the basal margin of the point and extends longitudinally up the face. The generally accepted interpretation of this attribute is that fluting facilitated hafting of the point to a foreshaft and provided a secure and efficient bind (Haynes
1987:91). Use of the fluted point in this context is illustrated by Lahren and Bonnichsen (1974) and reprinted in Chapter 10, Figure 10.9.

The use of high-quality lithic material for the manufacture of fluted points is necessary to overcome the difficulties and high failure rate of fluting a Clovis point. Aside from purely utilitarian functions, fluting may have also served ideational functions (Storck 1991), but empirical support for this view is weak. The fact that Clovis flintknappers preferred high-quality lithic raw material for fluted point production (Stanford 1991:2) and often incorporated the natural, aesthetic color patterns of the raw material into the final product (Haynes 1980) suggests a well-developed sense of aesthetics.

While no single Clovis site has produced all artifacts associated with this complex (Bonnichsen 1991), the repeated occurrence of certain artifact types at Clovis sites deserves some mention. Stanford (1991) lists artifact types comprising the general Clovis tool kit. These include bifaces, blades, blade cores (see also Green 1963), unifacial tools produced from blades, flakes, gravers, occasional burins, and a single occurrence of a "crescent" (Frison 1991). A variety of blade and flake tool forms are reported from Clovis sites (see Sanders 1990 as an example of this variation). Blades and blade cores are widely distributed throughout the distribution of Clovis artifacts but appear to be especially common on sites in the Southeast and Southern Plains (Sanders 1990; Stanford 1991). *Pieces esquilles* have been recovered from a number of fluted-point sites from the Northeast, Northwestern Plains, and Far North. Traditionally thought to be wedges, *pieces esquilles* have been the subject of recent study and it has been shown that these artifacts were more likely to have functioned as bipolar cores in areas where access to raw material was lacking (Goodyear 1993; Shott 1989).

Due to preservation problems (Haynes 1980), bone/ivory technology most likely comprised a much more significant part of the Clovis complex than is recognized. Bone or ivory "foreshafts" have been discovered at a number of Clovis sites throughout North America including the Anzick site (Lahren and Bonnichsen 1974), Sheaman site (Frison and Stanford 1982), Florida (Dunbar et al. 1989), East Wenatchee (Gramly 1993; Mehringer 1989), and Blackwater Draw (Hester 1972). These artifacts are typically cylindrical in shape with one or both ends beveled and/or tapered. The role of these bone implements has been debated in the recent literature and is discussed in greater detail in chapter 9. Other aspects of bone
technology are represented through the recovery of a mammoth bone shaft wrench from Murray Springs (Haynes and Hemmings 1968); a modified tusk fragment, a bone bead, and an awl or punch from Blackwater Draw (Saunders et al. 1990); and flaked mammoth long bone from the Lange-Ferguson site (Hannus 1990). Bone technology is most significantly represented at sites where conditions for organic preservation are best such as mammoth kill sites.

Attempting to define a cultural complex through material culture alone ignores other sources of information such as chronological position, i.e. radiocarbon dating, or documenting the various activities that took place at different sites. These other sources of information must be incorporated into existing theories of Clovis development in order to help clarify the variability in the material culture record.

1.3.2 Clovis Timeframe

The period of Clovis occupation in North America has long been a primary concern of archaeologists. Recent improvements in dating techniques, i.e. Accelerated Mass Spectrometry (AMS) dating, have refined the chronology of the Clovis complex. Due to the foresight of C. Vance Haynes, Jr., AMS dating of charcoal samples collected from fluted-point sites that were too small to be dated through older conventional methods have now been dated using new methods. The Clovis occupation is tightly defined to a period between 11,200-10,900 B.P. based primarily upon radiocarbon dates from the Western U.S. (see Haynes 1991, 1993). However, the geochronological and radiocarbon evidence from other regions suggests that Clovis occupation cover a greater time-span.

A number of significant radiocarbon dates have been reported from the eastern United States. Three radiocarbon dates were obtained from the Johnson site located on the Cumberland River in Middle Tennessee of 12,660 ± 970 B.P. (Tx-6999), 11,700 ± 980 B.P. (Tx-7000), and 11,980 ± 110 B.P. (Tx-7454) (Broster et al. 1991; Broster and Norton 1992). The first date was obtained from a small basin-shaped feature apparently not directly associated with Clovis materials; however, the second date was obtained from a charcoal sample associated with a fluted preform while the third date, also associated with a Clovis preform as well as carbonized spruce scales, was obtained from a small hearth (Broster and Norton 1992). Despite the large sigmas of the first two dates, these three dates together suggest an earlier than
expected age of occupation in the Southeast. Also of interest is the Paleo Crossing site in northeastern Ohio radiocarbon dated to 12,250 ± 100 B.P. (Brose and Barrish 1992).

These dates conflict with the chronological placement of the Early Fluted Point Horizon of eastern North America at 10,600-10,000 (Meltzer 1988:20). Rather than being contemporary with Folsom on the Plains as suggested by others (Haynes et al. 1984; Meltzer 1988), Clovis in the eastern U.S., particularly the Midsouth, appears to be as old or ancestral to Clovis in other regions (Broster et al. 1994; Bryan 1991; Mason 1962; Stanford 1991). While a significant amount of data has been compiled (see Haynes 1993), more data are required from throughout North America to refine the chronology.

1.3.3 Types of Clovis sites

Several types of Clovis sites have been identified in the archaeological record. These include kill sites, camp sites, manufacturing/processing sites, quarries, “isolates”, and unique clusters of tools.

Kill sites most commonly refer to mammoth kills such as Blackwater Draw Locality #1, the type site of the Clovis complex located in eastern New Mexico (Hester 1972). Other mammoth kill sites include Colby (Frison and Todd 1986); Lehner (Haury et al. 1959); Naco (Haury 1953); Dent (Figgens 1933); Murray Springs (Haynes and Hemmings 1968); Lange-Ferguson (Hannus 1990); Domebo (Leonhardy 1966); and Miami (Sellards 1938). Other types of prey identified from kill sites include bison (*Bison* sp.) from Blackwater Draw Locality #1 (Hester 1972) and American mastodont (*Mammut americanum*) at the Kimmswick site (Graham et al. 1981; Graham and Kay 1988). Undoubtedly other smaller game animals were utilized such as white-tail deer and caribou, despite the fact that poor preservation of smaller bones prevents the identification of kill-sites of this nature (Anderson 1990:176; Meltzer 1988:38; Spiess et al. 1985). Despite the absence of caribou faunal remains, Gramly (1982) has made the interpretive leap from refitting projectile point tips from one locus to bases from another in interpreting the Vail site as a camp/caribou kill site.

Kill sites are commonly located near springs or ponds that would have held water at the end of the Pleistocene (Haynes 1980). Given new evidence for drought during the Clovis period in the western U.S.,
such areas would have been especially attractive to herds of large mammals (Haynes 1991). It seems likely then that Clovis hunters would have “ambushed” large mammals that were mired down in mud at these localities.

Camp sites dating to the Clovis period are relatively rare and only a few have been investigated (Stanford 1991). Most camp sites are small and do not suggest multiple occupations. Examples of camp sites include the Dietz site in eastern Oregon (Fagan 1986, 1988; Willig 1984, 1988); the Pierce site in Tennessee (Broster 1982); and the Vail site, Maine (Gramly 1982).

Larger multi-occupation sites often are located near quarries (Stanford 1991) and reflect a variety of activities associated with manufacturing and processing of lithics, hides, and other items. This type of site is well-known from the unglaciated region of the eastern U.S. (Meltzer 1988) including such sites as Adams, Kentucky (Sanders 1990); Wells Creek, Tennessee (Dragoo 1973); Quad-Pinetree-Old Slough complex, Alabama (Hulse and Wright 1989); and the Carson-Conn-Short site, Tennessee (Broster and Norton 1992, 1993). The Thunderbird site, Virginia also is considered to be a quarry-related base camp (Gardner 1977). These sites in the East are often located on the well-drained upper terraces of major river channels at the mouths of tributaries overlooking lower elevations of the river channels (Broster and Norton 1992; Smith 1990).

The occurrence of “isolated” projectile points as part of the Clovis settlement system have been documented from the unglaciated eastern U.S. in the numerous Paleoindian surveys (Anderson 1990; Lepper 1988; Meltzer 1988). Meltzer (1988) proposes that isolated fluted points rather than true sites dominate the Clovis archaeological record south of the ice sheets. This leads to his interpretation of point distributions as a reflection of a generalized, highly-mobile settlement and subsistence pattern.

Whether this interpretation of isolates actually reflects Paleoindian settlement patterns has recently been questioned by Anderson (1990), Smith (1990), and Tankersley (1989, 1990). Anderson (1990:176) suggests that lack of megafauna remains (see also Meltzer 1988:24; Tankersley 1989:264) or similarities with Early Archaic assemblages disguise the extent of Clovis sites in the unglaciated East while Smith (1990:238) and Tankersley (1990:279) suggest that isolates may only represent the artifacts recognized and collected by amateurs and that more deeply buried remains may exist. Broster et al. (1994)
demonstrate that the dependence upon isolated projectile points in Meltzer's (1988) interpretation of the southeastern Clovis record is flawed in that a large number of Clovis sites are documented from the unglaciated eastern U.S.

The final site type - discrete clusters or groups of artifacts - reflect aspects of the Clovis complex not observed in the above site types. These sites include the Anzick (Jones and Bonnichsen 1994; Lahren and Bonnichsen 1974); Simon (Woods and Titmus 1985); Fenn (Frison 1991); Drake (Stanford and Jodry 1988); and the East Wenatchee assemblages (Gramly 1991, 1993; Mehringer 1989; Mehringer and Foit 1990). What these assemblages mean within the broader context of the Clovis complex is the focus of this discussion.

A degree of ambiguity in developing a terminology for these clusters of tools is evident in various studies and interpretations of this phenomenon. The site type, traditionally referred to as “Clovis cache” implies the storage of materials for recovery and use in the future. Cache implies intent to return and recover the artifacts. No supporting evidence for this inference has been produced. As such, “cache” may not be an appropriate term. This problem has been recognized previously (see Frison 1991:332; Wilke et al. 1991:267). Nevertheless, use of the term cache to refer to these assemblages has continued. In this paper, the term “assemblage” is used to refer to these few but unique sites to avoid confusion with meaning-laden jargon such as “cache”.

1.3.4 Clovis in Northwestern Plains

Clovis is not well known in the Northwestern Plains despite a great amount of effort researching this complex. Frison (1990) considers only four sites from the Northwestern Plains as unequivocal Clovis sites. These include Colby (Frison and Todd 1986); Lange-Ferguson (Hannus 1990); Anzick (Lahren and Bonnichsen 1974); and the Sheaman locality of the Agate Basin site (Frison 1982; Frison and Stanford 1982). However, the similarity of the single projectile point from the Sheaman locality with projectile points related to the Goshen cultural complex has been noted (Frison 1988). Conversely, quite a few Clovis points from surface contexts have been located (Davis 1993:263; Frison 1990:102). Davis (1993:264, Fig.
1), however, illustrates more Clovis sites than Frison (1990) indicates, but whether these represent surface finds as well as points found *in situ* deposits is not indicated.

Clovis finds in Montana, aside from the Anzick assemblage, include two specimens from the Riverdale site in west-central Montana (Taylor 1961); a surface find near Dillon (Jasmann 1963); and several fluted points possibly representing Clovis from the Chestnut Valley, Coleman Ridge, and surface finds near Great Falls (Shumante 1982). Davis and Greiser (1992; also Davis 1993:271) report an “intrusive” Clovis point in the Folsom level from the highly stratified Indian Creek site in west-central Montana. A single Clovis point and possible intact deposits were reported from east-central Montana in the Blue Mountain-Glendive area (Eckerle and Aaberg 1990). Davis (1993:263, 274-5) indicates that deeply-buried deposits prevent the easy discovery of most sites and hinder our understanding of this cultural complex in Montana and the Northwestern Plains.

Clovis peoples apparently used a wide range of adaptations in the Northwestern Plains. Clovis artifacts have been recovered from a variety of environmental settings (Davis 1993:274; Frison 1992:337). While no fluted points have been located west of the Continental Divide in Montana (Davis 1993:263), fluted points have been recovered at higher elevations in the foothills-mountain region of the Northwestern Plains (Frison 1992). However, the nature of the fluted point peoples’ adaptations in this ecological zone is largely unknown (Frison 1992:337). Davis (1993:265) notes that an increasing amount of information supports an interpretation of greater variability in subsistence patterns in the Rocky Mountain settings, especially in later Paleoindian contexts. He also notes (1993:265) Paleoindian ability to shift adaptations in order to meet and maximize existing conditions including the exploitation of big game. This pattern may hold true for Clovis populations in the higher elevations as well. Cultural information regarding settlement, mobility, and lithic raw material procurement may also be derived from the Anzick assemblage analysis. This information will undoubtedly clarify our understanding of Clovis adaptive strategies in the Northwestern Plains.
Chapter 2: Research Design

2.1 Introduction

The development of a scientific research design to investigate Anzick and related assemblages has involved many considerations. Because several alternative hypotheses have been suggested to explain the Anzick assemblage, the multiple-working hypotheses approach has been adopted as a methodology to systematically consider various interpretive options. The multiple-working hypotheses method was first brought to scientific notice by T. C. Chamberlain in 1897. This method involves three steps: accumulation of data indicative of certain inferences, formation of these inferences, and testing the implications associated with each inference in order to see which best explains the data. Thus, previous hypotheses may be substantiated or refuted and new ones developed.

In the case of the Clovis assemblages considered herein, little data have been systematically collected but hypotheses concerning function and meaning have been proposed. While previous researchers have provided information concerning the role of these assemblages, hypotheses have often been formed at a single level of inference. Rather than reiterate previous hypotheses, a consideration of all the available information from previous analyses as well as a multi-level artifact analysis of the Anzick assemblage may provide the data necessary to test the feasibility of the proposed roles or meanings of these assemblages. As such, a review of all the Clovis assemblages and previously proposed hypotheses is necessary prior to discussing how the analyses conducted herein may address the implications of each hypothesis.

2.2 Discovery and Content of Unique Clovis Assemblages

In addition to the Anzick assemblage, the Clovis assemblages of concern in this study include Fenn, Drake, Simon, and East Wenatchee assemblages. The locations, descriptions, and interpretations of these assemblages are provided below (see Figure 2.1). These assemblages are discussed in the current study at the expense of other sites or assemblages due to the unique contexts and assemblage contents. Although much of the information pertaining to the contextual information of these assemblages is tentative,
Figure 2.1. Location of Clovis sites consisting of unique assemblages discussed in text: 1). Simon site; 2). Anzick site; 3). Drake site; 4). East Wenatchee site; 5). Fenn site (after Frison 1991).
it is evident that these assemblages were not associated with other activities such as habitation or raw material acquisition. As such, these assemblages represent a unique aspect of the Clovis complex. Table 2.1 lists the artifact inventories of these assemblages.

2.2.1 The Drake Assemblage

Stanford and Jodry (1988) report the discovery of the Drake Clovis assemblage in northcentral Colorado from a plow-disturbed context. The assemblage was originally discovered in 1978 by an amateur archaeologist. Only complete projectile points were recovered. Testimony by the discoverer indicates that the artifacts were shallowly buried as a discrete cluster. Shortly thereafter, Bruce Lutz, archaeologist from the University of Northern Colorado, investigated the site. An additional Clovis point mid-section was recovered from the amateur's backdirt pile and refit to distal and basal fragments. Damage to this artifact appears related to modern plowing rather than prehistoric breakage. Dennis Stanford of the Smithsonian Institution continued excavations and recovered a hammerstone near the original discovery.

The Drake assemblage consists of 13 complete Clovis projectile points, a hammerstone, and the white fragments of material identified as ivory (Stanford and Jodry 1988). No other tool types or classes of artifacts were recovered. Stanford and Jodry (1988) indicate six of the Clovis points have been resharpened, while the remaining specimens are unmodified. Eleven of the 13 points are made of non-local Alibates dolomite from Texas and the remaining two are of unidentified raw materials. Color patterns appear to have been incorporated into the production of these artifacts - a characteristic that has been noted for Clovis points in general (Haynes 1980).

2.2.2 The Fenn Assemblage

Frison (1991) provided the first preliminary report of the Fenn assemblage, which is the basis for the summary below. Although the exact location is unknown, the Fenn assemblage was presumably discovered by an avocational archaeologist in the vicinity of southwest Wyoming, northwest Utah, and southeast Idaho (Frison 1991). This discovery occurred possibly as early as 50 years ago and the
assemblage has remained in the hands of the discoverer's family. The original individual who discovered the Fenn assemblage has since died (Frison 1991). Unfortunately, little or nothing is known of the original context of the Fenn assemblage.

The flaked stone assemblage consists of 56 artifacts. The entire assemblage is highly variable in content and raw material. Included in this total are 18 projectile points (three quartz crystal, one obsidian, and 14 chert); a chert crescent similar to specimens commonly associated with Western Pluvial Lakes complex in the Great Basin; a single chert blade tool; and 37 bifaces (28 chert and nine obsidian). The obsidian projectile point exhibits scratches on the fluted surface, an attribute also reminiscent of Clovis points from the Great Basin (Frison 1991). The raw materials were procured over an extremely large area. The quartz crystal and obsidian sources are apparently located in southern Idaho. Three types of chert were utilized in the manufacture of lithic artifacts. Phosphoria chert and Madison formation chert are available in the Bighorn Mountains in northern Wyoming. Green River formation chert is available primarily in southern Wyoming. Use-wear and resharpening are indicated for one of the chert (Phosphoria) projectile points and blade tool. Frison (1991:324) also indicates that red ocher is present on the Fenn specimens.

2.2.3 The Simon Assemblage

The most recent discussion of the Simon assemblage (Woods and Titmus 1985) provides the basis for the summary below. The Simon assemblage was discovered in southwest Idaho in 1961 during earth-moving activities by Mr. W. D. Simon. Earl H. Swanson, Jr. and B. Robert Butler were notified of the discovery and conducted investigations at the site. The discovery was described initially by Butler (1963) and later by Muto (1971). Butler (1963) interpreted the assemblage as composed of various morphological and functional artifacts. Muto (1971) rejected Butler's (1963) classification and determined that the assemblage reflects stages of lithic reduction.

Thirty-three tools are present in the total assemblage including five complete projectile points, four quartz crystal bifaces, and the remainder (n=24) are mostly large bifaces. Frison (1991) suggests the quartz crystal source is possibly located in southern Idaho although this remains to be determined. The number
and source(s) of other raw materials represented in the assemblage is also unclear. The Simon artifacts were coated with red ochre but no human remains were found (Woods and Titmus 1985:6).

2.2.4 The East Wenatchee Assemblage

The East Wenatchee assemblage, also known as Richey-Roberts, was discovered in a Central Washington apple orchard in 1987. Two orchard workers, Mark Mickles and Moises Aguirre, recovered 19 stone tools while installing a sprinkler system in the orchard (Mehringer 1989). The artifacts were returned to the orchard owners and, through a number of acquaintances, the collection eventually came to the attention of Peter J. Mehringer, Jr., of Washington State University. A large team of specialists convened to aid in the site excavation from 1988-1990. A portion of the site remains intact (Gramly 1991, 1993; Mehringer 1989; Mehringer and Foit 1990). This is the first assemblage among those discussed here to have been systematically excavated.

As part of the total site was left undisturbed, the complete artifact composition is unknown (Mehringer 1989). The East Wenatchee assemblage contains a number of exquisitely manufactured stone tools, including 14 Clovis points, among which are the largest Clovis points yet recovered. Single examples of a chopper and graver, four sidescrapers, five prismatic blades Flake-blades, and three adzes or flaked stone axes have also been reported (Gramly 1991, 1993). Thirteen bone implements similar to the Anzick specimens were also recovered with this assemblage. No information is presently available concerning raw material sources. Blood residue analysis revealed traces of human, bison, and rabbit blood upon various specimens from the assemblage (Gramly 1991).

Table 2.1. Artifact inventories of assemblages discussed in text.

<table>
<thead>
<tr>
<th>Assemblage</th>
<th>Projectile Points</th>
<th>Bifaces</th>
<th>additional tools</th>
<th>bone implements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drake</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fenn</td>
<td>14</td>
<td>1</td>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>Simon</td>
<td>5</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>East Wenatchee</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.2.5 The Anzick assemblage

While the composition of the Anzick assemblage has been provided recently (Jones and Bonnichsen 1994), the definitions utilized to divide the lithic assemblage are provided below in Table 2.2. The composition of the Anzick assemblage is provided here so comparisons can be made with the other assemblages (see Table 2.3). The assemblage is initially divided into three classes: human skeletal remains, bone tools, and lithic artifacts. The lithic artifacts are further subdivided into five subclasses of flaked stone tools: projectile points, bifaces, unifaces, flake tools, flakes, and fragments. Figure 2.2 illustrates the division of the assemblage into its representative components.

Table 2.2. Artifact definitions for classification purposes.

<table>
<thead>
<tr>
<th>Artifact Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projectile point</td>
<td>A tool made of stone or other material designed to be hafted to a spear, dart, or arrow shaft and propelled. Lithic projectile points have converging lateral margins at the tip with various hafting morphologies.</td>
</tr>
<tr>
<td>Biface</td>
<td>A lithic artifact having been flaked on both faces with flakes originating from common margins.</td>
</tr>
<tr>
<td>Uniface</td>
<td>A lithic artifact having been flaked only on one face. The entire margin or one or both ends or margins may be worked. Unifacial tools often have steep working edges.</td>
</tr>
<tr>
<td>Endscraper</td>
<td>Tool with working edge on one or both convex ends. Stone endscrapers may be bifacially or unifacially chipped.</td>
</tr>
<tr>
<td>Sidescraper</td>
<td>Tool with working edge along lateral margins. May be the product of unifacial or bifacial flaking.</td>
</tr>
<tr>
<td>Flake</td>
<td>Flake is used here to refer to the by-product of lithic manufacture.</td>
</tr>
<tr>
<td>Flake-blade</td>
<td>Flake that is at least twice as long as wide.</td>
</tr>
<tr>
<td>Flake tool</td>
<td>Flake with minimal modification to shape used as a tool.</td>
</tr>
</tbody>
</table>
Table 2.3. Assemblage composition of the Anzick Clovis assemblage.

<table>
<thead>
<tr>
<th>Artifact Class</th>
<th>Human skeletal remains</th>
<th>Bone Foreshafts</th>
<th>Projectile points</th>
<th>Bifaces</th>
<th>Unifaces</th>
<th>Flake Tools</th>
<th>Flakes</th>
<th>Fragments</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total #</td>
<td></td>
<td>12</td>
<td>8</td>
<td>70</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>15</td>
<td>119</td>
</tr>
<tr>
<td>MNSP</td>
<td></td>
<td>2</td>
<td>4-6</td>
<td>68</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>14</td>
<td>116</td>
</tr>
</tbody>
</table>
Figure 2.2. Classes of artifacts defined in Anzick assemblage.
Minimum numbers of specimens (MNSP) were determined through counting a common element as a standard in a class and refitting broken specimens. Although the exact number of human skeletal fragments is unknown, at least two juveniles are represented in the skeletal assemblage. Bone foreshafts include two complete specimens, four beveled end fragments, and five mid-sections. Using end fragments as a standard, at least four and up to six bone foreshafts can be considered to comprise this class (see chapter 9 for more detailed descriptions).

The lithic assemblage comprises the largest artifact class. At least 103 flaked stone artifacts are inventoried for this class including projectile points (n=8); bifaces (n=70); unifaces (n=4); flake tools (n=3); flakes (n=3); biface fragments (n=15). Raw materials utilized in lithic production are discussed in greater detail in chapter 5. Four biface fragments can be refit resulting in a total of 68 complete or nearly complete bifaces. The unifaces can be divided into endscrapers (n=2) and side scrapers (n=2). Flake tools include one flake-blade and two large flake-spalls exhibiting signs of use-wear (see chapter 8). Fifteen biface fragments were too fragmentary to be counted as individual bifaces. Two fragments were refit producing a single larger fragment (MNSP=14).

2.3 Working Hypotheses

Four primary hypotheses concerning the role of these assemblages can be delineated from the literature. These are derived from each of the preliminary investigations discussed above and include (1) the mortuary hypothesis; (2) the quarry cache hypothesis; (3) the tool kit hypothesis; and (4) the heirloom hypothesis. Descriptions of each of these hypotheses are given below along with how the respective researchers derived their conclusions. How each hypothesis may be tested is included in this discussion. If any of these assemblages fail to meet implications of each hypothesis, then that hypothesis may be rejected. The hypothesis that best meets the predictive implications and is corroborated by the data may be accepted as the most parsimonious explanation. A summary of the implicative characteristics associated with each hypothesis is provided in Table 2.4.
2.3.1 Mortuary Hypothesis

Stanford and Jodry (1988) and Frison (1991) suggest similar, albeit slightly different, interpretations for the Fenn and Drake assemblages. They hypothesize that the Fenn and Drake assemblages had a mortuary function as do the other assemblages considered in this study. Stanford and Jodry (1988) suggest that the Drake assemblage is an expression of Clovis mortuary practice despite the absence of human skeletal remains. Because ritual activity is indicated by the presence of red ochre in the Anzick and Simon assemblages, Stanford and Jodry (1988) infer that similarities between artifacts (i.e. projectile points) indicate like functions for these assemblages such as grave goods. Similarities between assemblage contexts also supports Stanford and Jodry's (1988) inference of mortuary activity.

Frison (1991) proposes that the artifacts in the Fenn assemblage were produced as a burial offering indicative of status differentiation (1991:324). Use of the highest quality raw materials, the excellent manufacturing craftsmanship, and presence of red ochre in four out of five assemblages (Drake being the exception), led Frison to conclude these assemblages were placed with burials removing them from the Clovis socioeconomic system. As such, these artifacts did not have a utilitarian function within the socioeconomic sphere of the Clovis complex and would not have been stored for later use as would be the case in caching behavior.

The production of Clovis artifacts for status differentiation challenges accepted models of hunter-gatherer mortuary practice and social status. These models suggest that artifacts associated with deceased individuals in egalitarian societies should reflect the role(s) of those members in that society (Binford 1971; Tainter 1978). Presently the only identifiable human skeletal fragments are the remains of two juveniles from the Anzick assemblage (Lahren and Bonnichsen 1974; Stafford 1994). The association of finely crafted stone and bone artifacts reflecting primarily economic activities such as hunting and lithic production with juveniles is counterintuitive to expectations of the above models. Following the models of Binford (1971) and Tainter (1978), adult males would be traditionally associated with the artifacts in these assemblages.

If the artifacts in these Clovis assemblages were produced specifically for mortuary purposes, multiple lines of evidence may be used to test this inference. A specialized production of tools for burial
purposes should preclude evidence of use-wear and resharpening on the artifacts. Establishing the presence of use-wear and re-sharpening of artifacts in these assemblages would indicate that the artifacts had a utilitarian role.

Studies focusing on the role of red ochre within the context of the Clovis complex may also shed light on possible ritual activity possibly associated with these assemblages. Use of red ochre has generally been associated with ritual activity (cf. Roper 1991). However, a more utilitarian role of red ochre has been offered by Titmus and Woods (1991) suggesting that red ochre may have been employed as an abrasive in lithic production. Comparative research of red ochre use may clarify its association with these assemblages.

It should be noted that, although these assemblages may not have been specially produced for mortuary function, a mortuary association cannot be ruled out altogether. Although lithic analysis can be used to prove artifacts were not prepared specifically as grave goods, this does not exclude the possibility that utilitarian artifacts were involved in ritual activity.

2.3.2 Lithic Reduction or Quarry Cache Hypothesis

In their analysis of the Simon assemblage, Woods and Titmus (1985:6) concentrate on artifact morphology, specifically tool outlines, in their study of the Simon assemblage. They infer that the variation in size and shape of the bifaces in the Simon assemblage reflects a "blue print" of Clovis point production in the form of stages of lithic reduction. Furthermore, they imply that these assemblages were intended to be recovered in the future for further reduction and use. Similar statements concerning lithic reduction have been offered for the Fenn (Frison 1991:330) and Anzick (Wilke et al. 1991) assemblages. The hypothesis that groups of artifacts with similar shape and size reflect reduction stages is an assumption to be tested. Detailed technological analyses are required to establish lithic reduction stages such as that suggested by Frison (1991), Wilke et al. (1991), and Woods and Titmus (1985). However, none indicate their methods for establishing technological relationships between groups of artifacts in their analyses of the Anzick assemblage.

Lithic analysts have often viewed the study of lithic technology as a means of developing normative statements about the organization and operations of past lithic technological systems (Young et
al. 1994). As the norm is emphasized, variation in the entire lithic technological system is largely ignored. Rather than incorporating artifact variation in lithic analysis, the tendency of this approach has been to characterize lithic production processes in discrete "stages" of manufacture reflected by one or a few specimens (Young et al. 1994:212). Such stage classifications have been adopted by Callahan (1979), Collins (1975), Flenniken (1981), Muto (1971), Sheets (1975), Wilke et al. (1991), and others (see additional references in Rozen and Sullivan 1989).

Stage analysis has been criticized upon several tenets: (1) that stage analysis is a "top-down" approach derived from experimental flintknapping, (2) lineal models of stage analysis do not reveal processes responsible for artifact production, but only address change in artifact morphology, and (3) relationships between variability in raw materials and production is ignored (Young and Bonnichsen 1984; Young et al. 1994). Referring to stage models, Rozen and Sullivan (1989) state "these models fail to provide a means by which analysts can sort artifacts consistently into postulated 'product groups' on the basis of artifact form alone." Given the normative classification systems, the primary goal of lithic analysis (i.e., reconstructing past behaviors) is lost. Artifact morphology may provide the basis for the concept of style as discussed in the previous chapter but is inadequate in itself for understanding the behaviors behind the production of artifacts. The homogeneity of artifact typologies or classifications must be established through a system of understanding stone tool production beyond pigeon-holing artifacts into pre-conceived morphological categories.

Aside from the problems of stage analysis outlined above, the assumption of the reduction hypothesis that groups of artifacts reflect production rather than use does not account for use-wear and resharpenering of the lithic artifacts. Despite the fact that some of the artifacts in the Simon assemblage exhibit use-wear and damage (cf. Woods and Titmus 1985), the reduction classification of Woods and Titmus (1985) present an alternative interpretation to Butler's (1963) functional classification for this assemblage.

In summary, at least three lines of evidence must be addressed in order to verify the lithic reduction/quarry cache hypothesis. The first is accounting for the presence of use-wear and re-sharpening among various artifacts in the assemblages. Secondly, if the bifaces and projectile points in the
assemblages do reflect stages of lithic reduction, this must be emperically and objectively demonstrated through systematic division of the assemblages into groups or clusters based on discrete observable characteristics. Similarities in technology must also be demonstrated within each cluster. Variation in technology within a cluster must be explained to maintain the validity of the cluster. Technological links must then be established between clusters of artifacts so the entire length of lithic production present in the assemblage can be outlined and emperically documented.

2.3.3 Tool Kit Hypothesis

Gramly (1991) proposes that tool kits can be identified on the basis of positive identification of non-human blood residues. Bison, cervid, and lagomorph blood residues were identified from two of the projectile points. Along with the recovery of apparently utilitarian tools, Gramly (1991, 1993) concludes upon the basis of blood residue analysis that the East Wenatchee assemblage is a true tool cache for procuring and butchering animals. He suggests that the East Wenatchee cache represents a storage kit of Clovis projectile points and tools for a fall-winter hunt (Gramly 1991:4). Methods or data for determining seasonality are not indicated by Gramly (1991). Without support for this aspect of his hypothesis, seasonality cannot be used to support the toolkit hypothesis for these assemblages.

If an hypothesis is to be offered for all of these assemblages based upon overall similarities in assemblage composition, artifact form, technology, and ritualistic indicators, comparison of the contexts and compositions of the assemblages should verify or reject Gramly's (1991, 1993) toolkit hypothesis. In order to establish that these assemblages are caches of utilitarian artifacts, different classes of functional artifacts exhibiting use-wear or resharpening should be present. These same artifact classes should be present from assemblage to assemblage if the hunting/butchering toolkit hypothesis is correct.

Accounting for possible ritualistic use of red ochre in all but the Drake assemblage must also be considered. Titmus and Woods (1991) have provided alternate explanations for red ochre use, specifically as an abrasive for margin grinding on projectile points. However, testimony from the discoverers of the Anzick assemblage and remnants of red ochre on many artifacts, not just projectile points, from this and other assemblages suggests that this pigment was used in roles other than that suggested by Titmus and
Woods (1991). To summarize the toolkit hypothesis, proving that these assemblages are utilitarian in non-ritualistic contexts is essential.

2.3.4 Heirloom Hypothesis

A final hypothesis that has received only cursory attention is the heirloom hypothesis (Bonnichsen pers. comm.). This is the proposition that the artifacts in these assemblages are heirlooms intended to be handed down from generation to generation. Derived from preliminary analysis of the Anzick assemblage, this hypothesis is not exclusive of the functional or utilitarian nature of many artifacts in the Clovis assemblages nor the obvious burial association. As the Anzick assemblage is associated with juveniles, the artifacts could have been previously manufactured and used for various functions and then deposited in the burial due to unexpected deaths of children. Thus, ritual indicators evident in almost all the assemblages discussed here may be explained.

Whether the artifacts were produced to be handed down from generation to generation is somewhat conjectural and difficult to test. However, if the hypotheses discussed above are unable to be validated, then alternate hypotheses, however conjectural, must be provided to account for the data.

No wholistic analysis has been conducted on any of the assemblages considered here. Discriminating between competing hypotheses is not possible with incomplete data. However, each hypothesis carries implications that may be addressed with information provided by a single assemblage and supported by available evidence from the other assemblages. As such, incorporating all available evidence may indicate how to distinguish between hypothesis. Table 2.4 summarizes the hypotheses and characteristics associated with each hypothesis.
Table 2.4. Clovis assemblage hypotheses and implicative characteristics of each.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Mortuary/Status</th>
<th>Quarry/Lithic Red.</th>
<th>Tool Kit</th>
<th>Heirloom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human remains</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Red ocher</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Complete points/</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stages of reduction</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Similar contents</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Resharpening</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Presence of use-wear</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Blood-residues(^1)</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

\(^1\) Human blood-residues are assumed to be the result of production rather than use.

The implications or characteristics of each hypothesis are marked by an “X”. If these assemblages were produced specifically for burial purposes, the presence of human remains, ritualistic use of red ocher, and complete, unused artifacts should be ubiquitous to these assemblages. Complete points along with discrete stages of reduction should be present to verify the Quarry cache/Lithic reduction hypothesis. Little or no evidence of use-wear should present. Similar tool types and assemblage contents, evidence of utilitarian use (use-wear or blood residues), and lack of ritualistic indicators are essential to the Toolkit hypothesis. The Heirloom hypothesis has the most implications and may be the most difficult to test. Evidence of mortuary activity is necessary to support of the Heirloom hypothesis. However, if functional tools were handed down to the next generation, evidence of utilitarian or functional nature should also be present. This hypothesis does not define what types of artifacts are expected in the assemblage in the same manner as the Lithic reduction or Toolkit hypothesis. Figuratively, any artifact types, depending upon the parental role, could have been handed down.

A multi-level artifact analysis of the Anzick assemblage may provide the information necessary to evaluate which of the above hypothesis is supported by the data. In conjunction with evidence from the other assemblages, the role or function of these assemblages in the Clovis complex may be better understood.
Chapter 3: History of the Discovery and Work

3.1 Introduction

The Anzick site has a rich and colorful history that is largely unknown to the archaeological community. This chapter aims to present the history of the discovery, fieldwork, research, and attempts to bring the Anzick assemblage together as a whole.

3.2 History of the Anzick Discovery

This section is largely summarized from the work of Dr. Larry Lahren. Dr. Lahren maintained historical records and has recently had these available (cf. Lahren n.d.). The first evidence of an archaeological site was discovered in 1961 when Mr. Bill Bray of Wilsall, Montana was fishing at the confluence of Flathead Creek and the Shields River about a mile south of Wilsall. At the base of a sandstone outcrop near the area where he was fishing, Mr. Bray discovered a large biface coated in red ochre in a woodchuck backdirt pile. No other artifacts were found. However, the breakthrough discovery was not to happen until May, 1968. Two construction workers, Mr. Ben Hargis and Mr. Calvin Sarver, both of Wilsall, Montana were excavating fill materials with a backhoe from the base of a sandstone outcrop talus slope. This was the same outcrop from which Mr. Bray had found his artifact eight years earlier. After much talus had been removed and the deposits had changed to a finer material, Mr. Hargis discovered a large bifacially flaked artifact in a load of this finer material placed in a hole in the road (Lahren and Bonnichsen 1971). This led to the use of shovels in the area where the workers suspected the artifact had originated. Subsequently, over 100 stone and bone artifacts were unearthed. Underlying the artifacts were human skeletal remains. This discovery led the two workers to cover the area with a load of talus. According to Hargis and Sarver, all the artifacts and skeletal remains were heavily coated in red ochre. The red ocher was so thick on the artifacts that it “came clear up to our elbows in the kitchen sink” as the artifacts were washed (Lahren and Bonnichsen 1971).
After the discovery of the artifacts, B. Hargis and C. Sarver approached the land owner, Dr. Melvyn Anzick, for permission to search for "arrowheads" on his land. By this time, the news of the incredible discovery had leaked out and Dr. Anzick had heard of the find. Dr. Anzick indicated that he had heard of their discovery and agreed to allow the two men to search for arrowheads as long as he would receive half of what they found. The assemblage was soon divided between the three individuals. The division of the assemblage between private individuals hampered attempts to study the entire assemblage for many years and prevented earlier publication of the discovery.

After the discovery of the assemblage, Dr. Anzick contacted the late H. Marie Wormington of the Denver Museum of Natural History. Dr. Wormington referred Dr. Anzick to Dr. Dee C. Taylor of the University of Montana, who conducted the first investigation of the site. His team re-opened the excavation under the rockshelter and expanded the excavation. As a result of this excavation in the talus slope, a bison bone bed suggestive of a bison jump was exposed. Despite the amount of disturbance, the excavators were able to establish a basic stratigraphy for the site. The relationship between the Clovis artifacts, the human remains, and the bone bed remained undetermined. Taylor (1969) noted that the bison bone seemed to be restricted to the upper half of the talus. However, it was not possible to determine which stratigraphic unit produced the Clovis artifacts and human remains. Thus, Dr. Taylor (1969) decreed the "Wilsall" excavations were an "exercise in frustration" and little could be done to salvage the site.

During this same time, Larry Lahren, a graduate student at Montana State University, was contacted by an amateur archaeologist, Jeff Skillman. Mr. Skillman introduced Lahren to Hargis and Sarver. Lahren was shown several bucketfuls of large bifaces, Clovis points, bone tools, and a human occipital, and he observed that all the recovered materials were coated in red ocher. Also of interest was the fact that many of the stone tools exhibited similar manufacturing techniques. These two factors led him to the initial conclusion that the artifacts were contemporary and part of the same assemblage. Lahren contacted Robson Bonnichsen, a graduate student at the University of Alberta, after they had met at a conference. Lahren was aware of Bonnichsen's expertise in lithic technology and wanted his input in the technology of the artifacts. Given that the established professional authority in Montana had indicated the
context of the Anzick assemblage was ambiguous, the two graduate students knew they would have to fight to gain recognition of the importance and significance of the Anzick assemblage.

The site was given the title “Anzick site” after the landowner, Dr. Melvyn Anzick, from a previous designation as the Wilsall-Arthur Site (24PA506). Lahren and Bonnichsen continued investigation into the Anzick site from 1970-71. These investigations produced important results including photographic documentation and field work. In order to address and gain an understanding of the relationship between the cultural material and stratigraphic deposits, the site was re-opened in the 1970 field season. A single 2m² test unit (Area 1) was excavated adjacent to where the burial was found. In the following year, the Department of Archaeology at the University of Calgary funded further investigation into the Anzick site. Seven test trenches (Areas 2-8) were placed contiguous to the burial area. Although no occupational or habitation zone was located, a red ochre zone was recognized in situ in the wall of a test pit and an additional human clavicle was recovered. In addition to the excavations, discussions with the B. Hargis and C. Sarver provided several important clues to the nature of the site. One important clue was that the artifactual materials were recovered in close proximity and cultural materials were lying above the human remains. The results of these investigations were presented at the 1971 Society for American Archaeology Annual Meetings at Norman, Oklahoma.

By this time, the entire assemblage were divided among three private owners and other professional institutions including the University of Montana and the Smithsonian. Lahren realized the importance of having the assemblage together as a whole and began a process to reunite the assemblage that would take nearly twenty years. Senator Mike Mansfield was contacted by Lahren in 1974 in order to seek out his help in the matter. Senator Mansfield contacted S. Dillon Ripley, Secretary of the Smithsonian Institution, who then referred Lahren to Dr. Dennis Stanford and Dr. William Fitzhugh of the Smithsonian Institution. With the aid of the Smithsonian institution, casts of Anzick, Hargis, and Sarver’s collections were made through D. Stanford’s Paleoindian Program. Although the original artifacts were returned to the owners, this provided life-like replicas for study.

The second publication of the Anzick assemblage, a preliminary report of bone implements interpreted as projectile point foreshafts, provided a new dimension to what was known of the Clovis
complex (Lahren and Bonnichsen 1974). While at the Smithsonian, part of the assemblage was photographed and featured on the cover of *National Geographic* (Canby 1979). Further research focusing on the production and technology of fluted projectile points recovered with the assemblage continued with several publications (Bonnichsen 1977; Young and Bonnichsen 1984, 1985).

A turning point in the history of the Anzick assemblage occurred in 1987. Lahren had borrowed Dr. Anzick's portion of the collection for a presentation at a local school. After receiving letters of appreciation from schoolchildren, Dr. Anzick realized the importance of the assemblage. He approached Dr. Lahren with the question of what he (Lahren) would do with the collection if it were his. Dr. Lahren responded that he would donate it to the Montana State Historical Society in Helena, Montana, where it could be safely maintained. Dr. Lahren contacted Dave Schwab, Montana State Archaeologist, about acquiring the assemblage. As the Montana Historical Society was developing a new display for the centennial anniversary of the state, it was only appropriate that part of the earliest evidence of human occupation be included in the display.

Dr. Lahren wrote letters to the other owners about the possibility and importance of placing the assemblage together as a whole in the historical society museum. During the intervening years between the discovery of the site and Dr. Anzick's agreement, Ben Hargis passed away and the collection went to his widow, Faye Case. Calvin Sarver also still retained his part of the collection. The owners did express interest in this proposition. On behalf of Dr. Lahren, Mr. Schwab contacted the owners and began making arrangements for an agreement. Ted Schwinden, Governor of Montana, wrote letters of interest and commitment to the owners. Mr. Schwab also contacted Dr. Stanford of the Smithsonian and Dr. Robson Bonnichsen of the Center for the Study of the First Americans, who also provided their support. Robert Archibald, then Director of the Montana Historical Society, also wrote letters supporting reuniting the assemblage.

Late in 1988, Sue Near of the Montana Historical Society made final arrangements to reunite the assemblage at the Montana State Museum. Faye Case permanently loaned her part of the collection to the Montana Historical Society, who in turn provided Mrs. Case with life-like casts of her portion of the assemblage. Dr. Anzick and Calvin Sarver each loaned their collections to the Historical Society for
permanent display with the stipulation that if the artifacts were removed from display, they would be returned to the owners. This agreement was deemed acceptable by all the individuals involved. After remaining divided for nearly twenty years, the Anzick assemblage now resides almost in its entirety at the Montana Historical Society Museum, Helena, Montana largely due to the efforts of Dr. Larry Lahren.

The importance of having this assemblage together as a single collection in a professional curatorial facility cannot be understated. After eluding much professional investigations for 20 years, research has continued on the assemblage.

Shortly after the assemblage was brought together at the Montana Historical Museum, Philip J. Wilke of the Department of Anthropology at University of California, Riverside, and J. Jeffrey Flenniken of Lithic Analysts, Inc. of Pullman, Washington conducted an investigation into the technology of the Anzick assemblage (Wilke et al. 1991).

In the Fall of 1992, I entered the Anthropology graduate program at Oregon State University in association with the Center for the Study of the First Americans where R. Bonnichsen served as chair of my graduate committee. Bonnichsen suggested that the Anzick assemblage would make an excellent thesis topic and I gladly accepted the opportunity to study the Anzick assemblage. Through the Center for the Study of the First Americans, arrangements for an internship were made with the Montana Historical Museum and, in the summer of 1993, spent two months studying the assemblage in Montana. This thesis presents the results of this internship.

With the discovery of other assemblages similar to the Anzick assemblages, future research in this phenomenon is warranted. Understanding the role assemblages like the Anzick assemblage played in the socioeconomic and ideological system of the Clovis Complex is far from complete. Until a consensus of the meaning of the Anzick and other Clovis assemblages is achieved within the professional community, our understanding of the earliest Americans will be incomplete. This thesis is a step in that direction.
Chapter 4: Physical and Environmental Context of the Anzick Site

4.1 Introduction

In order to more fully understand human adaptations, an understanding of the dynamics of past environments is essential. The geological, paleoclimatological, and paleoecological conditions of the Northwestern Plains region surrounding the Anzick site is summarized. This is followed by a description of the local site setting. Geomorphology, site stratigraphy, and formation processes of the site and how these variables may be reflected in the regional record is discussed. Results and discussion of radiocarbon dating of the site conclude the chapter.

4.2 Regional Record

4.2.1 Geographical location and Physiographical setting

The Anzick site is located within the Shields River Valley near the confluence of the Shields River, Potter Creek, and Flathead Creek at an elevation of 5000' (Figure 4.1). From this point, the Shields River flows south for 26 miles to its confluence with the Yellowstone River five miles northeast of Livingston, Montana. The Anzick site is situated slightly above the floodplain of Flathead Creek approximately three-quarters of a mile south of Wilsall, Montana, below a sandstone outcrop (Figure 4.2).

The Shields River Valley is bordered to the east by the Crazy Mountains and the Bridger Mountains to the west. This area is referred to as the Crazy Mountain Basin. The Crazy Mountain Basin is a complex structural depression situated adjacent to the northern margin of the Middle Rocky Mountain-Colorado Plateau "range-basin" province (Thom 1957). The Livingston Formation characterizes much of the Crazy Mountain Basin and is composed mainly of sandstone of various shades and lithology (McMannis 1957). Andesitic sandstone forms the backbone of the Battle Ridge which trends north-eastward to Wilsall on the Shields River (McMannis 1957). It is likely the sandstone outcrop above the Anzick site is related to this formation.
Barnosky (1989:58-59) provides an overview of the modern environment in the Northern Great Plains and Eastern Flank of the Rocky Mountains in Montana. Although the area of Barnosky's (1989) study lies to the north of the Anzick site, the distance is not so large as to preclude similarity in species composition and paleoecological histories. Plains vegetation is characterized by grama-needlegrass-wheatgrass (*Bouteloua, Stipa, and Agropyron*) prairie. Elements of *Artemisia* sp., and Cheopodiaceae are present in the prairie vegetation. Arboreal pollen is represented by aspen poplar (*Populus tremuloides*), balsam poplar (*P. balsamifera*), white spruce (*Picea glauca*), Engelmann spruce (*P. engelmannii*), and willow (*Salix*). Higher elevations support lodgepole pine (*Pinus contorta*), Douglas fir (*Psuedotsuga menziesii*), Engelmann spruce, whitebark pine (*Pinus albicaulis*), and subalpine fir (*Abies lasiocarpa*). Subalpine forests are characterized by spruce, whitebark pine, and subalpine larch (*Larix lyalli*). Juniper (*Juniperus*) is present in mountain ranges to the southeast of Barnosky's study area (Barnosky 1989:58). Ponderosa pine (*Pinus ponderosa*) is also present in other areas of the eastern Rocky Mountains.

### 4.2.2 Paleoclimate

Variation in climate is generally derived from two mechanisms: (1) external, "forcing" controls of the climate system, and (2) variation that develops within the climate system itself (Bartlein 1988:116). Climate modeling (COHMAP members 1988) demonstrates how the global climate system has responded to changes in the external and internal sources of variation (Webb and Bartlein 1988:3). The Milankovitch hypothesis is generally accepted as the primary external forcing mechanism (Broecker et al. 1985:21). The Milankovitch hypothesis centers upon the premise that changes in the orbital parameters of the earth result in differential solar insulation and produce climatic change (Hays et al. 1976). Three different cycles of orbital variation affect the climate system on the order of 100k, 40k, and 21k years. The operation of these cycles in tandem results in glacial and interglacial cycles. Internal non-orbital mechanisms shown to have a profound effect upon climate are ice sheets (Manabe and Broccoli 1985), re-routing of glacial meltwater (Broecker et al. 1989), and formation of North Atlantic Deep Water (Broecker et al. 1985). While these
Figure 4.1. Location of the Anzick site within the Shields River Valley, Montana (map courtesy of R. Bonnichsen).
Figure 4.2. Location and elevation of the Anzick site along Flathead Creek, Montana (map courtesy of R. Bonnichsen).
non-orbital mechanisms have had dramatic effect upon climate, changes in external controls often cause
responses in the internal system (Bartlein 1988; Imbrie 1985).

With the mechanisms of climate change in mind, the environmental conditions of the Northwestern
Plains since the late Pleistocene can be discussed. At the last glacial maximum, ca. 18,000 yr B.P., the
Cordilleran ice sheet extended into the northwestern portion of Montana (Booth 1987; Locke 1990). The
southwestern edge of the Laurentide ice sheet extended into the northeastern portion of Montana (Locke
1990), although the exact limits of the ice sheet in Montana and Alberta are unknown (Andrews 1987:23).
Southwestern Montana and the Yellowstone Plateau in northwestern Wyoming were covered by an ice cap
at the last glacial maximum, which was the source area for outlet glaciers extending into south-central
Warming and rapid decay of the ice sheets occurred at about 14,000 yr B.P. in the region (Porter 1988).

Evidence of major climatic shifts exists at other locales in southwestern Montana, ca. 11,000 yr
B.P. (Turner et al. 1991). At the end of the Pleistocene, increases in precipitation south of the ice sheets
and east of the Rocky Mountains have been inferred (Locke 1990) and observed in the sedimentary record
(Turner et al. 1991). However, at about the same time, rapid increase in aridity is observed in
archaeological sites in Montana and elsewhere in the Western U.S. (Haynes 1991; Turner et al. 1991). This
trend of increasing aridity correlates with the occurrence of the Younger Dryas cooling event. The
Younger Dryas Event is a return to full glacial conditions ca. 11,200-10,000 yr B.P. (Broecker et al 1985).
At 11,200 yr B.P. glacial meltwater was re-routed from the Mississippi River Valley to the North Atlantic
(Broecker et al. 1989). The increase in North Atlantic cold water caused the conveyor-belt circulation
system of the ocean’s currents to be “turned off” reducing the amount of heat brought from equatorial
regions. In response to this decrease in temperature, a return to glacial conditions occurred rapidly. Haynes
(1991) has recognized the correlation of the Younger Dryas event, extinction of Late Pleistocene fauna, and
the appearance of the Clovis complex in North America ca. 11,200-10,900 yr B.P. The correlation between
Paleoindian adaptive systems and rapidly changing environments has also been discussed (Bonnichsen et al.
1987).
4.2.3 Paleoecology

Although Custer and Stewart (1990) have demonstrated the importance of accurate paleoecological reconstructions with interpretation of the archaeological record, it should be noted that these reconstructions are generally coarse-grained and that development of fine-grain reconstructions is not presently possible given current techniques and data (Tankersley and Isaac 1990). However, a reconstruction approximating the conditions in which groups of humans were living may be provided for the Northwestern Plains since 13,000 yr B.P.

Baker and Waln (1985), Barnosky (1989), Barnosky et al. (1987), Mehringer (1985), Whitlock (1993), and Whitlock and Bartlein (1993) have provided ecological histories of the Northwestern Plains based primarily upon palynological data. Late Pleistocene vertebrate finds provide clues to the late Pleistocene environment of Montana. Elias (1988) has also compared the insect fossil record with the pollen records from many of the studies further increasing our understanding of climatic and environmental conditions during the Late Pleistocene in the Northern Plains. All these factors are considered below in building an environmental reconstruction of the Northern Plains at the time of Clovis occupation.

Mehringer (1985) notes that few localities containing pollen records older than 13,000 years are found in the northwestern interior of the U.S. including western Montana. However, in the existing records, the abundance of sagebrush (Artemisia) indicates a cold steppe environment at least this early (Barnosky et al. 1987; Mehringer 1985). Numerous Late Pleistocene vertebrate remains support this reconstruction. A musk ox (Ovibos moschatus) from Sheridan county, in extreme Northeast Montana, provides evidence for tundra or tundra-steppe conditions south of the ice sheets (Neas 1990). The Lindsay Mammoth site produced the remains of a single male Imperial mammoth (Mammuthus imperator) and dated to 11,200 yr B.P. (Davis 1993:265-266). Agenbroad (1984) has given Mammuthus imperator a mid-Pleistocene chronological position questioning whether or not the Lindsay mammoth is an Imperial mammoth or a later species. Late Pleistocene Woolly Mammoth (M. primigenius) and Columbian Mammoth (M. columbi), both of which are indicative of grassland/arctic-steppe environment, have been reported from the region (Agenbroad 1984). The thickness and extent of the Yellowstone ice cap also contributed to extreme
conditions in which only steppe-tundra species could exist and prevented the establishment of glacial

Pollen records from northern Montana and the Yellowstone Plateau provide vegetational records
from the late Pleistocene/early Holocene (Barnosky 1989; Whitlock 1993; Whitlock and Bartlein 1993).
From these records, an environmental reconstruction approaching conditions confronting the early
Paleoindian groups may be possible.

After retreat of the Yellowstone ice cap, sediments from the Yellowstone region dated before
11,500 yr B.P. are characterized by Artemisia with spruce (Picea) parkland developing between 11,500 -
10,500 yr B.P. (Barnosky et al. 1987; Whitlock 1993). More diverse coniferous forests, consisting of
Picea, Abies, and Pinus, and resembling subalpine forests in the Yellowstone Plateau region today, appear
about 10,500 yr B.P. after the establishment of spruce parkland (Whitlock 1993). The general occurrence
of Artemisia in greater abundance prior to the establishment of Picea parkland between 12,000 and 11,000
yr B.P. suggests the existence of meadow, shrub, and steppe-tundra conditions shortly after deglaciation
(Whitlock 1993; Whitlock and Bartlein 1993).

However, pollen records from two sites located farther to the north in Montana than the sites
examined in Whitlock’s (1993) study do not indicate pine or deciduous forests replacing spruce (Barnosky
1989). Guardipee Lake is located 50 km east of Glacier National Park and Lost Lake is located 65 km to
the east of Great Falls at the northern margin of the Highwood Mountains (Barnosky 1989). Pollen records
from Guardipee Lake spanning 12,200-9300 yr B.P. suggest a continuous treeless vegetation record
characterized by shrubs in mesic habitats ca. 12,200 yr B.P. This regime was replaced by drier conditions
and an increase in sagebrush 11,500 yr B.P. (Barnosky 1989:69-71). Continued drying and xerophytic
conditions continued till 9300 yr B.P. with Chenopodiaceae and Poaceae increasing in relative abundance
to Artemisia (Barnosky 1989:69). Lost Lake to the southeast of Guardipee Lake provides evidence for
continued drought in the Northwestern Plains till 6000 yr B.P. (Barnosky 1989).

The shrub-meadow steppe-tundra existing until 11,500 yr B.P. indicates much colder and drier
conditions than presently as predicted in general circulatory models (Whitlock 1993:193). The fossil insect
record also suggests a 5.4°C lower temperature along with the estimates from pollen records of 4-6°C
decrease in temperature (Elias 1988:150). Warming and increase in precipitation from a northward shift of the jet stream is evidenced by the development of spruce (*Picea*) parkland at 11,500 yr B.P. and shift to *Picea-Abies-Pinus* forest ca. 9,500 yr B.P. in the Yellowstone region (Whitlock 1993:193-195). However, xerophytic conditions continue to exist to the north at this time (Barnosky 1989). The general circulatory model predictions of increased solar radiation during the mid-Holocene followed by more modern conditions is supported by an increase in percentages of dry, fire-adapted species such as *Pinus*, *Pseudotsuga*, and *Populus* between 9500-5000 yr B.P. with vegetative communities equating those of the present developing afterward (Whitlock 1993).

The paleoecological conditions within the vicinity of the Anzick site can be approximated using the various data sets discussed above. The paleontological record suggests cold, glacial conditions persisting up to the deposition of the Anzick assemblage with a trend towards increasing aridity and xerophytic conditions. Palynological evidence indicates a dry shrub-grass environment to the north of the Anzick site while spruce parkland is found to the south of the Anzick locale. Whether grassland or spruce parkland existed in the immediate vicinity of the Anzick site is undetermined. Given the conditions of the Yellowstone ice cap, palynological evidence, and vertebrate remains, a mixed grassland-spruce parkland at 11,000 yr B.P. in the immediate area of the Anzick site is a reasonable reconstruction of the environmental conditions facing the Late Pleistocene occupants of Montana.

4.3 Local Record

4.3.1 Site Geomorphology and Formation

As previously stated, the Anzick assemblage was discovered at the base of a sandstone cliff along the floodplain of Flathead Creek. Lahren and Bonnichsen (1971) have discussed the geomorphic processes responsible for the formation of the site area, which will be summarized here. Channel filling of the Shields River and Flathead Creek is evident along but not in the burial area. Recent deposition from a spring system has produced a meadow area reaching up to the level of the burial area. During initial channel filling, it is possible that the Anzick burial was in a ledge situation rather than the basal slope position.
associated with increase in sedimentation and rise of the meadow area. Weathering of the sandstone cliff resulted in colluvial deposition and development of talus over the burial area.

Relating the geomorphic processes described above to the regional geomorphological record is more difficult. It is possible that downcutting in the Yellowstone and tributary river valleys occurred at the end of the Pleistocene with the melting of the Yellowstone ice cap and associated alpine glaciers. Channel filling could have followed the Pleistocene/Holocene transition with the establishment of stable stream systems and development of dry, warm conditions. The development of the meadow area and talus deposition observed in the geomorphic record begin and continue till the modern period.

4.3.2 Site Stratigraphy

The upper stratigraphic levels above the Anzick assemblage had been removed by the construction activities before these units could be defined by archaeologists. However, during the 1970-1971 field season, Lahren and Bonnichsen were able to define the remaining stratigraphy of the Anzick site. A profile of the excavated area is illustrated in Figure 4.3. The uppermost stratigraphic unit consists of angular rubble, silt, and clay overlying clay and small angular rubble. The angular rubble, silt, and clay was primarily undisturbed except a portion near the ledge which was rodent disturbed. The clavicle that Lahren and Bonnichsen recovered was from this unit near the base of the rodent disturbed area. Underlying the clay and small angular rubble is a large angular rubble unit. The basal layer consists of sandstone bedrock underlying the large angular rubble unit. The bedrock forms the cliff which provided the talus overlying the burial area. All the stratigraphic units extend from the cliff out to the meadow area.

4.3.3 Radiocarbon Dates

Stafford (1994) has dated the human remains recovered from with the Anzick assemblage through AMS (accelerated mass spectrometry - see Table 4.1). Dating individual amino acids from both skull fragments provides a greater than 2,000 year age difference between the two individuals. The red ochre
Figure 4.3. Anzick site stratigraphic profile, west wall (courtesy of R. Bonnichsen).
Table 4.1. Radiocarbon dates derived from human skull fragments associated with the Anzick assemblage (after Stafford 1994).

<table>
<thead>
<tr>
<th>AMS lab No. (white calvarium)</th>
<th>C-14 date, Yr. B.P.</th>
<th>AMS lab No. (stained calvarium)</th>
<th>C-14 date, Yr. B.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA-313C</td>
<td>8620 ± 340</td>
<td>AA-313A</td>
<td>8690 ± 310</td>
</tr>
<tr>
<td>AA-313D</td>
<td>8940 ± 370</td>
<td>AA-313B</td>
<td>10,500 ± 400</td>
</tr>
<tr>
<td>AA-2973</td>
<td>8510 ± 120</td>
<td>AA-2978</td>
<td>10,240 ± 120</td>
</tr>
<tr>
<td>AA-2974</td>
<td>8740 ± 90</td>
<td>AA-2979</td>
<td>10,820 ± 100</td>
</tr>
<tr>
<td>AA-2975</td>
<td>8520 ± 80</td>
<td>AA-2980</td>
<td>10,710 ± 100</td>
</tr>
<tr>
<td>AA-2976</td>
<td>8680 ± 90</td>
<td>AA-2981</td>
<td>10,940 ± 90</td>
</tr>
<tr>
<td>AA-2977</td>
<td>8590 ± 90</td>
<td>AA-2982</td>
<td>10,370 ± 130</td>
</tr>
</tbody>
</table>

| average-                      | 8610 ± 90          | average-                       | 10,680 ± 50         |

The stained calvarium provided seven dates averaging 10,680 ± 50 yr B.P. These ranged from 8690 ± 310 yr B.P. - 10,940 ± 90 yr B.P. All the dates were greater than 10,240 yr B.P. with the exception of the 8690 ± 310 yr B.P. date. An average date of 8600 ± 90 yr B.P., with seven dates ranging from 8510 ± 120 B.P. - 8940 ± 370 yr B.P., was obtained from the bleached calvarium.

The radiocarbon dates derived from the Anzick skull fragments have stimulated much debate concerning the age and association of the artifacts and human remains. Stafford (1994) considers the younger set of dates valid due to the fact that both sets of skeletal material contained collagenous compositions and ages on XAD-purified hydrolyzates matched dates from amino acids. He interprets the younger remains as an intrusive Archaic burial (Stafford 1994:51).

This interpretation is considered tentative here for a number of reasons. First, given the rodent disturbance of the site, it is possible that the younger skull fragment could have been exposed and/or contaminated. The construction workers indicated that the artifacts had been found close to the surface. The younger skull fragment could have been exposed and contaminated in a manner not considered by Stafford (1994). Second, the use of the site by later populations seems to be restricted to using the cliff as a bison jump. Whether or not there is any substantial Archaic camp or occupation is unknown. Third, the discoverers of the assemblage indicated that the skeletal material had been found below the artifacts. This suggests that the burials were deposited at the same time or just prior to the burial of the Clovis-age
artifacts. In this reconstruction, the younger dates are erroneous and the skeletal material is of the same age as the cultural material.

Regardless of the true age of the younger specimen, what Taylor (1969) could only think of "what could have been" has been proven. There is no doubt that at least one of the individuals is of Clovis age, and is associated with the unmistakable Clovis artifacts.

4.4 Summary

To summarize the paleoecological conditions at the end of the last Ice-age in Montana, the inhabitants survived in a period of much cooler and drier conditions than the present. Spruce parkland and grasslands dominated the environment surrounding the Anzick site while megafauna such as mammoth, musk ox, and other fauna inhabited this region and possibly were hunted by the early inhabitants. The period when the Anzick assemblage was deposited is marked by drastic environmental change indicated by the retreat of the Laurentide and Cordilleran ice-sheets, increase in aridity, disappearance of the megafauna, and establishment of new vegetative regimes.
Chapter 5: Methodologies and Systematics for Artifact Classification and Analysis

5.1 Introduction

In this chapter, definitions and procedures used to analyze the Anzick artifacts are discussed. Definitions of artifact classes and classification of the Anzick artifacts are largely derived from Bonnichsen (n.d.). Emphasis has been placed upon documenting the raw material, shape, technological, and use patterns in the technological organization of the Anzick assemblage. Analysis of these patterns in the assemblage provides data to address hypotheses regarding the Anzick assemblage.

5.2 Classification

A paradigmatic approach to classification of the Anzick assemblage is employed in the current study. This approach has been discussed previously by Bonnichsen (n.d.). The paradigmatic approach is based upon the principles of set theory in which groups of data that share at least one common characteristic can be divided into smaller groups determined by differences or similarities of at least one additional characteristic. This allows an assemblage to be divided into mutually exclusive categories on the basis of observable, defined properties. Classification can be expressed in branch diagrams with different levels of organization (Figure 5.1). Artifact class definitions are presented in Table 5.1. The total composition of the Anzick assemblage is presented in Table 5.2.

The first level of division in the Anzick assemblage classification separates organic and inorganic materials. The second level of division illustrates the division of specific raw materials. Biological remains are divided into human and faunal categories. Faunal remains are further separated from human remains by cultural modification into a functional tool class. The second level of division of the flaked stone category generation of six mutually exclusive artifact classes. These classes include the following: projectile points, bifaces, unifaces, flakes, flake tools, and flake-blades. A final level of division in the flaked stone class separates unifaces into categories based upon differences in location of the working edge. The final artifact classes illustrated in the branch diagram are defined in Table 5.1.
Anzick Assemblage

Organic
- human remains
- faunal remains
  - bone foreshafts

Inorganic
- flaked stone
  - projectile points
  - bifaces
  - unifaces
    - endscraper
    - sidescraper
  - flakes
  - flake tools
  - flake blade

Figure 5.1. Branch diagram illustrating levels of classification of the Anzick assemblage.
Table 5.1. Artifact definitions for classification purposes.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projectile point</td>
<td>A tool made of stone or other material designed to be hafted to a spear, dart, or arrow shaft and propelled. Lithic projectile points have converging lateral margins at the tip with various hafting morphologies. Projectile points in the Anzick assemblage are recognized by the presence of fluting.</td>
</tr>
<tr>
<td>Biface</td>
<td>A lithic artifact having been flaked on both faces with flakes originating from common margins.</td>
</tr>
<tr>
<td>Uniface</td>
<td>A lithic artifact having been flaked only on one face. The entire margin or one or both ends or margins may be worked. Unifacial tools often have steep working edges.</td>
</tr>
<tr>
<td>Unifacial Endscraper</td>
<td>Tool with working edge on the proximal and/or distal end.</td>
</tr>
<tr>
<td>Sidescraper</td>
<td>Tool with working edge along one or both lateral margins.</td>
</tr>
<tr>
<td>Flake</td>
<td>Flake is used here to refer to the by-product of lithic manufacture. Flakes exhibit attributes such as a lip, bulb of percussion, and ribs.</td>
</tr>
<tr>
<td>Flake-blade</td>
<td>A flake that is at least twice as long as it is wide.</td>
</tr>
<tr>
<td>Flake tool</td>
<td>A flake with minimal cultural modification that is utilized as a tool.</td>
</tr>
</tbody>
</table>
Table 5.2. Assemblage composition of the Anzick Clovis assemblage.

<table>
<thead>
<tr>
<th>Artifact Class</th>
<th>Human skeletal remains</th>
<th>Bone Foreshafts</th>
<th>Projectile points</th>
<th>Bifaces</th>
<th>Unifaces</th>
<th>Flake Tools</th>
<th>Flakes</th>
<th>Fragments</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total #</td>
<td>?</td>
<td>12</td>
<td>8</td>
<td>70</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>15</td>
<td>119</td>
</tr>
<tr>
<td>MNSP</td>
<td>2</td>
<td>4-6</td>
<td>8</td>
<td>68</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>14</td>
<td>116</td>
</tr>
</tbody>
</table>
The paradigmatic classification seeks to group artifact classes on the basis of empirical characteristics that document decision-making behavior (Bonnichsen n.d.). This decision making behavior has been discussed previously as the technological organization of the assemblage. Decisions concerning the overall morphology of the artifact is reflected in the raw material, shape, technology, and use choices of the craftsman. Similarities and differences in attributes related to raw material, shape, technology, and use reflect behavioral patterns. These patterns possibly indicate variation reflective of socio-cultural groups. Consistent attribute patterns may provide an “archaeological fingerprint” that indicates “who” occupied a site or region (cf. Bonnichsen n.d.). Thus, raw material, shape, technology, and use analyses are conducted in the study of the Anzick assemblage technological organization and described below.

5.3 Raw Material Analysis

The raw material analysis of the Anzick lithic artifacts seeks to define the number and types of lithic raw materials in the Anzick assemblage through characterization by color, coloration patterning, luster, texture, and other attributes such as presence of cortex and mineral inclusions. The characterization of lithic artifacts by color, color patterning, luster, texture and other attributes can indicate the number of raw material sources represented in the assemblage and also provides clues to identification of lithic raw material sources. Description of the lithic raw materials in the Anzick lithic assemblage is based upon macroscopic observations of color, color patterning, luster, texture, presence of cortex, and mineral inclusions. These attributes are defined in Table 5.3. Attributes were recorded for each artifact under uniform lighting conditions.

Artifact color is described by the standardized Munsell system. The lithic artifacts were directly compared to Munsell Rock color charts for color characterization. The dominant color of the artifact was recorded as the primary color. Many of the Anzick lithic artifacts are multi-colored. Secondary color is represented by the second-most common color observed on the artifact. Secondary color often occurs in patterns such as bands, speckles, or dendritic strands or may reflect a gradient, slight or dramatic, in color change. Like the primary color, the Munsell system is used to record the secondary color. Luster is defined here as the light reflectivity of a lithic raw material. Determination of luster types is subjective as a luster
identification chart was not available for this analysis. As such, luster is used here as a means of general description. Only significantly different types of luster were identified, including translucent, opaque, dull, earthy, or waxy. Texture may indicate the quality of a raw material for flintknapping. The presence of cortex refers to remnants of the weathered, exterior rind common to cryptocrystalline raw materials occurring on the artifact’s surface. Other attributes such as mineral inclusions that are observable were also recorded for each artifact.

Table 5.3. Attribute definitions utilized for lithic raw material analysis.

<table>
<thead>
<tr>
<th>1. Color:</th>
<th>Systematic description of lithic artifact’s colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. primary:</td>
<td>Dominant color of an artifact</td>
</tr>
<tr>
<td>B. secondary:</td>
<td>Second most common color of an artifact; often occur in patterns</td>
</tr>
<tr>
<td>2. Color patterning:</td>
<td>Coloration patterns that may occur on an artifact</td>
</tr>
<tr>
<td>A. bands:</td>
<td>Parallel strips or bands of different colors appearing on an artifact</td>
</tr>
<tr>
<td>B. strands:</td>
<td>Dendritic or non-parallel patterns of colors</td>
</tr>
<tr>
<td>C. speckles:</td>
<td>Splotches, spots, or other patterns of colors</td>
</tr>
<tr>
<td>3. Luster:</td>
<td>Degree and type of light reflectivity of a lithic artifact.</td>
</tr>
<tr>
<td>A. translucent</td>
<td>Significant amount of light transmitted through raw material; almost transparent</td>
</tr>
<tr>
<td>B. opaque</td>
<td>Less significant amount of light transmitted through raw material</td>
</tr>
<tr>
<td>C. dull</td>
<td>No reflectivity</td>
</tr>
<tr>
<td>D. earthy</td>
<td>Grainy appearance; moderately reflective</td>
</tr>
<tr>
<td>E. waxy</td>
<td>Smooth “waxy” appearance; highly reflective</td>
</tr>
<tr>
<td>4. Texture</td>
<td>Subjective description of lithic material quality for flintknapping</td>
</tr>
<tr>
<td>A. very fine</td>
<td>Excellent quality for flintknapping</td>
</tr>
<tr>
<td>5. Other attributes</td>
<td>Presence of minerals or other incorporations such as “mossy” inclusions</td>
</tr>
<tr>
<td>A. inclusions</td>
<td>Presence of weathered, exterior rind of raw materials</td>
</tr>
</tbody>
</table>

Patterns of certain raw materials for different artifact types may be demonstrated through comparisons of percentages of raw materials in a class. Constraints placed upon the production of certain classes or subclasses by the raw material itself may be indicated by comparisons of metric measurements, means, and ranges of measurements. These data may suggest the role of lithic raw material use and economic adaptations of the Clovis complex in the Northern Plains. Based upon associations of lithic raw
material types, sources, and artifact types, issues such as raw material procurement, technological organization, and settlement mobility may be addressed.

5.4 Shape Analysis

A shape analysis was conducted as a means of objectively defining groups of artifacts. In comparison with other data, morphological groups provide information related to the technological organization of an assemblage. The relationship between shape as part of an artifact style or type to the analysis of the Anzick assemblage is discussed.

The initial role of style in archaeology was recognition of artifact types and the development of typologies that allowed archaeologists to organize assemblages in time and space (Conkey and Hastorf 1990; Odell 1981). Artifact styles are considered to have had roles in past societies that reflect social interaction as well as serving as spatial or temporal indicators (Conkey and Hastorf 1990; Hegmon 1992). Attributes such as shape, decoration, and raw material are considered to be culturally diagnostic and provide patterned information indicative of "types". Wobst's (1977) defines style as "that part of formal variability in material culture that can be related to the participation of artifacts in processes of information exchange." Formal variability in artifact styles is reflected in choices made between typological, technological, and raw material options by the prehistoric craftsman (Clark 1989:30). This can also be stated as the "sum total of the different components of the overall morphology of a piece of worked stone" including morphological, functional, and raw material variation (Clark 1989:31). Bradley and Stanford (1987) include general outline (i.e. morphology) among lithic attributes that reflect social/cultural standards. The importance of morphology in comparison to the other attribute analyses defined in this chapter is expressed in these views of style.

Two steps were followed in the shape analysis. Metric measurements of a number of certain attributes were taken. These attributes are defined in Table 5.4 illustrated in Figure 5.2. Metric attributes of artifacts manufactured from different raw materials are compared. Variability within artifact classes related to raw material types may be an initial intimation of artifact variability. Attribute measurements were taken following the point line technique (Bonnichsen 1978; Young and Bonnichsen 1984:145). The
point line is a system that permits standardized data recording. Artifacts are placed on an X-Y axis with the
catalogued face as ventral. The base or most proximal portion of the artifact is aligned on the X-axis and
the longitudinal or Y-axis bisects the artifact. As no artifact is perfectly symmetrical, the distal is usually
off-center from the Y-axis. With the artifact oriented, measurements are taken with sliding calipers and
outlines of the artifact may be drawn. Outlines of the Anzick artifacts in orientation have been prepared
previously R. Bonnichsen (n.d.). Alteration of the system for flake tools and unifaces to accommodate
shape variation is described in chapter 9.

Table 5.4 Definitions of metric attributes used in shape/size analysis.

<table>
<thead>
<tr>
<th>Metric Attribute</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. maximum length (ML)</td>
<td>The distance from the distal tip to the base situated on the Y axis.</td>
</tr>
<tr>
<td>B. mid-width (MW)</td>
<td>The distance between the left and right lateral margins halfway between the distal tip and X-axis.</td>
</tr>
<tr>
<td>C. distal width (DW)</td>
<td>The distance between the left and right lateral margins 10 mm below the distal tip.</td>
</tr>
<tr>
<td>D. proximal width (PW)</td>
<td>The distance between the left and right lateral margins 10 mm above the most proximal margin.</td>
</tr>
<tr>
<td>E. thickness (TH)</td>
<td>The thickness of the artifact at the intersection of the mid-width and length measurements.</td>
</tr>
<tr>
<td>F. basal depth (BD)</td>
<td>Distance between the most proximal portion of artifact and top of basal indentation.</td>
</tr>
<tr>
<td>G. number of flutes (#Fl)</td>
<td>The number of flutes per face, i.e. ventral/dorsal (fluted points only).</td>
</tr>
<tr>
<td>H. flute length (FL)</td>
<td>Length of channel flake scar on each face, i.e. ventral/dorsal (fluted points only).</td>
</tr>
</tbody>
</table>
The second step of the shape analysis involves development of a means for objectively defining groups of artifacts. Ratios of metric measurements, when plotted on a graph, may illustrate that groups of artifacts cluster together. A similar approach is used by Goodyear (1995) to define groups of projectile points in the Brand assemblage, a Paleoindian site in Arkansas. Scatterplots are employed in the current...
study to graphically illustrate and define groups of bifaces. Comparison to other variables such as raw material, technology, and use can substantiate the validity of such groups.

Artifact shape and symmetry is a qualitative variable that is not necessarily adequately expressed through measurement of metric attributes. An artifact’s overall shape is defined by the form of the tip, blade, and base. Definition of specific discriminating criteria allows intra-group shape variation to addressed according to common tip, blade, and base forms. Table 5.5 defines the different base, blade, and tip forms used to develop shape groups. These forms are illustrated in Figure 5.3.

Table 5.5. Qualitative definitions of biface section forms.

<table>
<thead>
<tr>
<th>I. Base (BS):</th>
<th>The portion of a biface, projectile point, or other tool hafted for use. As this is the generally non-utilized end and less subject to breakage, basal portions often serve as archaeological indicators.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. absent:</td>
<td>base is missing</td>
</tr>
<tr>
<td>B. concave (Cc):</td>
<td>basal margin contracts so that lateral margins extend beyond basal margin; creates indentation or basal depth</td>
</tr>
<tr>
<td>C. convex (Cv):</td>
<td>basal margin expands beyond length of lateral margins; generally rounded</td>
</tr>
<tr>
<td>D. pointed (Pt):</td>
<td>base forms a triangular point</td>
</tr>
<tr>
<td>E. straight (St):</td>
<td>basal margin is perpendicular to longitudinal axis</td>
</tr>
<tr>
<td>F. assymetrical (As):</td>
<td>basal margin is does not conform to specific shape</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II. Blade (BL):</th>
<th>This attribute refers to the mid-section of the artifact bounded by the hafted basal portion and the distal or tip of the biface or point; includes lateral margins.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. absent</td>
<td>blade portion is missing</td>
</tr>
<tr>
<td>B. incurvate (In):</td>
<td>lateral margins are incurvate</td>
</tr>
<tr>
<td>C. excurvate (Ex):</td>
<td>lateral margins are excurvate</td>
</tr>
<tr>
<td>D. straight (St):</td>
<td>lateral margins are parallel</td>
</tr>
<tr>
<td>E. assymetrical (As):</td>
<td>lateral margins do not conform to specific shape</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>III. Tip (TP):</th>
<th>Tip is used here instead of the term distal to refer to the end of the biface or point opposite the base.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. absent</td>
<td></td>
</tr>
<tr>
<td>B. triangular, excurvate (TrEx):</td>
<td>triangular tip is formed with lateral margins curving inward to convergence</td>
</tr>
<tr>
<td>C. triangular, incurvate (TrIn):</td>
<td>triangular tip is formed with lateral margins curving outward to convergence</td>
</tr>
<tr>
<td>D. triangular, straight (TrSt):</td>
<td>triangular tip is formed with straight converging lateral margins</td>
</tr>
<tr>
<td>E. assymetrical (As):</td>
<td>tip is irregular in shape</td>
</tr>
</tbody>
</table>
Figure 5.3. Artifact section form types: Top row - base forms, A. concave, B. convex, C. pointed, D. straight, E. assymetrical; Middle row - blade forms, A. incurvate, B. excurvate, C. straight, D. assymetrical; Bottom row - tip forms, A. triangular excurvate, B. triangular incurvate, C. triangular straight, D. assymetrical.
These forms are normative types or templates. A degree of flexibility in using these forms is required as boundaries between templates may be fuzzy. Much of the variation in the shape characteristics of the biface class is in degree rather than type. As a general rule, the section template that most resembles the biface base, blade, or tip at hand is coded to that biface section. If direct observation cannot delineate the most accurate template, the artifact section is measured in the point line orientation position. The percentage of the artifact section contacting the artifact margin is used to determine the form. For example, a biface base may appear to be straight to slightly convex. However, if 50% of the basal margin can be aligned directly on the X-axis, the base form is considered straight. Likewise, if less than half of the basal margin can be aligned in that manner, convex is accepted. The same reasoning is applied to all artifact sections and forms.

5.5 Technological Analysis and Imaging Methods

Technological analysis occurs at what Young et al. (1994:210) have termed “meso-analysis”. “Meso-analysis” focuses on the study of flake scars, the relationships between flake scars and stages of artifact production, and the linkage between morphology and behavior. Flake-scar studies provide information on production procedures which have been brought together as the cognitive approach to lithic analysis (Young et al. 1994:210). This approach has been discussed at some length previously and is compared and contrasted to the normative approach that focuses almost exclusively on artifact form (see Bonnichsen 1977; Young and Bonnichsen 1984, 1985; Young et al. 1994).

As previously stated, the cognitive approach attempts to link all aspects of stone tool production, i.e. material, cognition, and behavior, into more meaningful models in the analysis and interpretation of stone tool production and classification. By studying the decision-making processes of modern flintknappers, Young and Bonnichsen (1984) found that the products (flake scars) and by-products (flakes) of their behaviors contain attributes which are identifiable and constant. Thus, through observing the attributes present within a flake or flake scar, identification of the behavior which produced that flake or scar is possible. Flake scars rather than the flakes are of primary interest to the cognitive analyst for a number of reasons. First, experimental blind tests have shown that the behavior responsible for the flake
scar can be identified a significant amount of time (Young et al. 1994). Second, lithic artifacts such as bifaces or projectile points are often removed from the initial area of production, i.e. the quarry. These artifact types are then transported as curated tools from one camp to the next. Final production, resharpening, and discard occur at different sites leaving only flakes from single episodes of the artifact’s lifespan at any one site. With few flakes present in the Anzick assemblage, the use of the cognitive approach is necessitated to reconstruct behavioral patterns through flake scar attributes.

The cognitive approach involves several steps and numerous terms require definition. These steps are outlined in Young et al. (1994). The terms used in these steps are defined in greater clarity after the steps are summarized below:

1. Identify morpho-units and “read” the morpho-unit transforming it into a behavior unit
2. Infer purpose to behavior units creating production units
3. Establish sequence of production units
4. Document production strategies for individual artifacts in flow diagrams
5. Develop grammatical structure of the entire assemblage

A behavior unit may be defined as “analytic devices designed to simplify the behavior process by identifying recurring behavior patterns and indicating how they are to be recognized and labeled” (Young and Bonnichsen 1984). In other words, a behavior composed of a number of variables will produce the same gestalt of attributes in each flake scar produced by that same behavior. In this manner, the identification process is simplified. Individual flake scars are referred to as morpho-units. Morpho-units are defined as the constellation of morphological attributes that result from the application of a behavior composed of a number of variables such as flaking behavior, type of tool, and level of force (Young et al. 1994:213). Identification of the pattern or gestalt of attributes allows the analyst to “read” a morpho-unit or a series of morpho-units.

After the morpho-unit(s) have been “read”, inference of purpose transforms the morpho-unit into a production unit. The sequence of production units becomes important at this point. Illustrating that production units follow a certain order adds rules to the production process. The sequence of production
units reflects the behavior variables and rules available to the craftsman. This is referred to as a production code (Young and Bonnichsen 1984). A production code entails all the craftsman’s flintknapping knowledge utilized to manufacture stone tools. From the production code, production strategies are generated for individual artifacts. Production strategies are specific and unique to the individual tools as no two artifacts are made just alike. The sequence of production units is an artifact’s production strategy. The production strategy is illustrated in a flow chart documenting the sequence of production units. The intent of the flow diagram is not to document the exact sequence of every production unit, but to show that production units follow an order controlled by certain rules and variables (i.e. production code) such as flintknapping experience or raw material variation (Young et al. 1994). Flow diagrams are inherently unlike stage analysis in that flow diagrams are meant to document the production process of an artifact rather than classify the artifact according to a normative shape analysis. Preparation of flow charts facilitates comparisons of artifact production strategies and similarities or differences in production become quite evident. Artifacts produced in the same manner share similar flow diagrams. Flow diagrams that are similar but slightly different can be subsumed in a general production strategy if the different production units can be shown to recur in a regular, patterned manner. Flow diagrams that do not share similar production units and/or sequences represent distinct production strategies.

However, taken together, the entirety of the assemblage’s production strategies is referred to as the grammatical structure. A grammatical structure reveals the entire range of possible combinations of behaviors or production strategies of an assemblage. Documentation of the grammatical structure of an assemblage clarifies the underlying logic in stone tool production at the cognitive decision making level, i.e. why the artifacts are made the way they are. Technological variation can be incorporated along with raw material and morphological variation to a greater extent in assemblage interpretation than with more normative analytic techniques. The relationships of the terms defined above are illustrated in Figure 5.4.
Figure 5.4. Relationships between terms utilized in the cognitive approach.
As noted by Bonnichsen (n.d.), the systematic analysis of flake scars has been slow to develop. Studies concerned with lithic production often lack clear morphological referents (production units) of concern. This can be attributed largely to the small size of flake scars and difficulty in analysis. However, the development of computer imaging approach that allows flake scars or series of flake scars to be enlarged and enhanced. Details of flake scar patterns can be much more easily examined and greater access by other researchers is facilitated. This technique has been termed “Frame analysis” by Bonnichsen (n.d.) in which the production strategy and possibly history of an artifact can be represented. Frame analysis is based on the assumption that similar morpho-units were produced in the same manner. Bonnichsen (n.d.) describes the advantages of this system:

"...the advantage of the method is that: (1) it clearly delineates the scar pattern, e.g. emperical morphological referent, that is a fundamental building block used in reconstruction of production strategies; (2) by use of a short-hand abbreviation system, the analyst can create a detailed description of the inferred production units and rules of applications to characterize the observed pattern in each frame; (3) by summarizing the production code within each frame, a comprehensive description of how an artifact was made and used can be inferred; (4) the inferred relationships between production units (sequencing rules) can be summarized in flow diagrams."

The computer techniques and methodology for documentation of morpho-units as morphological referents for the technological analysis is described next. The computer imaging technique consists of several steps. First, images of the artifacts have to be created. For the Anzick assemblage, negatives of the ventral and dorsal faces of each artifact were mounted as slides and scanned with a slide scanner at a high resolution (approximately 1200 dpi) and transferred to disk. The images were then enhanced with the use of Adobe Photoshop 3.0, a computer graphics program. Enhancement consists of inversing the negative image, adjusting brightness and contrast, and removing background noise. Additionally, flake scar ridges were outlined and highlighted with the burn tool. The burn tool allows the analyst to chose the size of an area represented by number of pixels and darkens that area. Flake scar ridges and features become much more visible. Casts or “close-up” photographs of the Anzick artifacts were utilized to help with the enhancement so false information would not be transmitted to the image. The final image is then imported
into Microsoft Power Point. Templates in Power Point allow composite images of each artifact to be constructed. Images can be enlarged and arranged as the analyst likes. After the template is complete, the template is imported into Microsoft Word. Documentation of morphological referents is accomplished in Microsoft Word. Discrete types or series of flake scars are isolated with the draw tools. Unique patterns are recognized and boxes are used to "frame" these patterns. The frames are numbered in the sequence that the flake scars were produced. Superposition of flake scars indicates the sequence of frames. In this manner, the production of the base, blade, and tips of artifacts can be illustrated and documented. The relationships between frames are presented in flow diagrams that illustrate the production process. Flow diagrams are presented through arrangement of the frames in numerical order. An arrow (→) is utilized to illustrate the progression of the behaviors. A double arrow (↔) indicates that certain behaviors may be used in a repetitive cycle. A dashed line (----) suggests a logical sequence between behaviors although lack of superposition between frames does not provide direct evidence for the progression of behaviors. This may involve documentation of the relationship between the tip and base where there is no superposition of flake scars.

Tables are used to summarize the production strategies of artifacts and comparisons between strategies can reveal similarities and differences in the assemblage. The total number of production codes within an assemblage (e.g. the grammatical structure) may be defined from the similarities and differences of production strategies. The technological homogeneity of the assemblage can be evaluated. The presence of different production codes within an assemblage requires explanation. A technologically-mixed assemblage may be the result of several possibilities (Young et al. 1994). If production strategies can be linked together through shared behaviors, a reduction continuum may be represented. Alternatively, technologically distinct groups may represent functional differences, distinct changes in lithic production techniques, or variable raw material use. Diffusion or exchange of artifacts may also result in assemblages with variable production codes. Disturbances such as re-occupation of the site and/or natural disturbances may produce mixed assemblages. Recognition of technologically-mixed assemblages allows for a great deal of insight into cultural processes previously unrecognized in lithic studies.
In order to accurately interpret flake scar patterns, specific attributes must be well-defined. Table 5.6 defines the technological units that may occur within the assemblage. These units are derived from this as well as other previous technological studies (i.e. Bonnichsen n.d.). As the production process associated with each artifact section is described, the units defined below may be applied to each section as needed. Slight alterations in how the units are applied may be required. A template was developed (Figure 5.5) to document the attributes of each frame. The attributes utilized in the flake scar analysis are defined in Table 5.6 after Bonnichsen (n.d.) and illustrated in Figure 5.6 and 5.7. The abbreviations in parentheses presented in Table 5.6 are codes describing the details of each frame. The relationships between frames are presented in flow diagrams that illustrate the production process.
Table 5.6. Attribute definitions for technological analysis.

<table>
<thead>
<tr>
<th>A. Frame No. (FrNo)</th>
<th>Sequential numbers assigned to all artifact frames.</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Force (Forc)</td>
<td>The type of force used to create a base morpho-unit.</td>
</tr>
<tr>
<td>1. Percussion (Pn)</td>
<td>The use of a hammerstone or billet to remove flakes by direct blow to the topside (from the craftsman’s view) or edge of artifact. These flakes are exhibited in greater quantity on bifaces than projectile points. Percussion flakes are larger and less regularly spaced than pressure flakes.</td>
</tr>
<tr>
<td>2. Pressure (Pr)</td>
<td>Flakes removed through the use of an antler, bone, or material flaker. Force is applied to the platform by direct contact of the flaker. Pressure flakes tend to be discrete, closely spaced, and rib scars are closely spaced.</td>
</tr>
<tr>
<td>3. Edge grinding (Eg)</td>
<td>Use of a hard grinder to dull artifact edges. Edge grinding may be used to create striking platforms or facilitate hafting. Marginal microflaking is evidence of this behavior.</td>
</tr>
<tr>
<td>4. Indirect percussion (Ip)</td>
<td>Indirect percussion involves placing a tool such as an antler on the edge of the artifact and hitting it with another tool.</td>
</tr>
<tr>
<td>5. Can not determine</td>
<td></td>
</tr>
<tr>
<td>C. Morpho Type (Morph)</td>
<td>This attribute documents the production units to used to create the base.</td>
</tr>
<tr>
<td>1. Retouch (Re)</td>
<td>Use of pressure force to reform the margin indicated by discrete, closely spaced, minimal to very minimal size scars along the perimeter of the base (see E for size below).</td>
</tr>
<tr>
<td>2. Shaping (Sh)</td>
<td>Discrete sequences of scars originating from the edge of the margin and extending the length of the margin. The distal ends of the scars have a wide, scalloped form and are often relatively steep (e.g. 45°) to the face of the artifact. This suggests pressure applied straight down with the specimen placed on an anvil or hard, flake surface.</td>
</tr>
<tr>
<td>3. Thinning (Th)</td>
<td>Flake scars originating from the margin and extending at least one-third the width of the artifact. The angle of flake removal is much more acute than shaping flakes, perhaps because bevel platforms are used relative to the face of the artifact. Flakes tend to feather in termination.</td>
</tr>
<tr>
<td>4. Fluting (Fl)</td>
<td>Removing a thinning flake from the base toward the tip so as to cross-cut the intersection of flakes originating from both lateral margins. A flute may extend only part way along the length of the artifact or it may extend the entire distance.</td>
</tr>
<tr>
<td>5. Margin contouring (Mc)</td>
<td>Removing material on the margin of a biface or point in order to achieve the desired thinness and curvature near the edge; margin contouring may involve reducing the edge angle. If however, the edge is too flat, contouring may require increasing the edge angle.</td>
</tr>
</tbody>
</table>
(Table 5.6 continued)

6. Impacting (Imp) Impact scars are usually detached from the distal end or distal lateral edges and cross-cut other patterns affecting basal morphology. Impact scars take a variety of forms.

7. Ground edge (Ge) Edge grinding is used to produce ground edges by abrasion. Ground edges are dull on the edge and if examined under a light magnifier, the dull, rounded edge is readily visual. Ground edges facilitate hafting and help prevent breakage of points upon impact.

8. Margin beveling (Mb) Removing short, fat flakes on the margin of an artifact in order to create a solid platform for the removal of thinning flakes; margin beveling is created on the underside (from the craftsman’s view) and usually involves the use of very minimal shaping units.

9. Notch (Nt) Pressure flaking is utilized to create a notch. Pressure is in a downward motion. A flake is removed from one face and then pressure force is applied to indentation from first flake. This is repeated until desired depth is acquired.

10. Percussion flake remnant (PnFlkRnt) A flat scar surface from the original flake on which the specimen that has not been altered by subsequent flaking.

11. Percussion thin remnant (PnThRnt) A partial scar or series of scars from a previous percussion thinning sequence. The large size of the flake scar suggest a percussion origin.

12. Pressure thin remnant (PrThRnt) A partial scar or series of scars from a previous pressure thinning sequence. The size and even spacing suggest the scar remnants are of pressure origin.

D. Size of scars (Sz) The attribute documenting the size of the framed morpho-unit(s).

1. Very minimal (Vm) Restricted to the edge rubs (abrades, buffets, or pressure rubs), results in dulling of edge characterized by microflakes.

2. Minimal (Ml) Flake scars restricted to margin of artifact; generally not extending more than one-third the distance to the midline.

3. Moderate (Md) Flake scars extend not less than one-third and not more than two-thirds the distance toward the midline.

4. Substantial (Sl) Flake scars extend not less than two-thirds and no more than one-half the distance toward the midline.

5. Very substantial (Vs) Flake scars extend over midline.

6. Outre Passe (Op) Flake scar removes portion of opposite margin of biface or projectile point. When carefully controlled, outre passe flakes can be used to thin the far edge of a bifacially flaked stone tool.

7. Can not determine

E. Form of Scars (Frm) Extent of framed morpho-unit identifiable for analysis.
(Table 5.6 continued)
1. Discrete flake scar
   Entire flake scar is visible on artifact's surface.
2. One-third overlap (1/3 ol)
   One-third of flake scar is overlapped by adjacent scar(s).
3. One-half overlap (1/2 ol)
   One-half of flake scar is overlapped by adjacent scar(s).
4. Two-thirds overlap (2/3 ol)
   Two-thirds of flake scar is overlapped by adjacent scar(s).
5. Random (r)
   Only slight portion of scar removed.
6. Can not determine

F. Spacing of Scars (Spac)
This attribute focuses on the spacing between scars relative to the plane of detachment. The distance in millimeters between flake scars are measured between platform remnants of adjacent flake scars.

1. random (r)
2. Can not determine (cnd)

G. Angle of scars (Ang)
Lines are projected through the central axes of scars when artifacts are in orientation position. Scar angles are documented to the nearest degree by using a protractor that is aligned with longitudinal axis of the specimen and read clockwise. Flake scar angles on the right margin are read clockwise and angles on the left margin in a counterclockwise direction.

H. Thinning Pattern (Patt)
Pattern of flake scar removal

1. Collateral Thinning (CoTh)
   Minimum to substantial flakes are removed at right angles relative to the point edge and generally converge at the central longitudinal axis of the specimen.

2. Resharpened Thinning (ReTh)
   Moderate to very substantial thinning flakes are removed to resharpen or reshape the artifact. Resharpening flakes can be distinguished as they cross-cut early sequences of finishing flake scars.

3. Random (r)
   Flake scars are randomly placed along artifact margins
Artifact Production Code: Anzick Assemblage
Catalog #:
Class:

Frame No.: 1 Location: 
Shap: 
Forc: 
(Morph: ; Sz: ; Frm: ; Spac: ; Ang: )

Frame No.: 2 Location: 
Shap: 
Forc: 
(Morph: ; Sz: ; Frm: ; Spac: ; Ang: )

Frame No.: 3 Location: 
Shap: 
Forc: 
(Morph: ; Sz: ; Frm: ; Spac: ; Ang: )

Frame No.: 4 Location: 
Shap: 
Forc: 
(Morph: ; Sz: ; Frm: ; Spac: ; Ang: )

Frame No.: 5 Location: 
Shap: 
Forc: 
(Morph: ; Sz: ; Frm: ; Spac: ; Ang: )

Frame No.: 6 Location: 
Shap: 
Forc: 
(Morph: ; Sz: ; Frm: ; Spac: ; Ang: )

Frame No.: 7 Location: 
Shap: 
Forc: 
(Morph: ; Sz: ; Frm: ; Spac: ; Ang: )

Frame No.: 8 Location: 
Shap: 
Forc: 
(Morph: ; Sz: ; Frm: ; Spac: ; Ang: )

Frame No.: 9 Location: 
Shap: 
Forc: 
(Morph: ; Sz: ; Frm: ; Spac: ; Ang: )

Frame No.: 10 Location: 
Shap: 
Forc: 
(Morph: ; Sz: ; Frm: ; Spac: ; Ang: )

Production Strategy Flowchart:

edge preparation thinning shaping

Figure 5.5. Sample technology attribute coding sheet.
Figure 5.6. Examples of technological attributes defined above; A. size: 1. very substantial, 2. substantial, 3. moderate, 4. minimal, 5. very minimal; B. spacing; C. form: 1. 1/3 overlap, 2. 1/2 overlap, 3. no overlap; D. angle.
Figure 5.7. Examples of flake scar thinning patterns; Row 1, Blade thinning patterns: (A) diagonal parallel thinning; (B) diagonal harlequin thinning; (C) resharpened thinning; (D) collateral substantial thinning; (E) pressure retouch; Row 2, Tip creating: (F) pressure thinning flakes, needle nose; (G) collateral pressure flakes, triangular; (H) tranchet, assymetrical; Row 3, Base shape: (I) pressure thinning; (J) fluting; (K) pressure retouch.
5.6 Use-Wear/Functional Analysis

Young et al. (1994) refer to use-wear analysis as micro-analysis. Micro-analysis "concentrates on the study of edge-damage (micro-flakes and crushed areas), straie, and polishes on artifact surfaces and the processes whereby these phenomena are created" (Young et al. 1994:210). Experimentation has been the predominate means of deriving use-wear information from stone tools (cf. Keeley 1980; Keeley and Newcomer 1977; Odell and Odell-Vereecken 1980; Tringham et al. 1974). Other, more comprehensive, reviews of use-wear have also been provided (Hayden 1979).

As noted by Odell and Odell-Vereecken (1980), use-wear studies generally fall within two categories: high-power and low-power. More recently, the development of scanning electron microscopy (SEM) can provide potentially greater information than either of the above approaches. The high-power approach involves the examination of the artifacts at magnifications generally greater than 100X and up to 400X (Keeley and Newcomer 1977; Odell and Odell-Vereecken 1980). While this method may "offer the potential of rendering specific information on the functions of stone implements", the use of more than one microscope, monetary expense, and time consuming analysis are criticisms of this approach (Odell and Odell-Vereecken 1980:88-89).

Alternatively, the low-power approach provides information nearly as accurate as the high-power approach without the drawbacks (Odell and Odell-Vereecken 1980:89). The low-power approach involves analysis generally within the 10X-40X range. At this level of magnification, the most common type of use-modification observed is scarring along the edges Due to limits of funding and microscope availability, the low-power approach was utilized in examining the Anzick assemblage. All artifacts presently housed at the Montana State Historical Museum were observed under a Wild Heerbrugg M5A stereomicroscope at 25X and 50X. Direct lighting was provided by a 6 v/15 watt lamp. The artifacts were scanned at 25X and all indications of damage were recorded. The same was done at 50X with a greater consideration for areas that exhibited use-wear or damage at 25X. The few specimens at the Center for the Study of the First Americans were not included in this level of analysis because it was felt that a different microscopic system
might provide results not directly comparable to the large sample from the Montana State Museum.

Attributes recorded in the analysis include marginal microflaking scars, rounded edges (polish), and rounded ridges (Table 5.7).

Table 5.7. Use-wear attribute definitions.

<table>
<thead>
<tr>
<th>Attribute Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microflaking:</td>
<td>presence of very minimal microflake scars along margins; usually stepped or termination</td>
</tr>
<tr>
<td>Rounded edges:</td>
<td>presence of polish on lateral margins of artifact</td>
</tr>
<tr>
<td>Location:</td>
<td>the general location of the use-wear, i.e. platform remnant vs. flake detachment edge</td>
</tr>
<tr>
<td>Rounded ridges:</td>
<td>presence of polish or alteration on flake scar ridges on artifact’s ventral or dorsal faces</td>
</tr>
</tbody>
</table>

Microflake scarring is the most common use-wear observed at low-power (Keeley and Newcomer 1977; Odell and Odell-Vereecken 1980). Marginal microflake scarring was recorded as present or absent. Variation in microflaking within the assemblage may reflect differences in manufacture, use, or natural abrasion. Distinguishing between these variables is difficult if not impossible at low-level magnification.

At high-power magnification, Keeley and Newcomer (1977) suggest that the most diagnostic element of use-wear is polish. Low-power magnification also reveals evidence of polish and use. Any indication of polish (edge rounding) and the location on the artifact is noted. Artifacts were compared with each other and a numerical system was developed to indicate the presence and degree of polish. This system presents a subjective indication of the degree of polish from 1 (absence of polish) to 4 (heavy polish). As this system represents a wide spectrum, intervals between numerical values were also recorded in some instances such as 2.5 or 3.5. Although the amount or type of polish present is subjective and relative, the presence or absence of use-modification is established.

Location of use-modification attributes along the artifact margin can indicate the process responsible for its production, either natural or cultural. While specific locations for evidence of use-wear are not provided, whether the modification occurs along platform remnants or flake detachment edges is
distinguished. If use-modification is relegated to platform remnants, grinding of the lateral margin or other form platform preparation could be responsible for the observed edge modification as flake detachment edges would retain their sharper edges. On the other hand, if the lateral margin between platform remnants exhibit use modification, actual use or a newly produced production platform, continuous along the lateral margin, could be inferred. Other lines of evidence such as degree of polish may clarify which process is most likely responsible.

Another attribute that was given consideration was ridge rounding. Ridge rounding refers to the smoothing of flake scar ridges on either face of an artifact due to rubbing against a hide bag or pouch or each other (R. Bonnichsen, pers. communication). This attribute could indicate if the assemblage has been transported, i.e. manufactured prior to deposition. Ridge rounding was also noted as present or absent.

The attributes defined above are significant indicators of use. Determining the processes responsible for variation in the above attributes is important as not all use-wear indicators are produced by cultural means. Natural or arbitrary processes can mimic actual use-wear. Comparisons of use-wear attributes by raw material and artifact class are also made. Patterns of variation in use-wear attributes by raw material or class suggest attributes were produced in a systematic manner and not the result of natural or arbitrary causes. Patterning along raw material, class, or other lines supports interpretations of cultural processes responsible for the presence of use-wear indicators.

5.7 Comparative Content Analysis

Inherent to the quarry/lithic reduction and toolkit hypotheses is the implication that certain artifact types can be expected to be present in an assemblage. If either of these hypotheses are to be accepted as a plausible interpretation of these assemblages, demonstrating that these artifact types are present in all assemblages is necessary. The lack of similarities or patterns in assemblage contents would require that each assemblage be interpreted separately. While the contents of the Drake, Fenn, Simon, and East Wenatchee assemblages have already been summarized, comparisons with the Anzick assemblage are made in chapter 11 prior to offering final conclusions.
5.8 Bone Implements

The bone implement analysis is concerned with documenting the total number of artifacts in this class and exploring various manufacturing and functional interpretations are explored. Two complete specimens from the Anzick assemblage and functional aspects have been discussed previously (Lahren and Bonnichsen 1974).

A number of metric and qualitative attributes are recorded for the Anzick bone implements. Table 5.8 defines the metric attributes recorded and Figure 5.7 illustrates these attributes. The letter for each attribute in Table 5.8 corresponds to the same letter in Figure 5.7. The Anzick specimens are compared with similar bone objects from other Paleoindian sites.
Table 5.8. Bone tool attribute definitions.

<table>
<thead>
<tr>
<th>Attribute Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. <strong>Maximum Length</strong> (ML): Maximum length of implement.</td>
</tr>
<tr>
<td>B. <strong>Maximum Width</strong> (MW): Maximum width of implement.</td>
</tr>
<tr>
<td>C. <strong>Maximum thickness</strong> (MT): Maximum thickness of implement</td>
</tr>
<tr>
<td>D. <strong>Proximal Bevel Length</strong> (PBL): length of beveled end near analyst</td>
</tr>
<tr>
<td>E. <strong>Mid-Proximal Bevel Width</strong> (MPBW): width of proximal bevel at midpoint of bevel length</td>
</tr>
<tr>
<td>F. <strong>Mid-Proximal Bevel Thickness</strong> (MPBT): thickness of proximal bevel at midpoint of bevel length</td>
</tr>
<tr>
<td>G. <strong>Proximal Bevel Angle</strong> (PBA): the angle of proximal bevel</td>
</tr>
<tr>
<td>H. <strong>Pre-Proximal Bevel Width</strong> (PPBW): width of implement at proximal bevel and shaft junction</td>
</tr>
<tr>
<td>I. <strong>Pre-Proximal Thickness</strong> (PPT): thickness of implement at proximal bevel and shaft junction</td>
</tr>
<tr>
<td>J. <strong>1/3 Shaft Thickness</strong> (1/3T): thickness of shaft one-third of length from proximal end</td>
</tr>
<tr>
<td>K. <strong>1/3 Shaft Width</strong> (1/3W): width of shaft one-third of length from proximal end</td>
</tr>
<tr>
<td>L. <strong>1/2 Shaft Thickness</strong> (1/2T): thickness of shaft at half of total length</td>
</tr>
<tr>
<td>M. <strong>1/2 Shaft Width</strong> (1/2W): width of shaft at half of total length</td>
</tr>
<tr>
<td>N. <strong>2/3 Shaft Thickness</strong> (2/3T): thickness of shaft at two-thirds of length from proximal end</td>
</tr>
<tr>
<td>O. <strong>2/3 Shaft Width</strong>: (2/3W): width of shaft at two-thirds of length from proximal end</td>
</tr>
<tr>
<td>P. <strong>Pre-Distal Bevel Width</strong> (PDBW): width of shaft at junction with distal bevel</td>
</tr>
<tr>
<td>Q. <strong>Pre-Distal Bevel Thickness</strong> (PDBT): thickness of shaft at junction with distal bevel</td>
</tr>
<tr>
<td>R. <strong>Distal Bevel Length</strong> (DBL): length of bevel away from analyst</td>
</tr>
<tr>
<td>S. <strong>Mid-Distal Bevel Width</strong> (MDBW): width of distal bevel at midpoint of distal bevel length</td>
</tr>
<tr>
<td>T. <strong>Mid-Distal Bevel Thickness</strong> (MDBT): thickness of distal bevel at midpoint of distal bevel length</td>
</tr>
<tr>
<td>U. <strong>Distal Bevel Angle</strong> (DBA): the angle of distal bevel</td>
</tr>
</tbody>
</table>
Figure 5.7. Bone implement attributes (see Table 5.8 for corresponding letter).
5.9 Economic and Adaptive Strategies

The emphasis in the previous discussion has been upon the development of a wholistic, comprehensive analysis of the technological organization of the Anzick assemblage. Each level of the analyses discussed above provides patterned data that are employed in testing the implications of a number of hypotheses. However, the view of the technological organization of the Anzick assemblage derived as a result of these analyses may be utilized in an additional manner. Incorporation of the view of the Anzick assemblage technological organization within existing views of Paleoindian economy is discussed below.

In recent years lithic analyses of Paleoindian assemblages have been concerned with issues of economic adaptations and raw material use (cf. Bonnichsen and Turnmire 1991; Tankersley and Isaac 1990; Ellis and Lothrop 1989; Montet-White and Holen 1991). As a result of these studies, a number of models used to infer Paleoindian economic adaptations have been developed. Data generated from the Anzick assemblage as a result of the analyses outlined here are compared to these models of Paleoindian economic adaptations. Inferences concerning the economic adaptations of Clovis hunters in the Northern Plains are provided in the conclusions.
Chapter 6: Lithic Raw Material Analysis

6.1 Introduction

An analysis of the lithic raw materials was undertaken at the Montana State Historical Museum in order to address two primary objectives. The initial objective was to determine the types of raw materials within the assemblage and provide descriptions for each type. The second objective was to identify raw material sources. These data are important for an understanding of the relationships of site assemblages to the raw material source(s) that provide insights into the cultural dynamics responsible for the procurement and utilization of that material (Reher 1991:252).

6.2 Raw Material Types

One hundred and two artifacts were analyzed in the raw material analysis. Four raw material types can be defined through macroscopic inspection of the Anzick assemblage. The total assemblage composition by artifact class and the raw material type are presented in Table 6.1. Descriptions of each material type defined in this study are presented below.

6.2.1 Chalcedony

Chalcedony is the predominant raw material in the assemblage represented by 66.6% (n=68) of the total lithic artifacts in the assemblage (see Table 6.1). This raw material is variable in color and other characteristics. Three primary variations of chalcedony are present in the assemblage. However, these three chalcedony variations can be traced to a single source. A single artifact, biface #42, exhibits all three variations in a manner suggestive of overlying bands or veins. Nevertheless, the majority of artifacts in the assemblage are represented by a single variation type. Dendritic patterns or bands of various shades are present in some specimens and recorded as the secondary color. Each variation is described in greater detail below.
These variations appear to have been deposited as veins overlaying one another. Each can be classified according to color, texture, and luster differences: (1) light yellowish-brown (10YR N6/0) to dark reddish-brown (5YR 3/3) material with a dull to earthy luster; (2) grey (2.5Y N6/0) to dark red (2.5YR 3/2) or purple (5P 2/2) material with an earthy-waxy luster; and (3) olive (2.5Y 5/4) to grey (2.5Y N4/0) material with a distinctive waxy luster. The first of these variations exhibits primarily a gradation in color with little secondary patterning in representative specimens. Only biface #77 exhibits longitudinal banding. The second variation is highly variable in color and patterns in the form of longitudinal bands are predominant. The third variation tends to be very waxy in appearance with dendritic strands or speckled patterns prevalent. Distinct boundaries between these variations are difficult to determine because attributes tend to gradate between “borderline” specimens. Because these three variations are from a single source, they are not meant to represent specific types. Further classification by raw material for artifacts manufactured from one of these three variations is not required.

Artifact classes represented by the chalcedony raw material type include projectile points (n=5, 62.5%), bifaces and bifacial fragments (n=53, 63.8%), unifaces (n=4, 100%), flake tools (n=3, 100%), and flakes (n=3, 100%). Chalcedony is the dominant raw material for two classes (projectile points and bifaces) and the sole raw material represented in the remaining classes (unifaces, flake tools, flakes).
6.2.2 Agate

The next most represented raw material is an agate with considerably less variability than the chalcedony. This material represents 31.4% (n=32) of the total artifacts in the lithic assemblage. Projectile points (n=2, 6.6%) and bifaces (n=30, 93.4%) are represented in moss agate material type. Color ranges from white to light gray (10YR5/6-10YR8/2; 7.5YRN7/0-7.7YN7/0; 2.5Y5/4-2.5YN7/0). Luster is opaque to translucent and very fine-grain in texture. The majority of the specimens exhibit dark green to black "mossy" inclusions typical of moss agate. Another significant attribute of this material type is that nearly all of the specimens have some amount of cortex remaining on the artifact surface (n=31, 96.7%). The cortex may cover a significant amount of the artifact's surface or occur only as minute inclusions. The only artifact made out of this material definitely without cortex is biface #106, which also is not translucent or opaque. The similarities in all the attributes allows this material to be easily typed as a single material.

6.2.3 Others

The remaining types of raw materials represented in the lithic assemblage are briefly described here. A very fine-grain maroon material in the projectile point assemblage has been identified as Phosphoria chert (cf. Francis 1991). A gray, fine-grain material is represented in the biface assemblage and identified as porcellanite (cf. Francis 1991, Fredlund 1976). Each artifact manufactured from these materials will be discussed in the representative artifact class chapter.

6.3 Raw Material Composition of the Lithic Assemblage

Figure 6.1 illustrates the raw material percentage composition of the Anzick assemblage. The dominance of chalcedony in the assemblage is obvious as is the importance of agate. A dramatic fall-off is evident in the use of other raw material types. Figure 6.2 illustrates the raw material composition by artifact class.
Figure 6.1. Raw material composition of the Anzick assemblage by percentages.

Figure 6.2. Raw material composition of the Anzick assemblage by artifact class.
The predominance of chalcedony in the assemblage as a whole and also being the only representative material in specific functional and technological classes is indicative of differential use patterns of this material. Although the sample size is very small, the unifaces and flake tools suggest that chalcedony utilization may reflect raw material preferences for specific functions. The prevalence of bifaces in the assemblage however suggests that biface function may outweigh uniface and flake tool function and the presence of both agate and chalcedony bifaces in the assemblage requires an alternate explanation for raw material utilization patterns.

Like the indications of the chalcedony utilization patterns, the moss agate material provides suggestions to significant differential use. The presence of cortex on nearly the entire moss agate assemblage and complete absence from the chalcedony assemblage is intriguing. The significant variation in cortex presence vs. absence between artifact groups manufactured from each of these raw materials suggests that differences in geological context may be reflected in the raw material utilization patterns of the assemblage as whole. The importance of geological context of raw materials in the study of technological organization and lithic production has been recently noted by Andrefsky (1994, 1994a). In his studies, Andrefsky (1994, 1994a) notes that raw material size, shape, quality, and availability influence the decision making process of the craftsman. Cortex absence/presence may be an indication of the variables in the raw material variables listed above in Andrefsky’s studies. Different raw material utilization patterns may evolve from different geological occurrences of raw materials (Andrefsky 1994).

6.4 Raw Material Sources

Identification of lithic raw material sources in Montana and the Northwestern Plains is only in the beginning stages (D. Schwab, pers. comm., 1993). Similarities in raw material types throughout the Northwestern Plains make the identification and correlation of artifacts with sources difficult due to the lack of systematic study (cf. Frison 1982b). As noted by Frison (1982b:173) and Francis (1991), the variation evident in raw material types from single sources in the Northwestern Plains can be extreme. The identification of 74 varieties of chalcedony from the Mammoth Meadow I quarry site (Douglas 1991) exemplifies this point. As stated by Reher (1991), “Analysis of western plains lithic technology ultimately
depends on an understanding of the quarries where the regional dynamics of procurement and utilization was initiated. The analysis of site assemblages, the other end of the system, will remain highly informative but incomplete without such an understanding.” However, determination of raw material sources is important in addressing questions such as “what lithic procurement activities occurred in specific geological levels and/or workshop floors? How did lithic procurement activities change through time? How are these changes related to regional cultural interaction and/or climatic change?” (Bonnichsen et al. 1992).

Tentative identification of raw material sources in the Anzick assemblage may be possible from a number of published sources. Francis (1991) summarizes the geoarchaeology associated with numerous lithic raw material sources of the Northwestern Plains. Fredlund (1976) provides information concerning the distribution of porcellanite in eastern Montana. Lahren and Bonnichsen (1971) also describe sources of high-quality lithic raw material near the Anzick locale.

Conclusive identification of a chalcedony source is not presently available. R. Bonnichsen (pers. comm., 1996) has recently suggested that the Hartville Uplift formation may be the source for the chalcedony raw material. Comparison to known samples from outcrops of this source formation may indicate the potential of this formation as the source.

A formation located to the north of the Anzick site is known as the Moss Agate syncline (see Figure 4.1). Moss agate quarries do occur along this geological feature (Bonnichsen, pers. comm., 1993). Once again, whether this is the source of the moss agate raw material in the Anzick assemblage is uncertain. Other moss agate sources have been reported from Eocene, Oligocene, Miocene formations in Southwest Wyoming where this material was heavily utilized (Francis 1991). Davis et al. (1987) report moss agates from the Indian Creek site in the northern Rockies of west-central Montana. Conclusive correlation of sources and assemblage materials through methods such as thin-section petrography or trace-element analysis is required prior to assigning either the agate or chalcedony to a specific source.

The single specimen of porcellanite is most likely derived from sources located to the west of the Anzick site in the Powder River Basin of the Fort Union Formation (Fredlund 1976; Francis 1991). Projectile point #69 is manufactured from Phosphoria chert derived from sources located in the Bighorn Mountains (Francis 1991) to the southeast of the Anzick site. These sources are over 200 and 100 miles,
respectively, direct distance from the Anzick site (Figure 6.4). Disparities in the frequencies of raw material types present in an assemblage have been frequently used to infer means of raw material procurement and settlement mobility (Andrefsky 1991; Binford 1979; Boldurian 1991; Hofman 1991; Meltzer 1984-1985; Tankersley 1989, 1990, 1991). Inferences of these models of Paleoindian economic patterns are discussed in chapter 11 in conjunction with the remaining levels of analysis.

6.5 Summary

Four lithic raw material types are present in the Anzick assemblage in various quantities. A chalcedony present as three variation types comprises the bulk of the assemblage. Less variable is a moss agate represented in only the projectile point and biface classes. Artifacts manufactured from Phosphoria, a projectile point, and porcellanite, a biface, are also present in the assemblage. The use of certain raw materials for artifact classes is evident. Variation in geological occurrence of raw material types is suggested as a possible interpretation for this pattern rather than evidence for preferential use in functional artifact classes.
Figure 6.3. Approximate source areas for Phosphoria chert and Porcellanite (locations after Fredlund 1976; Francis 1991; base map after Davis 1993).
Chapter 7: Projectile Points

7.1 Introduction

Eight projectile points are present in the Anzick assemblage. Seven of these are complete or nearly so and one is represented by the distal tip. These artifacts are illustrated in Appendix A.

Abbreviations for artifact production codes have been previously defined in chapter 5 (see Table 5.4). The results of each level of analysis are provided below followed by a brief summary.

7.2 Raw Material Analysis

Raw material attributes for the projectile point class are presented in Table 7.1. Three raw material types are present in this class. Chalcedony is the predominant raw material of this subclass with 63% (n=5) of the projectile points manufactured from this material. Moss agate represents 25% (n=2) of the class. Finally, a single projectile point (12%) is knapped from a fine-grain, maroon color material identified as Phosphoria chert. In the previous chapter, it was established that the source of Phosphoria chert approximately 100 miles to the southeast in the Bighorn Basin of northern Wyoming/southern Montana. Implications concerning procurement of non-local raw material and group mobility are discussed in chapter 11.

<table>
<thead>
<tr>
<th>Artifact #</th>
<th>Raw material</th>
<th>Primary Color</th>
<th>Secondary Color</th>
<th>Luster</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>agate</td>
<td>2.5Y N7/0</td>
<td>10R 2.5/1</td>
<td>translucent</td>
</tr>
<tr>
<td>25</td>
<td>chalcedony</td>
<td>10YR 5/8</td>
<td>10R 2.5/1</td>
<td>earthy</td>
</tr>
<tr>
<td>36</td>
<td>chalcedony</td>
<td>2.5Y 5/2</td>
<td>2.5Y N3/0</td>
<td>waxy</td>
</tr>
<tr>
<td>68</td>
<td>chalcedony</td>
<td>10YR 5/6</td>
<td>10R 3/1</td>
<td>earthy</td>
</tr>
<tr>
<td>69</td>
<td>Phosphoria</td>
<td>10R 3/2</td>
<td></td>
<td>waxy</td>
</tr>
<tr>
<td>70</td>
<td>agate</td>
<td>2.5Y N7/0</td>
<td></td>
<td>translucent</td>
</tr>
<tr>
<td>82</td>
<td>chalcedony</td>
<td>7.5YR N5/0</td>
<td>2.5Y 7/2</td>
<td>waxy</td>
</tr>
<tr>
<td>83</td>
<td>chalcedony</td>
<td>5YR 3/2</td>
<td></td>
<td>earthy</td>
</tr>
</tbody>
</table>

Table 7.1. Munsell color designations and luster of Anzick projectile points.
Secondary color patterns are evident on four artifacts of the total number. The secondary color patterning of point #25 reflects gradation of color rather than a distinct pattern. Projectile points #36 and #68 exhibit speckles and dendritic patterns in secondary coloration, respectively. Longitudinal banding is present on point #82.

7.3 Shape Analysis

Data on eight attribute measurements were recorded for the projectile point class. These attributes include maximum length; distal, mid, and proximal width; thickness at mid-length; basal depth; and number and length of flutes. All available information was recorded for each specimen. Table 7.2 presents attributes by individual specimen and Table 7.3 provides ranges and means for the total sample.

As demonstrated by the large range, maximum length is the most variable attribute. The longest point in the assemblage, #82, is manufactured on a blade or blade-like flake while the shortest, #25, is manufactured on a small flake blank. The tip of #36 is broken just short of the lateral margin convergence. This probably does not significantly affect group length mean or range. Point #69 is heavily re-worked preventing determination of the original length. Given the difference in length between #’s 25 and 82 and greater similarity in maximum length measurements of the remaining points, it is evident that parent blanks of various size were utilized to produce the points in the sample. As would be expected, the data initially suggests that unresharpened point length is a reflection of original blank length, i.e. longer points were made from longer blanks.

All width measurements are less variable than length. The broken distal tip of point #36 obviously biases the distal width range as shown in Table 7.3. The extensive resharpening of #69 once again has impacted this attribute relative to the other points. If these two specimens are removed from the sample, the range is somewhat smaller (16 mm-11.5 mm; mean = 13.4 mm) and more accurately reflects the mean of the group (13.8 mm). The narrow range for this attribute hints that maintenance of a certain distal width independent of other attributes probably was important for easy penetration of animal skin and hide. Alternatively, mid and proximal width ranges and means appear to be more strongly related. With the exception of #25, the difference between these two attributes for any specimen does not vary more than a
Table 7.2. Anzick projectile point attribute measurements.

<table>
<thead>
<tr>
<th>Point #</th>
<th>material</th>
<th>ML</th>
<th>MW</th>
<th>DW</th>
<th>PW</th>
<th>TH</th>
<th>BD</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>agate</td>
<td>93</td>
<td>30.5</td>
<td>14</td>
<td>30</td>
<td>7.1</td>
<td>1</td>
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<tr>
<td>25</td>
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<td>5.3</td>
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<td>chal.</td>
<td>69</td>
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<tr>
<td>70</td>
<td>agate</td>
<td>77</td>
<td>26</td>
<td>11.5</td>
<td>25</td>
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</tr>
<tr>
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<td>151</td>
<td>39</td>
<td>14</td>
<td>38</td>
<td>8.9</td>
<td>&lt;1</td>
</tr>
<tr>
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<td>chal.</td>
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<td>NA</td>
<td>12</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

1 right proximal corner broken
2 very distal tip broken

Table 7.3. Ranges and means of Anzick projectile point attribute measurements.

<table>
<thead>
<tr>
<th>Point #</th>
<th>material</th>
<th>ML (range)</th>
<th>MW (mean)</th>
<th>DW (range)</th>
<th>PW (mean)</th>
<th>TH (range)</th>
<th>BD (mean)</th>
<th>FL (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>agate</td>
<td>151-65</td>
<td>36-26</td>
<td>21.5-10</td>
<td>38-24</td>
<td>8.9-5.3</td>
<td>3-&lt;1</td>
<td>49-12</td>
</tr>
<tr>
<td>25</td>
<td>chal.</td>
<td>92.5</td>
<td>31.8</td>
<td>13.8</td>
<td>30</td>
<td>6.75</td>
<td>1.5</td>
<td>231</td>
</tr>
</tbody>
</table>

1 all flutes, ventral and dorsal, averaged

Table key: ML (maximum length); MW (mid width); DW (distal width); PW (proximal width); TH (thickness); BD (basal depth); # Fl (number of flutes); FL (flute length)
single millimeter. Maintenance of a certain width in the proximal half of the point regardless of length was necessary for hafting of the point. For example, point #69 retains a hafting width similar to the other points despite its shorter length. Resharpening of the point while hafted would leave the proximal portion unaffected by length reduction. While a tendency for longer points to have larger mid and proximal width measurements is evident, width of the hafting area may reflect the parent blank size rather than the unresharpened length of the projectile point.

Thickness at mid-length also varies little within the sample. Once again, variation in this attribute appears to be related to parent blank size. Point #82 with the characteristic triangular cross-section of a blade or flake-blade is thickest at mid-length. The thinnest point, #25, reflects the thin parent flake-blank. The remaining sample is fairly homogenous regardless of length or other attributes. The narrow thickness and haft width range suggest a certain width:thickness ratio was desired by the craftsmen. A 4.7:1 width:thickness ratio is derived from the means of both attributes. This apparently is the optimal width:thickness ratio for projectile point manufacture. Two alternatives of point production were available to the craftsman. Either raw material blanks or flake spalls amenable to bifacial reduction and maintenance of a certain width:thickness ratio could have been selected for point manufacture. Use of flake spalls is attested by projectile point #'s 25 and 82, both of which exhibit remnant detachment surfaces from the parent blank.

Basal depth is important because this attribute has defined fluted point variations such as the Gainey-style fluted point with deep basal concavities (cf. Deller and Ellis 1988; MacDonald 1968; Storck 1991). Variation in basal morphology between regions supports Bonnichsen's (1977) notion of regional Clovis variability. Because of the small measurements, basal depths of less than 1 mm are recorded as <1 in Table 7.2. However, these measurements were counted as 1 in deriving the mean. Other than being slight to non-existent, Basal depths generally are slight to non-existent for the sample. Clovis points recovered in the region near the Anzick site such as those from the Simon assemblage (Titmus and Woods 1991a) compare favorably with the Anzick specimens in this regard. However, other specimens exhibit deeper basal concavities that are not characteristic of the Anzick sample.
Number of flutes per point does not exhibit a large deal of variation while flute length tends to be somewhat more variable. Both faces of each point are generally fluted once with the exception of the dorsal faces of #’s 6 and 25. The dorsal face of #6 has 2 flutes extending almost the same length. Rather than being fluted, #25 has several thinning flakes rather than a true flute on the dorsal surface. Flute length ranges from 49 mm to 12 mm in length for the entire projectile point assemblage. As previously mentioned, point #82 is made on a blade or blade-like flake with a predominant dorsal ridge. This dorsal ridge facilitated the flute removal. The use of a central ridge in fluting points is expressed by Barnes points from the Great Lakes (Deller and Ellis 1992) and Cumberland points in the Southeast (Justice 1987). However, rather than being manufactured on blanks with dorsal ridges, collateral flaking was used to create a ridge on Barnes and Cumberland points (Deller and Ellis 1992:33). With #’s 25 and 82 are removed, flute length range decreases (16-30 mm) although some variability is evident. Flute length does not appear to correlate with point length or other attributes. Differences in flute length are most likely a result of application of different technological attributes and flintknapper fortuity.

In addition to the metric quantification, classification of the projectile point assemblage by shape characteristics is also employed. Groups of points are classified following the shape attributes previously defined in chapter 5. The point assemblage is very similar in morphology, most likely due to similarity in function. However, patterns not immediately recognized become may become apparent when compared with the raw material, technological, or functional attributes. Figure 7.1 illustrates the paradigmatic classification of the point assemblage by artifact section shape.

The paradigmatic classification of the projectile point assemblage by shape does not immediately indicate any distinct patterns within the assemblage. Bases and tips tend to be consistently shaped to a particular template. No particular grouping by raw material is apparent. Blade shape illustrates the greatest number of possibilities. However, the variation between the actual specimens is slight. Given the extralocal source for point #69, resharpening is one obvious source of variation in blade shape. Intra-assemblage similarity in function and requirements such as hafting presupposes a great deal of morphological variation. Technological comparisons are considered below.
Figure 7.1. Paradigmatic classification of the projectile points by shape.

Parent blank or preform type appears to be a source of morphological variation in the point assemblage as shown by point #’s 25 and 82. Despite the differences in length between these points, both exhibit characteristics of the total sample such as maintenance of hafting width, width:thickness ratios, and similar distal widths. Even point #69, which has been extensively resharpened, maintains the hafting width and width:thickness ratio like the other points despite decrease in length during its use-life. This suggests that point maintenance occurred while the point remained hafted. Variation in the raw material geological occurrence does not seem to have played a role in morphological variation in the point assemblage as the points manufactured of different raw materials do not exhibit significant morphological differences.

Resharpening of point #25 is manufactured from non-local stone. The loss of length with use and resharpening over time is suggested for this specimen’s attributes.
7.4 Technological Analysis

Documenting projectile point production has been the subject of several publications concerned with application of the cognitive approach to lithic assemblages (Bonnichsen 1977; Young and Bonnichsen 1984, 1985). A flow diagram of projectile point production in the Anzick assemblage has been previously offered by Young and Bonnichsen (1984; see Figure 7.2). While the model presented in Figure 7.2 is based upon two projectile points, the entire projectile point assemblage is analyzed in this study to better understand the manufacturing technology. The previously developed model by Young and Bonnichsen (1984) is utilized in the present study to aid in identification of production units. Each artifact was analyzed by the frame analysis technique described in chapter 5. Refer to systematics in chapter 5 for abbreviations used in the template attribute charts. The behaviors represented by the framed units are arranged in a flow chart for each artifact.

The frame analysis data provided with each projectile point codesheet are summarized in Table 7.4. This table demonstrates which production units regularly occur together. Different production strategies utilized to manufacture projectile points that incorporate sources of variation such as original blank type or degree of reduction can be generated from the information presented in Table 7.4. The production strategies associated with each artifact section are described following Table 7.4.
Figure 7.2. Anzick projectile point flow diagram (after Young and Bonnichsen 1984).
Table 7.4. Technological coding of Anzick projectile points.

<table>
<thead>
<tr>
<th>Art. #</th>
<th>TP Shap</th>
<th>TP Tech</th>
<th>TP Patt</th>
<th>BL Shap</th>
<th>BL Tech</th>
<th>BL Patt</th>
</tr>
</thead>
<tbody>
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<td>Tr</td>
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<td>PrTh</td>
<td>PrSh</td>
<td>Reth</td>
<td>CoTh</td>
</tr>
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<table>
<thead>
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<tr>
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<td>83</td>
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</tr>
</tbody>
</table>
Discussion of the manufacturing process will begin with the tip section of the projectile points. Tip production appears to represent the least variable aspect of projectile point manufacture. All the projectile points share the same tip shape with the exception of point #36, which has a broken tip. Only two production behaviors are represented in the sample for the tip section. The first production unit, Pressure thinning, is present on six of the eight projectile points. These units generally are oriented so that a $90^\circ$ angle with the lateral margin of the artifact is maintained. The size of these flake scars are often substantial or greater in size and extend beyond the artifact midline. The pressure thinning production units exhibit a collateral thinning pattern with the exception of point #69, which exhibits a resharpened pattern. Point #25 exhibits smaller flake scars that appear to shape the tip rather than thin. Hence, these production units are designated as Pressure Shaping units.

The blade production process tends to exhibit a greater amount of diversity than the tip production. Shape is somewhat more variable as in this section of the artifact as previously discussed. The difference between straight and excurvate blades is very slight and probably is not a significant source of technological variation. The asymmetry of point #69 reflects resharpening as discussed below. Two variable production strategies appear to be represented in the projectile point assemblage. The first of these is represented by two artifacts, #’s 25 and 82, while point #’s 6, 36, 68, 69, and 70 reflect the second strategy.

Point #’s 25 and 82 reflect aspects of the production process that most likely have been erased by subsequent behaviors on the other projectile points. Both #25 and 82 are made on flakes and exhibit remnant scars from the original detachment surface. Edge grinding represented as very minimal to minimal flake scars is present on both of these specimens. This production unit most likely is intended to dull the margin and provides a platform for the following behavior. Pressure thinning truncates the edge grinding flake scars and help thin the artifact. Pressure thinning units are oriented at right angles to the longitudinal margin and exhibit a collateral thinning pattern. The lateral margins of these two points do not exhibit the refining, margin contouring flake scars associated with the other production strategy. Point #82 is further separated from the other points by the presence of very substantial percussion flake scars. The percussion scars extend nearly the length of the dorsal surface while a single percussion flake scar may be present on the ventral surface. The percussion flake scars extend over the midline and do appear to be truncated by
pressure thinning production units originating on the opposite margin. Percussion thinning occurred prior to fluting so the dorsal ridge was somewhat “flattened” when the point was fluted. This suggests that the parent blank of point #82 was a blade with a steep dorsal ridge. Excess material present on the dorsal ridge had to be removed so the flute would adequately thin the hafting area.

Projectile point #’s 6, 36, 68, 69, and 70 may reflect complete projectile points. The evidence of the early behaviors represented in point #’s 25 and 82 such as remnants of the detachment plane and margin grinding most likely have been obliterated by subsequent behaviors in the previous artifact group. Pressure thinning of the blade section is evident on all the specimens as well as refined, margin contouring units. The previous production units thin the points in the same manner exhibited by #’s 25 and 82. All the pressure thinning units are arranged in a collateral thinning pattern with the exception of #69, which is reminiscent of resharpening. The latter production units remove excess material located between negative platform scars and contour the artifact margin. Only projectile point #70 does not appear to clearly exhibit the margin contouring production units.

Final production of the basal section of the projectile points is now described. Concave bases characterize all the points with complete base sections. Compared to blade production, fewer production units are present in the projectile point base sample and are relatively evenly distributed. The four primary behaviors recognized in base production including a pressure shaping behavior, pressure thinning, flute production, and final edge grinding or margin dulling behavior. While not every specimen in the sample may exhibit all four behaviors, the type of parent blank or use patterns may accommodate the variation that is present.

Lateral thinning of the basal margin was the initial behavior in base production. This behavior often occurs in conjunction or as part of the blade thinning of the projectile points. The flake scars exhibit the same general configuration as the blade thinning pressure units. The only point that does not appear to display this behavior, #69, most likely has had evidence of this behavior obliterated by resharpening and use.

A pressure shaping behavior is evident with most of the points by the removal of small flakes from the basal margin parallel to the longitudinal axis of the point. Point #’s 25, 36, and 82 do not exhibit clear
evidence of this behavior. As these production units have been largely obscured by fluting, detailed
attribute descriptions are not possible. However, the locations of these units do provide an indication of the
intended function of this behavior. The removal of small flakes from the basal margin helps to isolate a
platform for flute production and serves as a “guide” to direct the flute down the length of the blade. This
technique of fluting platform isolation has been recognized in numerous Clovis assemblages (cf.
MacDonald 1968; Sanders 1990; Witthoft 1952). The lack of this behavior on the points mentioned above
can be attributed to the flake types utilized in the production of #’s 25 and 82 while fluting may have
“erased” this behavior on point #36.

After an adequate platform had been established, the flute was produced. Different methods of
fluting may have been utilized on opposite faces of each point. Young and Bonnichsen (1984) suggest that
fluting could have been accomplished through either pressure or percussion flaking. A percussion method
is suspected in instances of large arc-shaped ribs extending the length of the flute (Young and Bonnichsen
1984). Wide, expanding flute scars such as these are observed in Figures A.1(A), A.3(B), A.4, A.5(A),
A.6(A), and A.7(A). The long, narrow flute scars as observed in Figures A.1(B), A.3(A), A.5(B), A.6(B),
and A.7(B) suggest an alternate means of production. The flutes on these point faces exhibit long, parallel
margins that appear to terminate in slight step fractures rather than feathered termination as in the previous
percussion flutes. A long, narrow flake scar morphology often is associated with the use of an anvil, chest
crutch, or indirect percussion. Whittaker (1994:238-240) illustrates a flute scar with parallel margins
similar to the flute scars last mentioned. Sanders (1990) recognizes the use of a punch in the production of
the reverse flute (i.e. flute on opposite face with initial flute). Following the removal of the initial flute, a
punch or indirect method of percussion would have been required to accommodate the inability of the thin
point to withstand less controlled percussion methods. A punch would have allowed greater control in
fluting the point and made breakage through a misdirected percussion endeavor would have been
minimized. One point, #25, does not exhibit true fluting. Rather, this point has been basally thinned
through pressure flaking. Given the very thin cross-section of this point, it most likely would have broken if
the craftsman had attempted fluting.
Although it is not always apparent as a separate behavior, margin contouring of the margins may have occurred after fluting as well as before as indicated by Young and Bonnichsen (1984). Because the flute does not intersect with many of the margin contouring units, it is difficult to determine the precise order of these behaviors. A likely scenario would have the prehistoric craftsman continually shaping and contouring the margins of the artifact without restricting this production unit to a single occurrence in the process.

The final behavior in basal production is edge grinding along the lateral margins. Microflaking reflects dulling of the basal and lateral margins with the use of a hard abrader. Grinding the basal lateral margins presumably is for hafting purposes by minimizing the cutting action of the sharp edges of the point with hafting materials.

Figure 7.3 illustrates revised production flowchart for the entire point assemblage. A relatively simple process is suggested for projectile point production. Variation in projectile point technology is most apparent with projectile points near the beginning of their use-lives compared to those exhibiting significant reuse. However, the range of projectile point technology displayed by the assemblage allows a fairly complete production grammar to be defined. Flakes or blades evidently were selected for point production. Points with percussion flake remnants or unmodified surface area have not been laterally thinned to the same extent as the other points or do not exhibit the extensive basal margin dulling characteristic of complete or utilized points. After a suitable flake had been chose, the thin flake margins were ground. This provided a method of initially shaping the artifact as well as setting up platforms for thinning. Continuous platform preparation of the margins is suspected and has been previously noted (Young and Bonnichsen 1984). The lateral blade and basal margins were then thinned with pressure flaking. Series of pressure flakes may overlap earlier sequences and often extend the length of the blade and base. These series of flake scars can be characterized in a parallel, collateral thinning pattern. Following pressure thinning, the space between the negative platform scars were thinned and shaped resulting in a refined point shape and cross-section. Excess material was removed by minimal pressure shaping of the margins. This sequence may have been repeated prior to the producing the tip. The tips were thinned and shaped in much the same manner as the remainder of the artifact. Pressure thinning was utilized for tip production. Like the lateral
Figure 7.3. Revised projectile point production flowchart.
margins, a 90° angle relative to the artifact margin was maintained. Fluting appears to have occurred fairly late in the production process. Small guide "flutes" defined as pressure shaping were commonly employed. Once the general morphology of the point was obtained and platform prepared, flutes were removed from both faces by either method described above. Final margin contouring and lateral grinding concludes the initial production. Resharpening and reuse of projectile points is evident through flake scar patterns that overlap previous sequences and eliminate the symmetry of the artifact. The revised flowchart is very similar to that offered by Young and Bonnichsen (1984). The flowchart presented here elaborates and expands upon the previously developed model.

A final word concerning projectile point production is given. Projectile point production appears to have been focused upon selection of flake blanks. Reduction of large bifaces does not appear to have been a component of the point production process. While any evidence of biface reduction would be removed by the time the artifact reached projectile point size, the Anzick projectile point assemblage does seem to follow a logical procession from blank selection to reuse. To support the flank blank vs. biface supposition, Frison (1991) has noted that many of the large bifaces in the Fenn assemblage would not have been suitable for reduction into projectile points because of their large size. Sanders (1990) also notes a discrepancy between the size of the finished points and late reduction stage bifaces from the Adams site. Many of the large bifaces in the Anzick, Fenn, and other assemblages would have produced flakes suitable for point production, possibly similar in size to point #25. A new look at Clovis biface reduction technology is necessary and possible alternatives to traditional interpretations of Clovis bifaces as point preforms must be sought.

7.5 Use-Wear Analysis

Eight projectile points or projectile point fragments were analyzed according to the methodology outlined in chapter 2. Table 7.5 presents a summary of the results of the use-wear analysis. Ridge rounding was not observed on any of the projectile points. Microflaking, edge rounding, and margin and basal
grinding are present and recorded for the projectile point sample. Length and degree of polish along the projectile point basal margins is also provided. Figure 7.4 illustrates examples of projectile point use-wear discussed in the text.

Table 7.5. Anzick projectile point use-wear analysis.

<table>
<thead>
<tr>
<th>Art. #</th>
<th>Microflaking</th>
<th>Edge Rounding</th>
<th>Ridge Rounding</th>
<th>Basal grinding (L/R)</th>
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</thead>
<tbody>
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<td>n/a</td>
<td>43/38</td>
</tr>
<tr>
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<td>n/a</td>
</tr>
<tr>
<td>36</td>
<td>present</td>
<td>2</td>
<td>n/a</td>
<td>38/24</td>
</tr>
<tr>
<td>68</td>
<td>present</td>
<td>2</td>
<td>n/a</td>
<td>29/33</td>
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<td>69</td>
<td>present</td>
<td>4</td>
<td>n/a</td>
<td>44.5/47</td>
</tr>
<tr>
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<td>present</td>
<td>2.5</td>
<td>n/a</td>
<td>27/23</td>
</tr>
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</tr>
<tr>
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<td>absent</td>
<td>1</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Microflaking was observed on all specimens with the exception of point #83. Microflaking consists of very small, stepped flakes along the lateral margins of the projectile points. Slight microflaking is observed along both margins of point #'s 68 and 70 while microflaking on point #36 is mostly restricted to the right ventral (left dorsal) margin. Irregular projections are noted along both distal margins of #36 as well. Projectile point #69 exhibits slight microflaking on the left ventral margin approximately 20 mm from tip. More extensive microflaking was recorded for point #'s 6, 25, and 82. Point #'s 6 and 25 exhibits microflaking on both margins. Microflaking is also present on point #82 along both margins of the hafting area and distal tip.

Edge rounding or polish is most evident along the hafting areas of the projectile points although the blade margins of selected points also exhibit this attribute. Point #6 exhibits a slight amount of polish on the left margin 16 mm from the tip. Slight polish or dulling was observed along the blade margins of point #'s 36, 68, 70, and 82 in various locations. Edge dulling in these cases appears most evident in the space between negative flake scars. Sharp, irregular projections were noted along the tips of #'s 36, 68, 82, and 83. Irregular projections are not present on point #70, which also displayed a slight amount of polish.
along the margins. Point #70 indicates that removal of irregular projections from the artifact margin occurs along with use and the development of margin polish. No polish or edge rounding was observed for point #25 or #83.

Basal grinding was recorded for all specimens with the exception of #’s 25 and 83. The length of margin grinding along the left and right basal margins of the projectile points is indicated in Table 7.7. The longest point in the sample, #82, exhibits the longest length of margin grinding while #69 has the shortest. Differences in length of grinding between margins varies from specimen to specimen. Only a few millimeters separate the length of grinding of both margin on four specimens (#’s 6, 68, 70, and 82). However, a larger degree of variation in length of margin grinding is evident in #’s 36 and 69. Resharpening could have removed evidence of margin grinding along the lower blade margins of point #69. The reason for the variation in point #36 is unknown or could simply be fortuitous.

The role or function of margin grinding in Clovis projectile points has recently been contested. A traditional interpretation is that grinding of the haft element of the projectile points helped to keep the edges of the point from cutting sinew or other material used to haft the artifact (Young and Bonnichsen 1985). In addressing the function of margin grinding, Titmus and Woods (1991) observed from an assemblage of Clovis points from Idaho that the basal margins were ground almost as often as the lateral margins. In addition to protecting the haft element, margin grinding could also have served to strengthen the projectile point at the juncture between the foreshaft and the point (Titmus and Woods 1991:200). The removal of small irregularities along the point’s margin would have helped strengthen the bond between point and foreshaft and reduced or prevented bend-break stress and grinding the basal margin would have helped reduce impact stress preventing longitudinal breaks (Titmus and Woods 1991:200).

If we are to follow Keeley and Newcomer (1977) that polish is the best evidence for use, then six of the eight projectile points (#’s 6, 36, 68, 69, 70, 82) demonstrate use to varying degrees. All of these points exhibit slight to extensive degrees of polish. There is also a correlation between degree of polish and resharpening. Point #69, which is obviously reaching the end of its use-life and has been extensively resharpened, exhibits the greatest amount of polish and edge rounding along the haft area. Point #70 also displays a correlation between polish and removal of margin irregularities. While specific activities these
Figure 7.4. Clovis point use-wear; a). extensive polish, basal margin #69; b). moderate polish, basal margin #70; c). slight polish, basal margin #25.
points were used in may not be determined at low magnification, it is evident that the projectile points have been utilized. As such, the projectile points are functional tools that most evidently were not produced specifically for mortuary purposes.

7.6 Discussion

The projectile point assemblage provides a substantial amount of information that is summarized here. Three raw material types (chalcedony, agate, and Phosphoria) were utilized in the production of projectile points. All the completed projectile points exhibit very similar morphologies with only slight variations in shape. A single, general production grammar appears to represent the projectile point assemblage although some variation is present between individual production strategies. The range of behaviors present possibly represents what would be expected in the use-life of a projectile point from initial blank selection to use and resharpening. If the entire production grammar is represented within the projectile point assemblage, then alternate interpretations to the “blueprint” of biface and projectile point production suggested by the quarry cache hypothesis must be considered. The use-wear analysis also provides significant information. Of the entire projectile point assemblage, only two specimens did not exhibit any degree of use in possible utilitarian contexts. The likelihood that the projectile point assemblage was produced for specifically for mortuary purposes is greatly diminished. As such, the mortuary hypothesis may not be an adequate interpretation of the Anzick assemblage. The biface assemblage, by far the largest represented class, may provide insight to supplement the information derived from the projectile point assemblage.
Chapter 8: Bifaces

8.1 Introduction

Bifaces comprise the largest class of artifacts in the Anzick assemblage. The biface class of the Anzick assemblage consists of 70 relatively complete specimens that represent 68 minimum individuals. Each of these specimens are illustrated separately in Appendix B. An additional 15 bifacial fragments are also present in the assemblage. Seven of these fragments (#'s 107-113) refit with biface #78. Of the remaining eight fragments (#’s 55-58, 62, 65), two can be conjoined (#55 and 62) although the remainder are too fragmentary to refit with each other or other specimens. A large degree of variation in raw material attributes, size, shape, technology, and function in the biface assemblage is obvious. In-depth, detailed analysis is necessary to reveal patterns within this class. Raw material, shape, technology, and use-wear analysis of this class are presented below in the same manner as in chapter 7. Systematics and methodologies have been previously defined in chapter 5. Refer to this chapter for definitions used in each level of analysis below.

8.2 Raw Material Analysis

A total sample of 84 bifaces were analyzed. The majority of these represent the complete or nearly complete specimens (n=69) while the rest are the fragmentary specimens mentioned above. Like the other lithic artifact classes, raw material analysis is based upon visual observations without the use of additional techniques such as trace element analysis. The shortcomings of subjective definitions of raw material types without verification through objective techniques has been discussed (see chapter 6).

Chalcedony represents the largest group of bifaces (63.1%, n=53). Moss agate represents 35.7% (n=30) of the biface subclass. One biface (#48, 1.2%) is manufactured from porcellanite. If only the specimens used to tabulate minimum number of specimens are considered, slightly different results for raw material percentages are produced. Chalcedony (n=38, 55.1%) still dominates while moss agate (n=30, 43.5%) and porcellanite (n=1, 1.4%) comprise the remainder. Raw material attributes for the bifaces are
presented in Table 8.1 for chalcedony and Table 8.2 for agate and porcellanite. The three chalcedony variations discussed in chapter 6 are indicated in Table 8.1 by a numerical value of 1-3. To reiterate these values, the three chalcedony variations are summarized as follows: (1) brownish with dull-earthy luster; (2) grey to purple with earthy-waxy luster; and (3) olive with waxy luster.

A Munsell soil color chart was utilized to define color for the majority of bifaces in this study at the Montana State Museum. However, the purple color of a number of chalcedony bifaces was not adequately represented by the colors in the Munsell soil color diagram. A Munsell rock color chart did provide a much better representation for these artifacts. It must be noted, however, that the rock color chart was compared to color slides rather than the actual artifacts. Those artifacts described by the rock color chart are marked by an asterisk (*) in Table 8.1.

Natural coloration patterns occur in many of the chalcedony bifaces of the Anzick assemblage. The selection of materials with banding into Clovis lithic artifacts has been recognized (Haynes 1980). Incorporation of color patterning into the production of tools has provided insight into distinguishing Paleoindian lithic material from later cultural remains and also the specific reduction techniques employed (cf. Deller and Ellis 1992). Banding is the most characteristic pattern of the biface materials. Bands are oriented in a general longitudinal direction from the tip to the base. The color of these bands are generally lighter in shade than the primary color and vary in width from nearly microscopic to fairly wide. A wide range of colors are represented in the specimens with numerous bands. It has not been possible to make Munsell color designations for each of the individual bands. One of the most striking color patterns is displayed by biface #77. This artifact exhibits alternating red and yellow bands from tip to base. However, the faces contrast so that one face is dominated by red bands and the opposite by yellow bands.

Other significant coloration patterns include dendritic strands or gradual gradients in color change. These coloration patterns are less indicative of specific patterns of raw material use. Nevertheless, these coloration patterns are further characteristic of the variation in the chalcedony raw material type.

The moss agate bifaces are much more homogenous in raw material attributes than the chalcedony bifaces. Dark “moss” inclusions are present in numerous specimens as noted in Table 8.2. Of all the
bifaces in this material category, only one (#106) did not exhibit any remnant cortex on the artifact surface.

The presence of cortex on these specimens indicates the selection of nodules for production of moss agate.

Table 8.1. Munsell color designations, luster, and variation type of Anzick chalcedony bifaces.

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<thead>
<tr>
<th>Artifact #</th>
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<th>Patterning</th>
<th>Luster</th>
<th>Variation</th>
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<tr>
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<td></td>
</tr>
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</tr>
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1 See text description
* Munsell rock color chart
Table 8.2. Munsell color designations, luster, and other attributes of Anzick agate bifaces and porcellanite biface #48.

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<th>Artifact #</th>
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<th>moss inclusions</th>
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</tr>
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</tr>
<tr>
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<td>5YR 7/1</td>
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<td>opaque</td>
<td>present</td>
<td>absent</td>
</tr>
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<td>absent</td>
</tr>
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</tbody>
</table>
bifaces. The lack of cortex or weathering rind on the chalcedony bifaces suggests a different geological context of this raw material. Variation in raw material sources as well as geological contexts (cf. Andrefsky 1994) presents implications concerning mobility and technological organization discussed in chapter 11.

8.3 Shape Analysis

The primary goal of the shape analysis involves recognizing stylistic variation represented in the biface class. This is accomplished in two steps. The first step includes comparison of biface metrics by raw material. The definitions of the different metric measurements have been provided in chapter 5.

Comparisons of groups of artifacts by raw material can provide additional insight into raw material use and the influence of raw material upon artifact shape and size. The second step attempts to divide the biface assemblage into units based upon certain shape/size characteristics. Essential to the interpretation of the Anzick assemblage is providing the specific means of recognizing groups or subclasses of bifaces. Previous interpretations have not provided the methodologies utilized to recognize shape variation within the biface class of the Anzick assemblage. The shape analysis conducted in the present study attempts to provide a method for recognizing and quantifying significant variation in the biface assemblage. More meaningful interpretations may be derived in this manner rather than intuitive classification systems. Comparison of bifaces by raw material is presented below followed by discussion of shape/size variation within the biface assemblage beyond raw material types.

Metric measurements of the biface assemblage are provided in Table 8.3. Ranges and means of the metric measurements by raw material follow in Table 8.4. While not all of the bifaces in this class are complete, all possible measurements are given. By the definitions provided in chapter 5, proximal and distal width are not totally dependent upon length. If the tip or the base is broken, then the complete length cannot be provided nor the width of the missing part. However, the width of the remaining end of the biface can be determined. If the proximal and distal sections both are missing, then neither of these two measurements nor length can be determined. Mid-width and thickness at mid-length can not be accurately determined if either the base or tip is missing. Incomplete bifaces are denoted by an asterisk (*) in Table 8.3.
Table 8.3. Anzick biface assemblage metric measurements (all measurements in millimeters).

<table>
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<tr>
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<th>mid-width</th>
<th>proximal width</th>
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<td>194</td>
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<td>94</td>
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<td>13</td>
</tr>
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</table>
Comparisons of biface measurements by raw material type exhibit significant differences in size within the biface assemblage. The chalcedony bifaces are larger in all the measurements than their moss agate counterparts. Two agate bifaces (#'s 33 and 88) are much larger than the other agate bifaces in all measurements. These specimens skew the agate biface sample to appear larger than what the majority of
agate bifaces represent. As shown in Table 8.4, these two specimens do indeed appear to represent aberrant specimens. Conversely, the chalcedony bifaces included in this part of the analysis exhibit a wider range in all the metric measurements.

In order to illustrate that the differences in size in all measurements between the agate and chalcedony bifaces is significant, graphs with the means and standard deviations were developed for each measurements (Figures 8.1-8.5). The mean is plotted as a horizontal tick-mark cross-cutting a line representing the standard deviation. The single porcellanite biface is illustrated in these graphs as well. These graphs clearly illustrate that the chalcedony and agate bifaces do not overlap at a single deviation in any of the measurements. The chalcedony bifaces are larger in all measurements than the moss agate bifaces. However, the most striking aspect of these graphs is the relative difference between the length and thickness measurements of the agate and chalcedony bifaces. While the chalcedony bifaces are significantly longer than their agate counterparts, the former group is only slightly thicker.

Figure 8.1. Means and standard deviations of biface length measurements. Figure 8.2. Means and standard deviations of biface distal width measurements.
Figure 8.3. Means and standard deviations of biface mid-width measurements.

Figure 8.4. Means and standard deviations of biface proximal width measurements.

Figure 8.5. Means and standard deviations of biface thickness measurements.

Coupled with the previous observation that the moss agate and chalcedony were obtained in different geological contexts based upon the presence of cortex and banding, it can be stated with a reasonable degree of certainty that variation in raw material does affect biface size. However, raw material alone cannot account for the variation present in the biface assemblage. The similarity of the porcellanite
biface to the agate bifaces suggests that raw material is not the only factor in biface production. Actual shape, technological, and functional differences must be considered as well. Shape is discussed next.

Actual artifact shape is concern of the second level of this analysis. That significant differences in size by raw material are present in the biface assemblage has been documented. If differences in artifact shape also are determined to some degree by raw material, the shape analysis should reveal patterns of distribution along these lines. If artifact shape exists independently of raw material type, groups of bifaces should not exhibit patterning by raw material.

Isolating groups of bifaces is the purpose of the shape analysis. Whether or not stages of reduction, functional variation, or any other interpretations are accepted, groups of bifaces have to be empirically documented through discrete definitions of certain attributes. In order to define shape groups, scatterplots of ratios of the previously provided metric measurements are generated for the biface assemblage. The scatterplots demonstrate the biface specimens that are most closely related or similar in size. Groups or clusters of bifaces become evident when these ratios are plotted on a graph. A Pearson’s r correlation coefficient test was conducted in order to determine which of the metric measurements are most related (Table 8.5). Table 8.5 indicates that length and the width measurements are highly correlated and that thickness is only weakly correlated with the other measurements. Because thickness is not highly correlated and the fact that variation in thickness between bifaces manufactured from different raw materials does not appear to be significant, thickness will not be considered in the scatterplots. Ratios between all the remaining metric measurements will be plotted as scatterplots.

Table 8.5. Pearson’s correlation coefficients for Anzick biface metric measurements.

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<th>length</th>
<th>distal width</th>
<th>mid-width</th>
<th>proximal width</th>
<th>thickness</th>
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</table>
Goodyear (1995) employs frequency histograms to document shape groups within the Brand site projectile point assemblage. While Goodyear's (1995) methodology is not exactly the same as the use of scatterplots, both methods clearly illustrate which specimens will cluster together. While a certain degree of overlap can be expected between groups, scatterplots do graphically demonstrate the presence of groups or clusters of artifacts. Additional analyses are required to interpret the meaning of these groups or what they actually represent.

Length and width metric ratios result in the most distinct clusters. The length: distal width, length: mid-width, and length: proximal width scatterplots are illustrated in Figures 8.6-8.8, respectively. After graphs initially had been prepared, the length ratios revealed a greater and better defined degree of variation than the scatterplots composed from only width measurements. Six virtually homogenous groups of bifaces can be defined in each graph as well as a consistent number of outliers. The groups produced by each graph are very similar with little intra-group non-conformity when all three graphs are prepared. Table 8.6 lists the specimens for each group by specific scatterplot. This table demonstrates the extent of continuity between the graphs. Groups 1, 2, 4, and 5 exhibit specimens which do not appear in the same group for each scatterplot. Groups 1 and 2 exhibit one and two non-conformities, respectively. Groups 4 and 5 exhibits four aberrant specimens each. The initial results of the scatterplot comparisons does indicate that groups of bifaces are present and can be defined in the assemblage. Each of these groups are discussed in greater detail below.

Table 8.6. Composition and comparison of biface scatterplots.

<table>
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<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
<th>Group 6</th>
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<tr>
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Figure 8.6. Biface Length: Distal Width scatterplot graph (all measurements in mm). Length is the horizontal axis and distal width is on the vertical axis.
Figure 8.7. Biface Length: Mid-width scatterplot diagram (all measurements in mm). Length is the horizontal axis and mid-width is on the vertical axis.
Figure 8.8. Biface Length: Proximal Width scatterplot diagram (all measurements in mm). Length is the horizontal axis and proximal width is on the vertical axis.
The final artifact composition of the six groups and additional outliers are listed in Table 8.7. This table also provides the raw material type and shape forms for the tip, blade, and base. While measurement ratios do indicate groups of bifaces within the assemblage. However, shape also reveals patterns that are not evident through metric ratios. Possible additional groups are discussed by shape.

Group 1 consists of six bifaces manufactured from moss agate. These are the smallest bifaces in the assemblage and least symmetrical in outline. Only one, #96, does not exhibit an asymmetrical component. The most common shared shape element is evident by the base. The bases of these bifaces tend to be straight. While the tip and blade components are highly variable, the presence of straight bases in all but one (#9) is significant and may be indicative of function or reduction technology.

Group 2 is composed of nine agate bifaces. This group of bifaces exhibits measurements only slightly larger than the previous group. A considerable degree of asymmetry is evident in this group. Six of the nine bifaces exhibit at least a single assymmetrical component. Assymetrical components include tips (n=2), blades (n=2), and bases (n=5). Conversely, several of the bifaces have shared shape types. Six of these specimens (#'s 3, 59, 79, 85, 103, 104, 105) exhibit triangular tips and excuvrate blades. Functional implications may be derived from this observation.

Eleven bifaces are present in Group 3. Nine of these are manufactured from agate while porcellanite and chalcedony account for a single biface apiece. A greater deal of symmetry is observed in this group as only four bifaces in this group exhibit assymmetrical shapes. The asymmetrical shapes are limited to tips (#’s 50, 61) and blades (#31, 61, 84). Aside from these particular specimens, this group tends to exhibit triangular distal tips with excuvrate blades and convex to straight bases. The variation in base shape is one of degree rather than type.

Group 4 bifaces include six specimens. Four of these are manufactured from chalcedony and the remaining two are manufactured from agate. The only assymmetrical shape present in the group is the tip of biface #98. This single biface, manufactured from agate, does not conform to the other shape types exhibited in the group. Otherwise, the shape characteristics of this group are homogenous. The bifaces in this group have triangular tips, straight blades, and straight bases. The morphological similarity suggests this group may have shared functional or technological characteristics.
<table>
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<tr>
<th>Group 1</th>
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Table 8.7. Biface group composition, raw material types, and shape types.
Two bifaces in this group (#49, 77) appear closely related and less so with the remaining specimens. While some separation exists between the former two bifaces and the remainder, it is not considered great enough to warrant division into separate groups. The fall-off in agate specimens compared to chalcedony is obvious at this point. The previous assertion that raw material variation should be exhibited between biface groups does seem to be born out.

Group 5 includes 13 specimens, all of which are manufactured from chalcedony with the exception of #71. Only a single constituent of this group, #22, exhibits an asymmetrical shape—in this case the blade. All of this biface group display triangular tips. Variation in blade and base shapes is in degree rather than kind. Blade shapes are evenly distributed between straight (n=6) and excursive (n=6). Base shapes exhibit a similar pattern with convex bases (n=5) and straight bases (n=8) present. A tendency for bifaces in this group with straight blades to be associated with straight bases is recognized (n=5). Bifaces with excursive blades may be associated with either straight (n=3) or convex (n=3) bases. As a whole, this group could be described as elliptical or “tear-dropped” shaped with a high degree of symmetry.

The last formal group to be defined is Group 6. This group consists of nine chalcedony specimens and a single agate specimen. This last specimen, #33, is only marginally included in this group. Triangular tips, straight to slightly excursive blades, straight to convex bases characterize this group. Disregarding #33, the only specimen in this group to exhibit a blade with excursion shape is #12. Base shape exhibits a range from virtually totally straight to more convex in outline. While a range in base shape is evident, the previous contention that variation in base shape reflects degree rather than formal differentiation, at least among the chalcedony bifaces, is emphasized. This group of chalcedony bifaces display more narrow blade widths and longer lengths than the other chalcedony bifaces and groups as a whole. Technological and functional variation may explain the differences in blade morphology.

A number of bifaces are listed in Table 8.7 as outliers. While this biface might not fit into a specific group based upon metric measurements, similarity in shapes does allow an additional group to be defined. Three bifaces in particular reflect similar shapes (#'s 26, 34, 47). Biface #10 exhibits similar ratios except that this biface is uniquely bipointed. Other bifaces are more difficult to relate due to breakage, resharping, or a combination of the two.
To summarize the results of the shape analysis, six formal groups representative of the raw material and morphological variation in the biface assemblage are defined. While the differences between raw materials within the biface assemblage are obvious, explaining variation within the groups dominated a specific raw materials requires additional analysis. Technological and functional implications have been suggested throughout the previous discussion. These two levels of analyses are presented below.

8.4 Technological Analysis

Two goals are offered for the biface technological analysis. First, the technological analysis is aimed at understanding the total various means of production of this artifact class. Determination interpretation of the grammatical structure(s) of the assemblage is encompassed in this goal. Second, it was proposed in chapter 2 that a detailed technological analysis was required to test previous hypotheses of the Anzick assemblage. The technological analysis contributes to determining if stages of projectile point production are represented by the biface assemblage or if the different groups in the assemblage reflect alternative interpretations such as functionally separate tool "types". These questions have to be answered to accurately interpret the function or role of the Anzick assemblage.

In order to answer the questions, a frame analysis was conducted with the biface assemblage. Once each specimen had been analyzed, tables were constructed to provide the behavior/production units identified in the frame analysis. Tables 8.8-8.12 provide the technological data for each of the formal biface groups defined in the shape analysis.

A total of 54 specimens are presented in the tables listed above. Because the outliers do not constitute a "formal" group, these are not presented in a table. However, technological similarities of the outliers with other bifaces are noted. The outliers are also considered in the discussion following presentation of the tables. Intra-group comparisons of technological units present in each group will be discussed first. Following this, patterns for the entire biface assemblage will be discussed.
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Table 8.9. Technological units, Biface Group 2.

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<td>77</td>
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<td></td>
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<td>98</td>
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<td></td>
<td>(op)</td>
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</table>
Table 8.12. Technological units, Biface Group 5.

| Art. # | PrMb | PrSh | PrTh | PrNt | TP  | PrMb | PrSh | PrTh | PrNt | FlkRnt | Bl  | PrSh | PrTh | PrNt | FlkRnt | ThRnt | BS  | PrSh | PrTh | PrNt | FlkRnt |
|--------|------|------|------|------|-----|------|------|------|------|--------|-----|------|------|------|--------|------|-----|------|------|--------|
| 1      | x    | x    | x    |      | x    | x    | x    | x    | x    | x      | x   | x    | x    | x    | x      | x    | x   | x    | x    | x      |
| 2      | x    |      |      |      |      | x    |      |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 4      | x    |      |      |      |      | x    |      |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 13     | x    |      |      |      |      | x    |      |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 14     | x    |      |      |      |      | x    |      |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 15     | x    |      |      |      |      | x    |      |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 22     | x    |      |      |      |      | x    |      |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 28     | x    |      |      |      |      | x    | (op) |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 30     | x    |      |      |      |      | x    |      |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 45     | x    |      |      |      |      | x    |      |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 71     | x    |      |      |      |      | x    |      | (op) |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 90     | x    |      |      |      |      | x    |      |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |
| 91     | x    |      | (op) |      |      | x    |      |      |      |         | x   | x    | x    | x    |         | x    | x   | x    | x    |         |


Table 8.13. Technological units, Biface Group 6.

<table>
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<th>Art. #</th>
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<th>PrTh</th>
<th>PnTh</th>
<th>FlkRnt</th>
<th>TP</th>
<th>PrSh</th>
<th>PrTh</th>
<th>PnTh</th>
<th>FlkRnt</th>
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<td>21</td>
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<td>43</td>
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<td>x</td>
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<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>89</td>
<td>x</td>
<td>x</td>
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</table>
Six specimens are considered in Group 1. Tip and basal production of this group appear to be somewhat random. Few of these bifaces in this group exhibit the same technological units in these sections of the artifacts. Shaping and thinning appear to be the primary behaviors but do not appear in an ordered fashion. The blade technologies do present a more patterned approach to production. Five of the six bifaces exhibit some form of edge preparation. Pressure shaping is the primary behavior form with a single example of margin beveling. An alternative form of edge preparation may be exhibited by biface #35. This alternate edge preparation may actually be present to a greater degree in the agate biface specimens than is evident in Group 1. This will be discussed in greater detail following discussion of the groups dominated by agate specimens. Once the margins had been established, the biface was thinned through percussion thinning. Percussion thinning is not patterned in this group and percussion flake scars are randomly located along the margins. Rather than attempting to produce an evenly thinned artifact, only “thick” areas of the bifaces were thinned through percussion flaking. The general asymmetrical outline of these bifaces reflects the random thinning pattern production. It should be noted that percussion thinning does not always follow pressure shaping.

Group 2 bifaces depart significantly from the patterns revealed in Group 1. While a greater number of types of units are present, the majority of bifaces in this group share many of the same behavior units. All but two of the specimens in this group evince the original flake surface. Whether or not this indicates that production is incomplete is difficult to determine. However, pressure shaping and percussion thinning are the most common technological units present in this group. Like the previous group a pattern of margin shaping, possible intended to establish platforms, is evident. Pressure shaping is the premier behavior in the tip section with evidence of earlier thinning behaviors. Margin beveling and pressure thinning are represented by a single unit each in the tip section. Percussion thinning does not follow shaping, however. The same behaviors are present in the blade section except that percussion thinning is manifested in two different manners. *Outre passe* thinning flakes appear to be deliberately produced along with moderate to substantial thinning flakes. This pattern constitutes the alternative method of platform preparation mentioned above. Likewise, this will be discussed in greater detail following Group 3. In some instances, pressure shaping precedes percussion thinning and in others, shaping follows thinning. Thinning...
as a whole is unpatterned or random. Basal thinning is dominated by percussion thinning with little shaping. Platform and margin preparation are all but absent.

Group 3 bifaces (n=11) reveal similar patterns as Group 2. In the group as a whole, less of the original flake or raw material surface is discernible within this group. This is possibly due to an overall greater degree of reduction or thinning. With the exception of margin beveling, the tip sections are virtually identical. The primary difference lies in a greater emphasis in thinning as well as shaping the tips with the present group. Pressure and percussion thinning are more highly represented than in the previous group. The blade sections of the two groups are very similar as well. Pressure shaping and both *outrè passe* and moderate to substantial percussion thinning are apparent. *Ouatre passe* thinning is even more highly represented at this point than with the previous groups. While the majority of bifaces in this group display the same random thinning pattern as the previous groups, a collateral thinning pattern is obvious with a few specimens, particularly #’s 16, 27, and 86. *Ouatre passe* thinning is not displayed by these latter specimens. The significance of the presence of patterned, collateral thinning is discussed below. Once again, basal production consists primarily of percussion thinning with slightly more margin shaping and a single example of contouring. Shaping in most instances also appears to be an attempt at platform preparation while contouring here may not serve the same purpose. Alternatively, contouring here may be the same as shaping only with a slightly different morphology.

Before discussing the remaining groups, aspects of the agate biface technology require discussion. The alternate method of platform preparation and thinning mentioned above is a unique method of overcoming difficulties or problems with a specific raw material type. First, *outrè passe* flake scars are detectable on 15 of the 26 (57.7%) bifaces in the first three groups. Most of these particular behavior units occur in the blade section although occasional units are present in the tip and base sections. In Chapter 6, the nature of the agate raw material context was discussed. The overwhelming occurrence of cortex was interpreted as evidence of small, irregular nodular parent source for this material. A method for thinning this material was devised that maximized potential raw material. An *outrè passe* flake was removed that also removed part of the opposite margin. In so doing, a steep angle was created on the opposite margin. This steep margin was then employed as a striking platform for additional thinning. The second series of
thinning flakes often were only moderate to substantial or very substantial in size although *outrê passe* flakes on both biface surfaces are evident on a few specimens. Multiple *outrê passe* flakes may be present on a single face as well.

Second, neither a reduction continuum nor stages of reduction are evident with the agate biface groups. In fact, the larger bifaces (Group 3) exhibit a greater degree of thinning and shaping than Groups 1 and 2. Likewise, Group 2 displays a more patterned technology than Group 1. This suggests that larger nodules of agate were preferred for more standardized reduction. Projectile points manufactured from agate are present in the assemblage. The collateral thinning observed on the Group 3 specimens (#'s 16, 27, 86) may indicate that these could be projectile point preforms or were intended for projectile point production.

The remaining groups composed primarily of chalcedony bifaces are now discussed. Group 4 contains the least number of artifacts of any of the groups. Nine different types of technological units are identified in this group. Pressure shaping and percussion thinning are the most commonly observed unit types. Unlike the previous groups, the production process appears to be relatively the same regardless of the particular section of the artifact. As such, the general production process will be described. Original flake remnants are observed on two tips and one blade. The remnants observed on the tips consist of a flat surface at a 90° or slightly less angle relative to the artifact surface. It is suspected that this is an unmodified surface of the original parent blank. This particular characteristic is heavily represented in the following groups and will be discussed in greater detail below. This remnant was utilized as a platform for additional shaping and occasional thinning of the tips. *Outre passe* percussion thinning is present on a couple of tips but does not appear to be intentional. Pressure shaping and at least two examples of margin beveling constitute edge preparation behaviors. Edge preparation occurred along the entire margin as has been previously demonstrated for several of the Anzick artifacts (cf. Bonnichsen 1977). Individual platforms were not prepared for percussion thinning. Substantial to very substantial percussion flake scars were then removed from the margins while maintaining a 90° angle relative to the artifact edge. As a right angle was maintained relative to the edge of the artifact rather than the longitudinal axis, the percussion thinning units on the tips are generally less than 90°. The same edge preparation and thinning process is evident on the basal margins. However, basal thinning flake scars occur on the longitudinal axis, that is
180° from the tip. The basal percussion thinning scars are essentially the same as the blade percussion thinning scars with the exception of the angle of orientation. Percussion thinning, whether occurring on the base or blade, was intended to thin the artifact and is not fluting. However, a behavior process described as margin beveling and fluting is provided for #77. Margin beveling in this instance consists of very marginal flakes not totally unlike pressure shaping. What appears to be a “striking nipple” remnant is also present. Basal thinning of #77 is very similar to projectile point fluting but functionally most likely is not different from basal thinning of the other bifaces.

Percussion thinning in this group seems to be continuous along an entire margin. Once the desired thinning had been accomplished on one face, the opposite margin was thinned. Pressure shaping recurred on the opposite face overlapping previous thinning scars. Percussion thinning remnants are not very common in this group. While it is likely that percussion thinning did progress as a series, direct evidence for this is observed in only a single instance (#49). Pressure thinning is present sporadically with this group.

Biface #77 presents evidence of an interesting and potentially very significant behavior. Not quite halfway down the length of the blade on each margin, notches were deliberately flaked on each margin. A functional implication is proposed for the presence of these and other notches in the biface assemblage. This characteristic will be considered along with the flake remnants on the distal tips in the final discussion below.

Group 5 is comprised of the greatest number of bifaces (n=13). Seven types of technological units are defined in this group. Little technological difference is evident between the different biface sections. Flake remnants along the tips like those described for Group 4 are identified in almost half of this group’s bifaces (n=6). Similar remnants are present on one margin and one base. Pressure shaping and percussion thinning are ubiquitous with these bifaces. Shaping is evident on ten tips, ten blades, and six bases. Margin beveling occurs in at least four instances where shaping appears to be absent. If the artifact already has the desired shape, beveling may replace shaping. Continuous platform preparation is the primary purpose of these two behaviors. Percussion thinning almost always follows either form of platform preparation. Distal
thinning occurs with eight specimens and nine bifaces exhibit basal thinning. All of the bifaces in this group demonstrate blade percussion thinning. These percussion thinning scars primarily represent the first or early series of percussion thinning as evidence of previous thinning units are obvious on only three specimens. Blade percussion thinning scars are oriented at a $90^\circ$ angle relative to the artifact margin. Because most of these artifacts have straight or nearly straight margins, blade thinning units are at a right angle relative to the longitudinal axis. Basal thinning, however, may vary from $90^\circ$ to $180^\circ$. The percussion thinning pattern almost always constitutes a collateral parallel thinning sequence. Biface #45 is a particularly good example of the sequence of platform preparation and collateral percussion thinning. The absence of percussion thinning units on the dorsal surface has not obliterated the pressure shaping units used to establish striking platform for percussion thinning on the ventral surface.

Pressure thinning is not a common technological unit in this group. Its occurrence does require additional discussion. When pressure thinning is present in the blade section, it was utilized to trim the margins and thin or remove extensive flake scar ridges. Pressure thinning occasionally is employed to thin the basal section in lieu of or along with percussion thinning.

The final group to be discussed is Group 6 comprised of ten specimens. Five specific types of technological units are identified in this group. Flake remnants are present on the tips of three specimens and the blade of a single biface. Pressure shaping is common, albeit less pervasive than with Group 5. This is not intended to mean that no platform preparation was conducted. It is more likely that evidence of this specific behavior has been lost due to subsequent behaviors. Percussion thinning is recognized on eight of the ten tips and all the blades. Where percussion thinning does not occur on the tip, either pressure shaping or pressure thinning is the primary production unit. When percussion and pressure thinning occur together on the tips, pressure follows percussion. Percussion thinning infrequently occurs alone on the tips. Blade thinning is similar to tip production and can be characterized in the following manner. Percussion thinning follows pressure shaping as in Group 5. Multiple series of percussion thinning flakes are also evident. An initial series of large substantial to very substantial flakes were removed. Examples of these thinning scars are obvious with the ventral of #12, 42, 43, and 89. Substantial to very substantial thinning scars left after flaking were removed by a more refined series of percussion flake scars. Biface #’s 72 and 73 offer
examples of this series of percussion thinning flake scars. Biface #21 also exhibits a series or refined percussion thinning similar to the latter bifaces. Original surface is present on the ventral of this artifact indicating that refined percussion flaking does not necessarily always follow the early series of substantial to very substantial thinning.

Pressure thinning is present on many of the biface blades in Group 6 (n=7; 70%). However, the nature of pressure thinning is variable. Pressure thinning is restricted to areas of flake scar ridges with the bifaces characterized by the substantial to very substantial percussion thinning. Biface #42 is an example of this behavioral pattern. The same is true of the bifaces with the series of more refined, smaller percussion flake scars although the pressure flaking does appear to be more pervasive due to the greater number or percussion flake scars. The greater degree of refinement is observed with biface #72. Two bifaces, #’s 41 and 44, exhibit the greatest degree of pressure thinning and thinning. Extensive series of pressure thinning flakes were removed along the margins of these two artifacts. The lack of pressure shaping compared to the previous groups was mentioned above. The prevalence of pressure thinning in this group can account for this observation. Pressure thinning and refinement of the artifact margins has removed much of the traces of pressure shaping, especially with specimens such as #41 and 44.

Base production with this group follows the same pattern as previous groups with platform preparation through pressure shaping or beveling followed by percussion thinning. Pressure thinning is not a common element of the base production. This implies that maintenance of blade margins was of primary importance with less emphasis on base production. These differences in tip, blade, and base production insinuate functional interpretations that differ from more traditional interpretations such as projectile point production. The discussion below will expound upon alternative interpretations of the biface assemblage in conjunction with the other levels of analysis. A summary of the chalcedony biface production is provided below along with comparisons to other technological studies.

The chalcedony biface production technology appears to be much more standardized than the agate biface production. Less intergroup variation in production is evident with the exception of the more extensive blade and tip refinement observed in Group 6. The technology can be described as follows. Continuous platform preparation of the artifact margins in the form of pressure shaping and beveling can be
determined. Individual platforms do not appear to have been produced for subsequent percussion flaking with few possible exceptions such as the base of #77. Platform preparation such as this does not always occur on the tips. Original flake surface appears to have been intentionally retained as many of the chalcedony bifaces exhibit this characteristic. This tendency is manifested to the greatest extent with Group 5 although it is expressed in Groups 4 and 6 as well. This characteristic contrasts to the refinement of the blade sections of many of the bifaces. Original flake scar or parent material surface is observed in the blade or base section. Once again, alternative interpretations may account for the specific occurrence of this characteristic in the distal sections.

Once the desired platforms had been produced, percussion thinning preceded. Percussion flake scars were generally maintained at a $90^\circ$ relative to the artifact margin and extended well over the midline, often approaching the opposite margin. An entire margin or large portion was thinned before proceeding to the opposite margin resulting in a parallel, collateral sequence. Many of the large "outliers" such as #'s 34, 47, and 78 exemplify this patterned sequence of flake scars. A few specimens (#'s 5/29, 10) display a more random pattern. The base sections may exhibit a single or occasionally double flake scar extending up the length of the longitudinal axis or the collateral sequence extended the length of the longitudinal margins to the base while maintaining a $90^\circ$ angle. Unlike the agate bifaces, overshot terminations or _ou tre passe_ scars appear to be unintentional or accidental.

Following the initial series of thinning flakes, more refined percussion flaking thinned the biface to a greater degree. In much the same manner as the original series of thinning scars, this series occurs along an entire margin. The number of percussion thinning scar series is unclear. Some bifaces exhibit evidence of multiple series while others such as #21 may only display the last refined series. Regardless, once the desired thickness had been obtained, pressure thinning refined the margins and eliminated the extensive flake scar ridges following percussion thinning. The more extensive series of pressure flake scars may actually reflect resharpening and maintenance of the blade edges rather than additional reduction.

The production process described above is compared to the Clovis production technology of Bradley (1982). The _alternating opposed biface thinning_ of Bradley (1982:207) contrasts with the collateral sequence of thinning observed with many of the bifaces. Others bifaces like those mentioned
above do resemble Bradley's (1982) alternating opposed biface thinning. Platform preparation was repeated with series of flake scars removed from a single margin. As the biface was thinned in cross-section and became narrower in width, the number of percussion flakes in a series increased and became more refined. This refinement in the production strategy is similar to the **opposed diving biface thinning** of Bradley (1982). This level of reduction is much more similar to many of the bifaces in the Anzick assemblage. Bifacial thinning that occurred early in the reduction sequence may be more suited for the artifact at hand with less specific resemblance to other artifacts. As the craftsman reduced the artifact, production is more likely to be more consistent throughout the assemblage. Therefore, differences in technology are more likely to be pronounced prior to the more refined reduction. A greater consistency in technology may emerge as artifacts are reduced into their final or functional state.

Multiple production grammars are evident in the Anzick biface assemblage. The primary differences exist between raw material types. The agate bifaces are less likely to be subsumed under a single grammar than the chalcedony bifaces. Two grammatical structures are suggested for the agate bifaces while a single structure may encompass the chalcedony bifaces. This should not be taken or assumed as a "stage reduction scheme" or projectile point reduction technology for the chalcedony bifaces. It only means that chalcedony biface production is consistent enough between groups that a single flowchart may adequately express the production technology. Other interpretations are suggested for the presence of groups within the chalcedony bifaces and the biface assemblage as a whole. The grammatical structures are illustrated as flowcharts in Figures 8.9 - 8.11. Each of these are summarized below.

The first grammatical structure (Figure 8.9) is to describe the production of the agate bifaces not exhibiting the *outrre passe* thinning method. A somewhat random manner of production is represented in the flowchart. Pressure shaping and percussion thinning are the dominant behaviors with little emphasis upon refinement or maintenance of outline symmetry. Many of the bifaces characterized by this flowchart are in Group 1. Figure 8.10 illustrates the *outrre passe* method. A greater degree of thinning and shaping of the margins does occur with this grammatical structure. Bifaces present in Groups 2 and 3 can be characterized by this flowchart. The final flowchart, Figure 8.11, illustrates the grammatical structure for the chalcedony bifaces. It should be noted that a few of the agate bifaces such as #’s 16, 27, and 86 may be
subsumed under this strategy as well. A more standardized production process for chalcedony bifaces is implied although actual function of the different groups dominated by chalcedony bifaces may vary.

Figure 8.9. Grammatical structure flowchart, Group 1 agate bifaces.
Figure 8.10. *Outre passe* reduction flowchart, Group 2 and 3 and remaining agate bifaces.
8.5 Use-Wear Analysis

Use-wear is of particular concern to this study due to the implications of the presence of previous use or manufacture. If the artifacts had been produced at or just prior to their deposition, no use-wear would be expected to be present. The inference that some form of specialized artifact production, possibly for mortuary practices, may be made. On the other hand, if the artifacts do provide evidence of use-wear,
the assemblage may reflect a functional toolkit and not specialized mortuary behavior. The implications of either hypothesis drastically alters previous interpretations of the role of this and other assemblages in the Clovis cultural system.

A total of 57 bifaces were analyzed for traces of use-wear and edge modification. Several bifaces (#’s 96, 97, 98, 101, 103-106) were not available in Montana at the time of analysis. No attempt was made to analyze these artifacts for two reasons: (1) that the 57 specimens analyzed is a representative sample, and (2) an analysis under a different magnification system may provide different results than that generated by the system used in Montana. Nevertheless, the 57 artifacts sampled here provides a significant amount of information to be synthesized for one class of artifacts. Initially, the bifaces were divided into raw material categories to determine whether artifacts produced from different raw materials exhibited differential amounts of modification (see Tables 8.13 and 8.14). Several differences are apparent when the bifaces are divided along raw material categories. The previous section established that not only can bifaces be divided along raw material lines, but that groups of bifaces are present within each raw material type. Comparison by these groups is also presented.

Microflaking, edge polish, and ridge rounding are the use-wear attributes of concern in this level of analysis. Each of these attributes within the biface assemblage are discussed below. Comparisons between the presence and/or occurrence of these attributes provide information relating to differential use and function.

Microflaking is evident on nearly all specimens of all raw material types analyzed in the sample. Accounting for this propensity of microflaking with the Anzick bifaces presents an analytical problem. As noted above, microflaking may be indicative of manufacturing process as much as use-wear. At the low magnifications utilized in this analysis, recognition of the formation processes of microflakes is not
Table 8.14. Summary of the results of the use-wear analysis of the Anzick agate biface assemblage.

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<th>Rounded Ridges</th>
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</tr>
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<td>9</td>
<td>present</td>
<td>4</td>
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</tr>
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<td>16</td>
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<td>platform remnants, flake detachment edges</td>
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</tr>
<tr>
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<td>platform remnants, flake detachment edges</td>
<td>present</td>
</tr>
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<td>platform remnants, flake detachment edges</td>
<td>present</td>
</tr>
<tr>
<td>27</td>
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Table 8.15. Summary of the results of the use-wear analysis of the Anzick chalcedony bifaces assemblage.

<table>
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<th>Art. #</th>
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<th>Rounded Ridges</th>
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<td>platform remnants, flake detachment edges</td>
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</tr>
<tr>
<td>92/93</td>
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<td>2.5</td>
<td>platform remnants, flake detachment edges</td>
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</tr>
</tbody>
</table>
conclusive. Therefore, position or location of microflakes on the biface margins may be a better means of identifying the formation processes of these attributes. Clues to the formation of microflakes may be provided by the nature of the edge rounding or polish.

Following the ranking system described chapter 5, the agate bifaces (n=22) provide a mean of approximately 2.6. The agate bifaces as a whole exhibit degrees of polish ranging from 2 (light; n=4) to 4 (heavy; n=2) with the remainder (n=16) falling within the 2.5-3.5 range. All platform remnants of the agate bifaces appeared to be ground or polished to some extent. Only three artifacts from this sample exhibit flake detachment edges that do not appear to be ground or exhibit any evidence of use (#’s 33, 35, 85). The remaining 19 specimens exhibit polish and/or grinding along the platform remnants as well as flake detachment edges. As such, all the examined agate bifaces exhibit use-modification, polish or grinding, to one degree or another. Edge rounding or polish may occur as a result of edge grinding during platform preparation. However, the moderate to high mean of 2.6 recorded for the degree of rounded edges (i.e. polish) is a strong indicator of functional use rather than modification resulting from production. Platform preparation with the agate bifaces appears to consist of shaping or use of natural platforms rather than grinding. The functional contexts of the agate bifaces remains to be determined.

A mean of 2.35 from the degree of polish scale is derived for the chalcedony bifaces (n=35). The degree of polish range for the chalcedony bifaces is as large as that of the agate bifaces, but oriented towards the lower end of the scale. No bifaces manufactured from chalcedony exhibited the highest degree of polish (4) although #20 was rated at 3.5. All the remaining chalcedony bifaces (n=32) were ranked from 1-3. One chalcedony biface (#34) did not exhibit any polish while another (#89) exhibited only possible or less than slight polishing.

All the chalcedony bifaces in the use-wear sample exhibit some degree of polish along the margins. However, in the majority of specimens (n=26), this grinding/polish is restricted to areas of platform preparation and platform remnants. On the remainder of the sample (n=9), flake detachment edges do exhibit polish. Two possible interpretations can account for this pattern. Resharpening and maintenance of the blade edge probably has removed evidence of polish and use among many specimens. Resharpening of the blade itself may be just as good an indicator of use as polish. Second, some mode of carrying the
bifaces should be suspected. A leather bag or pouch may have been employed for this purpose. Areas of platform preparation left after flake removal would rub against the pouch creating an effect of use-wear (Kornfeld et al. 1990).

Figures 8.12 and 8.13 illustrate examples of use-wear for both the agate and chalcedony bifaces. Figure 8.12 provides examples (biface #'s 71 and 84) of the higher degree of polish recorded for the agate bifaces. The lesser degree of polish is also shown for the chalcedony bifaces (#'s 10 and 78; Figure 8.13). The specimens provided in the figures are considered to be reflective of the mean polish index for each raw material category.

All the agate bifaces exhibit ridge rounding (see Table 8.14). The implications of this is that these artifacts have suffered abrasion on both faces for a somewhat lengthy period of time (Kornfeld et al. 1990). If the source for the agate raw material lies near the Anzick locale, ridge rounding as a result of transportation has to be questioned. Abrasion from soil or each other after deposition could have produced the effect of ridge rounding. This attribute is almost as prevalent among the chalcedony bifaces. Only five specimens do not exhibit or only questionably suggest ridge rounding (see Table 8.15). Once again, if the speculative source of the chalcedony raw material is in the vicinity of the Anzick locale, ridge rounding more likely occurred after deposition rather than as a result of being carried.

Comparisons of the degree of use by shape groups is discussed next. Among the agate biface groups, Group 1 exhibits the highest degree of polish (2.8) followed by Groups 3 (2.6) and 2 (2.5), respectively. The differences between Group 1 and the other agate groups is even more pronounced at this point. Groups 5 (2.4) and 6 (2.35) present similar but less degrees of polish than any other group. This supports the less evidence of use among the chalcedony bifaces. Surprisingly, the highest degree of use among all the biface groups is demonstrated by Group 4 (2.87). The separation of this group from the other chalcedony bifaces on functional grounds is substantiated. The biface groups defined in the Shape analysis section may be more significantly removed from each other than previously thought. Not only do these groups reflect technological differences, but differences in use-wear suggest functional differences as well. The significance of the differences in these groups is explored in discussion.
Figure 8.12. Agate biface use-wear examples: A., biface #71, moderate-extensive polish, B. biface #84, moderate polish.
Figure 8.13. Anzick chalcedony biface use-wear examples: A., biface #10, moderate polish, B., biface #78, slight polish
8.6 Discussion

A significant amount of information has been gained as a result of the biface analysis. The multi-
level approach has revealed patterned, behavioral characteristics within the biface assemblage leading to the
development of alternate interpretations that contrast with traditional interpretations. A more accurate
picture of the role or function of the Anzick assemblage may be presented. The results of the Anzick biface
analysis will be briefly reviewed before proceeding to the much awaited “alternate interpretations.”

The raw material analysis provides the first indication of variation in the biface assemblage. Three
raw material types are present in the biface assemblage. Chalcedony, moss agate, and porcellanite comprise
the raw material types in the assemblage. Chalcedony is the most heavily represented raw material but moss
agate is also well represented. A single biface manufactured from porcellanite is present. Significant
differences in metric attributes between the bifaces produced from chalcedony and moss agate are apparent.
The moss agate bifaces are substantially smaller in all metric attributes and exhibit a greater degree of
asymmetry than the chalcedony bifaces. Slight to no overlap in metric attributes at a single standard
deviations suggest the size difference are significant and not the result of random variation. Nearly all of
the moss agate bifaces exhibit cortex or remnants of the original nodular surface unlike the chalcedony
bifaces, which exhibit very little original parent material surface. The cortical material and small size of the
moss agate bifaces suggest this material was acquired as small, irregularly shaped nodules. The size of
many of the chalcedony bifaces suggest that this material is bedded as large, plate-like deposits. It is alleged
that differences in the raw material context figure heavily in the following levels of analyses.

Differences in shape and size of the bifaces were further demonstrated by a shape analysis. While
differences between agate and chalcedony are apparent, variation within each raw material requires further
quantification. A total of six formal groups can be defined based upon length and width ratios. The
recurrent composition of groups in each of three different scatterplot diagrams indicates that such groups
are significant and not randomly defined. Three groups are comprised primarily of agate while three more
are comprised of mainly chalcedony bifaces. However, the reasons for the presence of specific groups
within each raw material type are less than obvious. Merely stating that a reduction strategy based upon stages is not enough. Technological and use-wear analyses provide the essential information in interpreting these groups.

The technological analysis defined three primary grammatical structures within the biface assemblage. Raw material once again delimits at least part of the range of variation. Two strategies may have been employed for agate biface production. Given the interpretation of the geological context of the moss agate material, bifaces manufactured from this material tend to exhibit reduction in a somewhat variable fashion. The smallest moss agate bifaces (Group 1) as well as a few others are characterized by a reduction strategy intended to thin the artifact without large regard for artifact symmetry. Percussion thinning is the primary behavior. A more methodological approach to some of the larger bifaces is not immediately apparent until flake scar types are defined. In this strategy, intentionally overshot percussion flakes removed excess cortex and thinned the biface. The termination on the opposite margin also served as a ready-made striking platform. This reduction strategy is considered to be an expedient method designed to overcome the limitations of the raw material. The chalcedony bifaces, on the other hand, were manufactured following a more formalized reduction strategy. A reduction strategy emphasizing platform preparation, bifacial percussion and pressure thinning, and maintenance of margin symmetry is observed throughout the chalcedony assemblage. Once again, the raw material context of the chalcedony may have allowed for a more standardized reduction strategy. Similarities with Clovis production trajectories defined elsewhere are noted. The technological variation in the biface assemblage overlaps with the shape/size groups. Subsequent differences in use or variation in function between the groups may be portrayed by the use-wear analysis.

As a whole, the agate bifaces present a greater degree of use based upon the defined use-wear attributes than the chalcedony bifaces. However, when the formal biface groups are compared, interesting patterns emerge. The group with the highest degree of use is composed of chalcedony while the group composed of the smallest agate bifaces is a close second. The remaining two agate biface groups are similar in use-wear attributes as are the two chalcedony groups with slightly less use-wear evident.
Functional context of the different biface groups further supports the division of the biface assemblage into the respective groups.

Traditional interpretations of the Anzick and other groups of Clovis artifacts as stages of projectile point production or even a reduction continuum are rejected. In fact, the largest agate bifaces have experienced the greatest degree of reduction while the smallest probably reflect expediently produced tools with little overall reduction. While a few of the agate bifaces may be projectile point preforms, these tools probably are utilitarian tools. Mode of hafting is not immediately apparent. These tools are interpreted as small, hand-held bifacial tools. The chalcedony bifaces also are interpreted as utilitarian tools. As projectile point production appears to have been based upon flakes rather than large preforms, the bifaces may reflect large, hafted tools. Several lines of evidence mentioned throughout the text support this argument. First, the lack of extensive modification to the distal tips along with occasional notching of the blade suggests that these artifacts were hafted by the tip. An example of this hafting technique is provided in Figure 8.14. The use these artifacts in this context is indicated by maintenance of blade symmetry and sharpness. The high degree of use as in Group 4 reflects this interpretation. Group 5 bifaces may not have been extensively utilized requiring no resharpening. Group 6 bifaces have been resharpened to a greater degree. Additionally, the large “outlier” bifaces may actually be bifacial cores. Large bifaces have been interpreted as a formal type of core in other Paleoindian assemblages (Kelly 1988; Frison 1991) and may apply here as well.

The biface assemblage is interpreted as a reflection of a highly adaptive cultural system able to adapt and overcome variation in local environments. Different reduction strategies were employed for raw materials available in different geological context in order to produce functional tools. Biface morphology, technology, and use reflect significant variation between raw material types as well as intentional production of different biface “types”. The hypotheses that the bifaces were produced specifically for mortuary purposes and/or reflect a “blueprint” of projectile point production are rejected. Instead, the biface assemblage appears to conform most closely to the heirloom hypothesis in that these artifacts were basically functional tools that were previously manufactured, possibly intended to be passed from generation to generation. The deaths of the juveniles resulted in the artifacts being deposited along with the burials.
Figure 8.14. Proposed hafting technique of typical Anzick biface.
9.1 Introduction

The remaining lithic artifact classes - unifaces, flake tools, and flakes - are dealt with in this chapter due to the small sample size for each class. Four artifacts are classified as unifacial tools, three as flake tools, and three flakes. Two of the unifaces may be classified as endscrapers (#'s 19, 99) while the other two are side scrapers (#'s 11, 100). The analyses are presented in the same manner for these tool classes as in the previous lithic artifact chapters. Artifact images and technological code sheets are presented in Appendix C.

9.2 Raw Material Analysis

Raw material attributes for the artifact classes discussed in this chapter are presented Table 9.1. All artifacts in these classes are manufactured from raw material derived from the same chalcedony source utilized in projectile point and biface production. The chalcedony material variability in this class is similar to the variation observed in the biface assemblage although the sample is much smaller. The variation group numbers are the same as used in Table 8.1. to describe the bifaces. Each artifact class is described below.

9.2.1 Unifacial Tools

All of the unifacial tools are manufactured from chalcedony. Three of these (#'s 11, 19, 100) are of light to medium brown color with an earthy luster while the final specimen (#99) is dark gray with a waxy luster. These chalcedony raw material variations are similar to the variation observed in the projectile point and biface assemblages. Uniface #99 was typed with the Munsell rock color chart like the similarly colored bifaces.
9.2.2 Flake Tools

Like the unifacial tools, all three flake tools (#’s 52, 66, 81) are manufactured from chalcedony. These exhibit variation in color and luster as the other chalcedony lithic artifacts. Tool #52 is a light olive brown color with reddish strands. Tool #66 exhibits a gradient in color red from reddish black to dark reddish gray. Tool #81 is purple with reddish gray inclusions.

9.2.3 Flakes

Three small (<3cm) chalcedony thinning flakes (#’s 114-116) are derived from a gray chalcedony. It is likely that these flakes are post-depositional. They could have been produced during fracturing of artifacts by the means of removal.

9.3 Shape/Stylistic Analysis

Because of irregularity in form, minor changes in attribute systematics had to be made. Additional attribute measurements taken on this sample include maximum width (MxW), distance of maximum width from X-axis (MxWD), angle of margin expansion (MAE), and working face length (WFL), thickness (WFT), and angle (WFA). The distal portion of the artifact in question was either the working face in the case of the endscrapers or the narrowest end for sidescrapers. The proximal margin was situated on the X-
axis so that the Y-axis bisected the artifact. Artifact margins were kept as parallel as possible with the Y-axis despite different angles of margin expansion. Margin angle expansion was measured from the X-axis to the right. Thus, an artifact which converges at the distal will exhibit the left margin angle at greater than 90° and the right at less than 90°. The opposite is true of artifacts which expand towards the distal.

Working face thickness was obtained from the thickest point of this area of the artifact. Working face angle was obtained by measuring the thickness at mid-width 5mm from the working face edge. These two points are plotted on an X-Y axis and the angle measured from the X axis. Because the working face theoretically will never exceed 90°, the angle provided is always acute. Attribute measurements are provided for unifaces in Table 9.2 and Table 9.3 for flake tools. Descriptions are provided for each class below.

9.3.1 Unifaces

Sidescraper #11 is described as a convergent sidescraper. The proximal portion of sidescraper #11 is broken at an 180° angle from the X-axis. Measurements for this specimen were taken with the Y-axis bisecting the distal with the right proximal corner situated on the X-axis. The left dorsal margin maintains a general right angle while the right ventral margin is slightly convex and expands to converge with the left margin. A roughly triangular shape is generated. Endscraper #19 is a distinctive "classic" Paleoindian unifacial endscraper. The margins of this specimen are roughly parallel for 33mm of the total length from the distal tip where the left ventral margin angles 54° to converge with the right margin. Endscraper #99 is much larger than #19. This artifact is roughly parallelogram-shaped with parallel margins. From the base, the left dorsal margin angle measures 105° while the right margin expands at an angle of 111° (see Figure C.3A). The widest portion of this artifact occurs 21mm below the working face. This artifact is also unusually thick in comparison to all the other lithic artifacts. Sidescraper #100 is more rectangular in shape with a slightly rounded base. The distal right dorsal margin angles at 40° to converge with the left margin, which remains parallel to the longitudinal axis. The right dorsal margin has been modified to a steep working face extending the entire length of the artifact.
Table 9.2. Anzick uniface attribute measurements.

<table>
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<th>ML</th>
<th>MxW</th>
<th>MxWD</th>
<th>MW</th>
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<td></td>
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<td></td>
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<td>(left/right)</td>
<td>(left/right)</td>
</tr>
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Although the Anzick uniface sample is too small to make any conclusive statements concerning stylistic parameters, the similarities of these artifacts with unifacial artifacts recovered from other Paleoindian sites does indicate certain styles of unifacial tools were preferred throughout the extent of Clovis distribution. Numerous convergent side scrapers similar to #11 have been recovered from a variety of widely dispersed sites such as the Vail site in the Northeast (Gramly 1982:122-3, Plate 17) and the Adams site in the southeastern U.S. (Sanders 1990:111-120, Figures 42-51). Large rectangular endscrapers similar to #99 and #100 are noted from the same sites. The similarities between these unifacial forms from sites located at large distances implies that style played a role in the production of these tools. The similarity of these styles over great distances suggests that social or economic factors were of equal or greater importance than raw material constraints. If the role of Clovis points served some sociopolitical function as suggested by others in its diffusion (e.g. Bonnichsen 1991), then it should be expected that the associated toolkits would gain similar status. Until Paleoindian unifacial tool data has been compiled from a number of sites, the role of style in unifacial tools will only be marginally understood.

9.3.2 Flakes Tools

Table 9.3 provides attribute measurements for the flake tools. The stylistic variability in the less formalized artifact categories such as flake tools reflects the expediency of these artifacts. These tools are considered expedient due to the lack of modification in form and simple technologies. Like the uniface subclass, the small sample prevents any definitive statements concerning stylistic components of flake tools.
Due to irregularity in shape, attribute measurements were derived with the catalog number in reading position with the Y-axis bisecting the artifact from the most distal to most proximal points of the flake. Tool #66 is more symmetrical than #'s 52 and 81; however, it is aligned in the same manner. All of these are chalcedony and fairly large. Table 9.3 provides attribute measurements.

Tool #52 is a long diamond-shaped, thin flake. Thin, wide, and long flakes such as this specimen were very likely to be the desired chalcedony flake blank for manufacturing bifaces. Tool #66 is a blade or blade-like flake. A single similar blade is also associated with the Fenn assemblage (Frison 1991) and the East Wenatchee assemblage (Gramly 1991). Whether this and other similar artifacts in the Clovis assemblages in question here are true blades is questionable. No blade cores are present in the Anzick assemblage and are generally found only in the Southeast (Sanders 1990) and Southwest (Bradley 1993). From a regional perspective, the artifacts in question here actually represent blade-like flakes rather than true blades. The final flake tool, #81, is a large spall-like flake. It is the longest and widest of all the specimens. The edges exhibit polishing attesting to this artifact’s use as a tool (see use-wear below).

Table 9.3. Flake tool attribute measurements.

<table>
<thead>
<tr>
<th>Art. #</th>
<th>ML</th>
<th>MW</th>
<th>MxW</th>
<th>Th</th>
<th>DW</th>
<th>PW</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>169</td>
<td>92</td>
<td>92</td>
<td>7</td>
<td>34</td>
<td>29</td>
</tr>
<tr>
<td>66</td>
<td>113</td>
<td>34</td>
<td>34</td>
<td>6</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>81</td>
<td>185</td>
<td>121</td>
<td>121</td>
<td>17</td>
<td>30</td>
<td>46</td>
</tr>
</tbody>
</table>

9.4 Technological Analysis

A frame analysis was conducted with the unifacial and flake tools to document the production technology of these two artifact classes. The methodology utilized in this frame analysis is the same as for the projectile points and bifaces. The technological units identified are summarized in Table 9.4.
Table 9.4. Technological attributes of unifacial and flake tools.

<table>
<thead>
<tr>
<th>Art. #</th>
<th>TP</th>
<th>BL</th>
<th>BS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PrSh</td>
<td>FlkRnt</td>
<td>PnTh</td>
</tr>
<tr>
<td>11</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A limited range of technological units are evident in the unifacial and flake tool classes. As expected, unifacial and flake tools production was conducted from large chalcedony flakes or flake blanks. The agate raw material source was apparently not utilized for less formal artifact production. While moss agate was utilized for a wide range of biface production, this material was evidently avoided for unifacial and flake tool production. If moss agate nodules generally were not available as large cobbles, this material may not produce the large flakes preferred by the craftsman. Alternatively, moss agate may not have been suitable for the intended functions of these tools.

All the unifacial tools exhibit some degree of shaping of the artifact margins. Unifacial tool #11 exhibits extensive shaping of the artifact margin while the steep working faces of #’s 19, 99, and 100 display modification. Percussion thinning units actually appear to have been removed prior to the removal of the tool blank. Exception to this rule may be present on #’s 99 and 100.

Some of the large flakes were utilized as tools without further modification (#52) or were only slightly modified (#66). Flake tool #81 appears to have been utilized as well as but large thinning flakes were removed after #81 was produced. Further reduction could transform a large spall-like flake such as this into a biface relatively easily.
9.5 Use-wear Analysis

The following section describes the use-wear analysis conducted on the unifacial and flake tool classes. The available artifact sample is somewhat limited. However, for the purposes of the current study, the sample does provide important information to complement the projectile point and biface use-wear analyses.

9.5.1 Unifacial tools

Only two (Nos. 11 and 19) were available for use-wear study at the Montana State Museum (see Table 9.4). Uniface No. 11 exhibited little or no evidence of use. An absence of polish or edge rounding and slight microflaking indicates that this artifact was not utilized. Uniface No. 19, a “classic” Paleoindian endscaper, does provide stronger evidence of use than No. 11. A slight amount of polish is evident on the working face. Extensive micro-flaking is also present on the working face and both margins. Similar micro-flaking is present along the margins of uniface No. 100. Highly variable results in experimentation (cf. Schultz 1992) and the cautionary approach to use-wear analysis discussed above prevent any speculation as to what specific function these tools may have served. Scraping, most likely hafted and pulling towards oneself, could produce the observed microflaking and polish.

Table 9.4. Uniface and flake tool use-wear analysis results.

<table>
<thead>
<tr>
<th>Artifact #</th>
<th>Microflaking</th>
<th>Edge Rounding</th>
<th>Ridge Rounding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unifaces</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>slight</td>
<td>1</td>
<td>absent</td>
</tr>
<tr>
<td>19</td>
<td>present</td>
<td>2</td>
<td>absent</td>
</tr>
<tr>
<td>Flake tools</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>present</td>
<td>1</td>
<td>absent</td>
</tr>
<tr>
<td>66</td>
<td>present</td>
<td>1</td>
<td>absent</td>
</tr>
<tr>
<td>81</td>
<td>present</td>
<td>3-4</td>
<td>absent</td>
</tr>
</tbody>
</table>
Figure 9.1. Microflaking present on working face of sidescraper #100.
9.5.2 Flake tools

All artifacts classified as flake tools (#'s 52, 66, 81) were available at the time of use-wear analysis. These artifacts are included in Table 9.5 with the unifaces. Specimen #52, a large spall or thinning flake, exhibits extensive amounts of micro-flaking along the right margin with minimal retouch on the left margin. Little or no polish was observed on this artifact. Specimen #66, a flake-blade, exhibits extensive amounts of micro-flaking and retouch along both margins. Most of these micro-flakes are feathered in termination but stepped termination micro-flakes are also present. No polish or edge rounding was observed on this specimen either. The absence of polish and regular pattern of micro-flaking, especially along the right margin, suggests this is the result of edge preparation rather than use. Artifact #81, a large spall, presents more substantial evidence of use than the other artifacts in this class. Polish and micro-flaking are present along the left margin from near the platform end to the broken, steep angle on the left basal margin. The extensive amount of polish along nearly the entire margin perimeter of this artifact intimates a large degree of use.

9.6 Discussion

In addressing the Clovis assemblage hypotheses, the artifacts in consideration in this chapter provide a small but important source of information. The correlation of both primary classes (unifaces, flake tools) with chalcedony supports previous considerations of lithic raw material context and procurement. The ramifications of raw material procurement and tool production is discussed in greater detail in chapter 11. Little research has been conducted to investigate stylistic and shape parameters of Paleoindian unifacial tools. Much of the research has focused upon formal artifact classes such as projectile points and bifaces. With more research, unifacial tool categories may reveal stylistic parameters to the same degree as these latter artifact categories. However, substantial evidence of use-wear and retouch is observed for these classes. A utilitarian function for these artifacts suggests production and use prior to deposition. The unifacial and flake tools evidently do not reflect specially produced mortuary goods.
Chapter 10: Bone Implements

10.1 Introduction

A number of complete and fragmentary bone artifacts were recovered along with the Anzick lithic assemblage. Two complete specimens have been described in a seminal article shortly after the discovery of the Anzick assemblage (cf. Lahren and Bonnichsen 1974). Similar bone tools have been reported from a number of other Clovis assemblages throughout North America. This chapter seeks to describe the entire assemblage and compare them with similar specimens discovered since the publication of Lahren and Bonnichsen’s initial paper. Illustrations of the bone foreshafts are included in Appendix D.

10.2 Assemblage Contents

Two complete foreshafts (#67 and #118/119), four beveled ends (#’s 37, 39, 94, 95), and five midsections (#’s 37, 38, 120, 122, 123) comprise the entire bone tool assemblage (Lahren and Bonnichsen 1974). Two specimens (#’s 117 and 122) from Lahren and Bonnichsen’s (1974) study have either been re-numbered or misplaced and were unable to be located for the present study. Of the complete specimens, #67 is refit from two fragments while #118/119 is composed of four fragments. Specimen #’s 95 and 123 refit to comprise a fragmentary specimen as do #’s 37 and 122. Artifact #’s 39 and 94 are individual beveled end fragments that do not refit with any other fragments. The remaining artifacts (#’s 38, 120) are mid-section fragments. Determining the total number of bone implements represented in the assemblage is challenging due to #67 having a single beveled end and a tapering cylindrical end while #118/119 is bi-beveled. This indicates that the original specimen, i.e. single or bi-beveled, may have provided one or two beveled ends to the total assemblage. Therefore, counting beveled end fragments in the total assemblage provides a minimum and maximum number of complete specimens. A minimum of four specimens could be present if the two individual beveled ends (#’s 39, 94) matched the two beveled end/midsection fragments (#’s 95/123, 37/122). Alternatively, a maximum of six could be present if each end fragment represents a single beveled implement plus the two complete specimens.
10.3 Raw Material and Manufacturing Techniques

The species or genus that provided the material for the bone tools has not been identified. Undoubtedly a large mammal most likely provided the length of bone judging by the length of the complete implements. Mammoth or mastodon bone is the most common genera suggested (Lahren and Bonnichsen 1974; Gramly 1993; Wilke et al. 1991).

The diaphysis of a long bone most likely provided the length of material utilized. Experimental studies by Dr. Robson Bonnichsen have suggested a method of reducing the length of bone to resemble the prehistoric specimens. Drawing a steep angled edge of a stone tool parallel to the long axis reduced the bone after being soaked in boiling water (Lahren and Bonnichsen 1974). Lahren and Bonnichsen (1974) note the experiments by Bonnichsen produced specimens identical to the Anzick originals. More comparative studies between foreshafts of different assemblages and experimental work along with ethnographic analogy may further clarify methods of bone tool production.

10.4 Stylistic Analysis

This section of the analysis provides descriptions of the bone tools from a morphological as well as decorative perspective. Metric data for the bone implements are provided in Table 10.1. Abbreviations are the same as presented in chapter Five. These data are compared with other similar bone tools and assemblages.

As only two specimens are complete enough to provide all attribute measurements, intra-assemblage variation is difficult to address. The metric attributes of the two complete foreshafts are very similar except in length where #118/119 is longer than #67. Very narrow ranges of for maximum width (15.5-20mm) and thickness (11-14.6mm) attributes are exhibited by all the specimens. Bevel angle range is also limited (9°-18°). Despite the general fragmentary nature of the implements, it is evident that a very specific design was intended for these artifacts.
Table 10.1. Bone implement attribute measurements (in mm except for angle attributes).

<table>
<thead>
<tr>
<th>Art. #</th>
<th>ML</th>
<th>MW</th>
<th>MT</th>
<th>PBL</th>
<th>MPBW</th>
<th>MPBT</th>
<th>PBA</th>
<th>PPB</th>
<th>PPT</th>
<th>1/3W</th>
<th>1/3T</th>
<th>1/2W</th>
<th>1/2T</th>
<th>2/3W</th>
<th>2/3T</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>132</td>
<td>18</td>
<td>12.3</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>50.5</td>
<td>20</td>
<td>13.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>54</td>
<td>17.4</td>
<td>12.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>67</td>
<td>227</td>
<td>15.5</td>
<td>13.8</td>
<td>37.6</td>
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<td>13</td>
<td>15</td>
<td>13</td>
<td>15</td>
<td>15</td>
<td>14.8</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>94</td>
<td>133</td>
<td>19.8</td>
<td>12.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95/123</td>
<td>128</td>
<td>19.9</td>
<td>13.4</td>
<td></td>
<td></td>
<td></td>
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<td>19.7</td>
<td>12.9</td>
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<tr>
<td>118/119</td>
<td>280</td>
<td>17.4</td>
<td>14.6</td>
<td>45</td>
<td>15.1</td>
<td>7.4</td>
<td>18°</td>
<td>17</td>
<td>13.8</td>
<td>17.5</td>
<td>14</td>
<td>17.5</td>
<td>13.2</td>
<td>17</td>
<td>12.7</td>
</tr>
<tr>
<td>120</td>
<td>92</td>
<td>19</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Art. #</th>
<th>PdBW</th>
<th>PdBT</th>
<th>DBL</th>
<th>MDBW</th>
<th>MDBT</th>
<th>DBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>14.7</td>
<td>10.1</td>
<td>50</td>
<td>12.8</td>
<td>7</td>
<td>12°</td>
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<td>39</td>
<td>12.7</td>
<td>11.6</td>
<td>47.8</td>
<td>15</td>
<td>8.5</td>
<td>13°</td>
</tr>
<tr>
<td>67</td>
<td>14.7</td>
<td>12.7</td>
<td>64</td>
<td>13.6</td>
<td>9.5</td>
<td>11°</td>
</tr>
<tr>
<td>94</td>
<td>16.4</td>
<td>11.8</td>
<td>45</td>
<td>14</td>
<td>7</td>
<td>16°</td>
</tr>
<tr>
<td>95/123</td>
<td>15.7</td>
<td>11.3</td>
<td>44.6</td>
<td>14.2</td>
<td>7.2</td>
<td>17°</td>
</tr>
<tr>
<td>118/119</td>
<td>15.5</td>
<td>11.5</td>
<td>51</td>
<td>14</td>
<td>8</td>
<td>9°</td>
</tr>
<tr>
<td>120</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
These artifacts can be described as essentially straight in plan view with cross-hatching on the beveled ends (Lahren and Bonnichsen 1974). A number of other bone implements similar to those associated with the Anzick assemblage from Paleoindian contexts have been discovered. These include specimens from Blackwater Draw (Hester 1972), the Sheaman component of the Agate Basin site (Frison and Stanford 1982), underwater Florida sites (Dunbar et al. 1989), and the East Wenatchee assemblage (Gramly 1993). The East Wenatchee and Agate Basin specimens most closely resemble the Anzick specimens so comparisons will be based primarily upon these assemblages. The primary point of variation between these and the Arizona and Florida sites is the manner of the shaft tapering. Specimens from the latter sites taper to a needle-like point while slightly rounded, beveled cross-hatched ends characterize the Northwest-Northern Plains specimens. The complete specimens of bone implements from each of the Northwest Plains-Intermontane U.S. are compared in Table 10.2 for all available attributes.

The single specimen from the Sheaman component of the Agate Basin site (Frison and Stanford 1982) is not entirely complete but significant similarities with the Anzick and East Wenatchee sites are apparent. The cross-hatched end tapering to a bevel is obviously similar to the specimens from Anzick and East Wenatchee. Although it is incomplete, the available attributes of this specimen compare favorably with the Anzick and East Wenatchee assemblages except in width and thickness.

Fourteen bone specimens were recovered with the East Wenatchee assemblage (Gramly 1993). Attribute measurements are available for 12 of these from Gramly (1993; see Table 10.2.). One of the two not listed above, M, was only identified as a mass small bone fragments in a soil block possibly in the excreta of a scavenger. The other remains in situ in an unexcavated soil block. Only a few of the specimens listed above are complete or near complete (A, B, C, D, E, F, I). The remaining have been damaged by modern activity or scavenger gnawing. Data for the incomplete specimens provided by Gramly (1993) were also included in Table 10.2. The specimens from East Wenatchee are much thicker and wider than the Anzick and Agate Basin specimens although length does not vary to the same extent.
Table 10.2 Comparison of metric data from complete bone implements from the Anzick, Agate Basin, and East Wenatchee sites (in mm).

<table>
<thead>
<tr>
<th>Site/spec. #</th>
<th>max. length</th>
<th>max. width</th>
<th>max. thickness</th>
<th>length of bevel</th>
<th>decoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anzick</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>227</td>
<td>15.5</td>
<td>13.8</td>
<td>64</td>
<td>cross-hatching</td>
</tr>
<tr>
<td>118/119</td>
<td>280</td>
<td>17.4</td>
<td>14.6</td>
<td>51</td>
<td>cross-hatching</td>
</tr>
<tr>
<td>Agate Basin</td>
<td>203.4</td>
<td>13.6</td>
<td>12</td>
<td>74.7</td>
<td>cross-hatching</td>
</tr>
<tr>
<td>East Wenatchee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>263</td>
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</tr>
<tr>
<td>B</td>
<td>209</td>
<td>24</td>
<td>17</td>
<td>n/a</td>
<td>cross-hatched</td>
</tr>
<tr>
<td>C</td>
<td>252</td>
<td>24</td>
<td>18</td>
<td>n/a</td>
<td>cross-hatched</td>
</tr>
<tr>
<td>D</td>
<td>242</td>
<td>29</td>
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<td>n/a</td>
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<tr>
<td>E</td>
<td>231</td>
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<td>20</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>F</td>
<td>190</td>
<td>26</td>
<td>18</td>
<td>n/a</td>
<td>cross-hatched</td>
</tr>
<tr>
<td>G</td>
<td>232</td>
<td>30</td>
<td>22</td>
<td>n/a</td>
<td>cross-hatched?</td>
</tr>
<tr>
<td>H</td>
<td>177</td>
<td>26</td>
<td>18</td>
<td>n/a</td>
<td>cross-hatched?</td>
</tr>
<tr>
<td>I</td>
<td>215</td>
<td>30</td>
<td>21</td>
<td>n/a</td>
<td>cross-hatched?</td>
</tr>
<tr>
<td>J</td>
<td>171</td>
<td>27</td>
<td>19</td>
<td>n/a</td>
<td>cross-hatched?</td>
</tr>
<tr>
<td>K</td>
<td>193</td>
<td>28</td>
<td>20</td>
<td>n/a</td>
<td>cross-hatched?</td>
</tr>
<tr>
<td>L</td>
<td>115</td>
<td>13</td>
<td>12</td>
<td>n/a</td>
<td>cross-hatched?</td>
</tr>
</tbody>
</table>

The most significant similarities between all the assemblages considered here are 1) cross-hatching, and 2) possible ritualistic breakage. Cross-hatching is present on all beveled specimens although this is inferred from illustrations for specimens with a "?" in Table 10.2. This could have been an aesthetic decoration that was also utilitarian (see use-wear below). A more functional interpretation is probably more accurate. Less utilitarian are deliberate breaks on nearly all the specimens. Scavenger gnawing, possibly wolverine, has severely damaged and broken many of the East Wenatchee specimens. However, well-preserved specimens from the Anzick and East Wenatchee assemblages have been deliberately broken one to three times. Pitting from impacts with a hammer of some sort are visible on Anzick #’s 118/119 (Figure C.7) and are most likely responsible for the fracturing in the incomplete Anzick specimens. Impacts are inferred from illustrations for numerous specimens in the East Wenatchee assemblage (Gramly 1993). Bi-beveled specimens appear to have been most commonly broken in three places dividing the artifact in quarters. The symbolic meaning of this breakage may only be guessed. Ritually damaging or killing artifacts or objects is ethnographically documented and may be represented by the deliberate breakage of the Anzick specimens Lahren and Bonnichsen (1974).
10.5 Use and Function of Bone Implements

Without unequivocally knowing the function of these tools, the nature of the use-wear that may be present can only be guessed. Once again, clues may be derived from early accounts of the assemblage as well as research conducted with other Clovis assemblages. Lahren and Bonnichsen (1974) indicate that the beveled ends of six implements were covered in a black resin matter, possibly a hafting agent or glue. Tankersley (1994) has identified a resinous material from the flute of a Clovis point from eastern Oregon. Covered with resin, the cross-hatch design on the beveled ends of the implements could be a means of reducing friction and increasing haft strength with the flute of a Clovis point (Lahren and Bonnichsen 1974). The heavily polished haft areas of projectile point #69 and other points with ground and polished margins indicates that the points were hafted in a secure manner. Lahren and Bonnichsen (1974) initially interpreted these implements as foreshafts. The presence of resin on the Anzick specimens and Tankersley’s (1994) specimen strengthen the foreshaft argument (see Figure 10.1) and also suggests these tools had been used in this functional context prior to deposition. However, other functional interpretations of the bone implements have been given and require attention.

Wilke et al. (1991) suggest that the bone implements are parts of composite pressure flakers. The implements are interpreted as handles that would have had bits attached to the beveled ends for pressure flaking. Wilke et al. (1991) reject the foreshaft interpretation in favor of the pressure flaker interpretation claiming that experiments have shown Clovis points cannot be mounted on the beveled end so that it is parallel to the foreshaft. This is a false statement. Experimentation by the author at the Montana State Museum and the Center for the Study of the First Americans demonstrated that with only the most heavily ground and polished portion of the point’s hafting area situated on the beveled end section, the point does form a straight alignment with the shaft. Projectile point #69 with the heavily ground margins has been repeatedly aligned in this manner. The pressure flaker interpretation is rejected in light of this information.

Gramly (1993) has interpreted the bone implements from the East Wenatchee assemblage as sled runners. As these are very similar to the Anzick assemblage, a similar function for both assemblages of bone tools is inferred. Evidence for sleds and use of domesticated dogs is completely lacking in
Figure 10.1. Proposed method of hafting Clovis projectile points with bone foreshafts (from Lahren and Bonnichsen 1974).
Paleoindian sites. The available evidence supporting a hafting function for the bone implements does not corroborate Gramly’s (1993) interpretation. Therefore the sled runner interpretation is rejected out of hand.

Other interpretations for similar bone implements include bone fleshers (Taylor 1969), bone points (Haynes 1980), and rods (Jelinek 1971). The flesher interpretation is ruled out on the grounds that stone tools would have done the job more efficiently and does not take into account the evidence for hafting. The specimens from the Anzick, East Wenatchee, and the Sheaman sites most likely would not have served well as bone points for reasons discussed earlier. However, other more pointed specimens from Blackwater Draw and Florida may have functioned in this role. How these tools may have functioned as rods is unknown.

10.6 Discussion

The presence of resinous material on the ends of the foreshafts and extensive preparation such as cross-hatching are indicative of the function and actual use of these tools as foreshafts during their use-life. Ritual activity apparently is also associated with these implements. Patterned breakage of the foreshafts in a systematic manner is indicated by percussion indentations on the foreshafts themselves and the general breakage into four quarters. Similarities in the cause and number of fractured specimens in the East Wenatchee site have been observed. These are very formal tools that undoubtedly would have been well-maintained. Removing the tools from the social system would only be likely in cases of important ritualistic activity such as mortuary behavior.
Chapter 11: Conclusions

11.1 Introduction

The use of a multi-level research design in the analysis of the Anzick assemblage has produced an impressive amount of data. The data generated as a result of a multi-level research design allows a number of competing hypothesis to be systematically tested. By systematically testing these competing hypothesis, a better understanding of the role and function of the Anzick and other assemblages within the Clovis Complex emerges. The implications of each competing hypothesis outlined in Chapter Two are discussed below in relation to each level of analysis conducted in the present study. Whether or not the expectations of each hypothesis defined in Chapter Two have been borne out is determined through the analyses conducted in the present study. The Anzick assemblage is then viewed within the context of Clovis assemblage phenomenon discussed in Chapter Two. The composition of the Anzick assemblage is compared with the Fenn, Simon, Drake, and East Wenatchee assemblages. Furthermore, information provided in the present study enhances our understanding of the technological organization of the Northern Plains Clovis peoples. Economic and adaptive issues suggested by the analysis are also discussed.

11.2 Testing the Clovis Hypotheses

11.2.1 Mortuary hypothesis

The mortuary hypothesis possibly has been the most popular advanced for Anzick assemblage. Building upon the propositions of Frison (1991) and Stanford and Jodry (1988) that the Fenn and Drake assemblages are burial assemblages produced for mortuary purposes, a number of implicative characteristics of this hypothesis have been outlined including the presence of human remains, ritual use of red ochre, definable stages of projectile point reduction, and lack of artifact use-wear. Each of these factors are discussed below.
The only known human remains directly associated with the Clovis Complex is the Anzick burial. Inferring that other Clovis assemblages are burial assemblages based upon similarities with the Anzick collection without human remains is speculative. However, given similarities in assemblage structure, composition, and technology, proposing a burial or ritualistic function for the other assemblages is not spurious. A feature that is common to four out of five of the assemblages is red ochre use. Although the role of red ochre has been contested (Titmus and Woods 1991), the context of red ochre in the Anzick assemblage does indicate a non-utilitarian role (cf. Roper 1991). A mortuary or burial function of these assemblages is not out of the question. The propositions that the artifacts were specially produced for burial purposes can not be accepted due to the presence of use-wear and resharpening.

11.2.2 Quarry Cache hypothesis

The quarry cache hypothesis after Woods and Titmus (1985), Frison (1991), and Wilke et al. (1991) suggests that discrete stages of projectile point production are present in the Anzick and other assemblages. The term "quarry cache" implies the assemblage was not intended to be used in their current state, but suggests the tools were to be recovered, completed into finished forms, and used at a later time. Stages of biface reduction have been offered by a number of researchers as a means of defining the production of bifacial tools, which are ultimately reduced projectile points. If the stage hypothesis is true, specimens should 1) exhibit similar production units, and 2) exhibit a distinct lack of use-wear.

Multiple lines of evidence suggest that the stage hypothesis does not adequately explain the Anzick assemblage. Projectile point manufacture appears to have occurred on flakes independent from bifacial production. Second, the groups of bifaces defined in the assemblage reflect raw material, technological, and functional variability. Use-wear is evident in the biface assemblage suggesting these were finished tools. Neither stages of production nor a reduction continuum is an accurate interpretation of the Anzick assemblage.
11.2.3 Toolkit hypothesis

Gramly (1991, 1993) has provided the basis for the toolkit hypothesis based upon evidence from the East Wenatchee assemblage. The definition of a number of functional artifact types and blood residue analysis does imply a more functional role of these assemblages than the previous interpretations. The use-wear analyses and recent blood residue analysis of the Anzick assemblage (Bonnichsen, unpublished) tend to bear out the functional implications of this interpretation.

Once again, red ochre present in the assemblages and human remains in the Anzick assemblage must be taken into consideration. A purely functional interpretation without incorporation of all evidence such as this is not acceptable. While the tools may be functional, the context of the assemblage suggests a non-utilitarian deposition.

11.2.4 Heirloom hypothesis

The heirloom hypothesis attempts to incorporate aspects of both the functional and ritualistic hypotheses. The fundamental premise of the heirloom hypothesis is that the Anzick assemblage represents a functional, utilitarian group of artifacts to be past from one generation to the next. This assemblage also entails much knowledge of the necessary cultural “equipment” required to survive in a late ice-age environment. Accepted models of mortuary behavior suggest that burial remains should reflect an individual’s role in life (Tainter 1978). As the individuals interred with the artifacts in the Anzick assemblage are children or juveniles, the association with of the Anzick artifacts does not conform to the model unless the youngest members of the Late Pleistocene society did the hunting. This, of course, is unlikely. However, if the artifacts do reflect the needs of an individual to survive in the afterlife, the association is not unusual. The use-wear and resharpening associated with functional artifacts is reconciled with the ritual aspects of the Anzick assemblage. As such, this hypothesis incorporates the myriad of available evidence to a greater extent than the other previous hypotheses.

This hypothesis does not intend to provide any additional implications of lithic production such as stages of production or continuums. Instead, this hypothesis attempts to explain the available behavioral
evidence. As such, this hypothesis allows the actual technological organization of the Anzick assemblage to be discussed within behavioral as well as environmental context. While many of the behavioral concerns have been addressed above, the implications of economic adaptations are discussed separately.

11.3 The Anzick Clovis Assemblage within the Context of the Clovis "Cache" Phenomenon

Does the heirloom interpretation outlined above suffice as an explanation for the Drake, Fenn, Simon, and East Wenatchee assemblages? This question is addressed by comparison of the four assemblages. If the heirloom hypothesis is correct, then the Anzick assemblage may be a model for what to expect with a burial assemblage. Other assemblages sharing this interpretation should exhibit similar artifact compositions. The Anzick assemblage is compared to the Drake, Fenn, Simon, and East Wenatchee assemblages below. The applicability of the heirloom hypothesis to these assemblages is reviewed.

The assemblage structure of the Drake, Fenn, Simon and East Wenatchee assemblages was provided in Chapter Two. Referring back to Table 2.1, the Anzick assemblage exhibits a composition and organization of the lithic assemblage most like the Fenn, Simon, and East Wenatchee assemblages. The presence of bifaces and completed projectile point forms manufactured from a few raw materials accompanied by fewer uniface and flake tools characterize these lithic assemblages. Each assemblage is dominated by bifacial tools exhibiting a wide range of formal morphological variation. Production technologies similar to the Anzick assemblage are exhibited by illustrated specimens from each assemblage. The Drake assemblage is less comparable to the Anzick assemblage due to the absence of bifacial and less formal flaked stone tools. The illustrated point (cf. Stanford and Jodry 1988) does exhibit similarities in morphology and technology with the Anzick projectile points. The preservation of bone tools in the East Wenatchee assemblage that greatly resemble the Anzick foreshafts reinforces the material similarity between the assemblages. Indications of the utility or functional nature of the assemblages have been revealed by previous researchers. The presence of use-wear precludes the assemblages from having been produced for non-utilitarian purposes.

The indication at this point is that the overall similarities between the assemblages reflects a cultural manifestation unique to the U.S. Northwest Interior. This proposition has been previously
suggested (Bonnichsen 1977; Young and Bonnichsen 1984). However, the lack of human remains from the assemblages points to the speculative nature of offering a single interpretation of this manifestation. While the specific function of each assemblage may have varied, the use of caching behavior is uniquely apparent in this region.

11.4 Clovis Lithic Technological Organization and Adaptive Strategies: A View from the Anzick Assemblage

Careful analysis of lithic artifacts not only contributes data concerning the composition and use of raw materials in an assemblage, but, in conjunction with comparative studies, can provide detailed information regarding technological organization and adaptive strategies. Despite the lack of solid information on raw material sources, much information can be deciphered pertinent to understanding the technological organization of the Anzick assemblage. The raw material composition of the assemblage; relationships between resharpening, exotic raw materials; and dominance of bifaces in the Anzick assemblage all prove insightful to understanding the technological adaptations and mobility strategies of the Clovis hunters in the Northern Plains.

Discussions of Paleoindian lithic procurement pivot on two contrasting positions: direct and indirect procurement. Direct procurement involves obtaining raw material directly from the source while indirect procurement refers to acquisition of raw materials or artifacts through trade or barter, secondary deposits of raw material, or “scavenging” cultural material left at a site by earlier occupants. Distinguishing direct from indirect procurement in the archaeological record has produced a sizable literature centering upon the relationships between raw material distribution and settlement and mobility patterns. Frequencies of raw material types, artifact function, and use have been utilized to explore these relationships. Two contrasting models are examined below and related to the context of the Anzick assemblage.

Tankersley (1990) suggests that indirect procurement, i.e. trade, may be discerned in a lithic assemblage by artifacts found a great distance (>250 km) from the raw material source and that comprise a small percentage of the total assemblage(i.e. one or two specimens). This hypothesis is developed from the Lower Midwest/Midsouth region where Paleoindian remains, particularly fluted point material, is abundant.
High quality lithic resources suitable for production of fluted points are fairly evenly distributed across the landscape making conditions suitable for the dominance of artifacts manufactured from local raw materials. High-quality raw material sources occur near large habitation-workshop sites in this region such as Adams (Sanders 1988), Wells Creek Crater (Dragoo 1973), and the Carson-Conn-Short site (Broster and Norton 1993; Broster et al. 1994). This correlation does imply that the majority of artifacts were manufactured from local material directly procured near habitation sites.

The few artifacts of exotic raw materials present at sites in this region are attributed to acquisition through long-distance trade (Tankersley 1990). Although appealing as a reasonable hypothesis, no reason is given why non-local or exotic raw materials cannot be acquired through long-distance movement in Tankersley’s (1990) model. Even though the raw material used for artifact manufacture in the region of Tankersley’s (1990) study probably was obtained through direct procurement, other aspects of technological organization including group mobility strategies, percentages of formal vs. expedient tools, and expected use-life of tools along with distribution and frequencies of raw materials in a regional context must be considered in examining means of procurement in the archaeological record.

Alternatively, Hofman (1992) has suggested in the case of Folsom bison hunters in the Southern Plains that mobility is primarily responsible for the distribution of exotic raw materials within a 100-300 km range. This proposition is based upon the relatively common occurrence of exotic raw materials within the above range in Folsom assemblages, uneven distribution of raw material sources in the region, a projected high mobility for Folsom groups based upon migratory bison hunting, and the "embeddedness" of lithic extraction within the settlement system (e.g. Binford 1979). Embedded lithic procurement implies that groups scheduled trips to raw material sources during seasonal rounds.

The uneven occurrence of quality lithic raw material in the Southwest in relation to other resources such as bison herds often made the next quarry visit less predictable for these groups than with the eastern U.S. Paleoindian groups. Groups of Folsom hunters traveled long distances following herds of bison without re-tooling or knowing when the next quarry may be visited. Efficient and conservative lithic use is evident through the correlation of declining projectile point length and distance to the raw material source and is employed as a key to mobility (Hofman 1991). High mobility in regions of uneven lithic resource
distribution is indicated by short, re-sharpened points manufactured from distant raw material sources (Hofman 1991). Lithic extraction most likely was embedded as part of the seasonal mobility strategy requiring prolonging the use-life of tools between quarry visits.

Without a knowledge of the raw material sources of the lithic classes in the Anzick assemblage, any speculation on the relationships between lithic procurement and mobility of the group(s) responsible for the deposition of the Anzick assemblage is tentative. However, accepting the arguments above relating raw material sources, projectile point resharpening, and mobility, some suggestions can be made to the mode of acquisition of the exotic raw materials and the predominate raw materials as well.

Localized and uneven lithic resources characterize the distribution of Northern Plains raw material sources as well as the Southern Plains in Hofinan’s studies (1991, 1992). Exotic raw materials are present in the Anzick assemblage with projectile point #69 (Phosphoria) and biface #48 (porcellanite). Phosphoria chert sources are located approximately 150-200 km from the Anzick site in the Bighorn Mountains (Francis 1991). Point #69 is near the end of its use-life as indicated by the extensive resharpening. The porcellanite biface does not exhibit use-wear but an exact source cannot be determined except that it probably lies at a significant distance to the southeast of the Anzick site (cf. Fredlund 1976). Sources of both the Phosphoria chert and porcellanite lie within the distance suggested by Hofnan (1992) as the range of mobile Folsom big-game hunters. Exploitation of migratory big game such as mammoth and bison in both the Clovis and Folsom complexes in the Northern Plains is well-documented. It is postulated that, given similarities in raw material source distribution and big-game hunting, similar patterns of lithic use should emerge between the Southern and Northern Plains. If the manifestation of projectile point resharpening, especially on points manufactured from non-local raw materials, indicates a high degree of mobility in the Southern Plains, then the same should hold true for the Northern Plains. Is such a pattern expressed with projectile point #69? Whether or not this point is a curated tool from a prior “gearing up” and transported to the Anzick site is difficult to determine. Such may be the case, but care must be taken to declare a mobility pattern characterized by high mobility based upon a single artifact. Why the porcellanite biface does not exhibit a similar amount of resharpening or use is unclear. It could represent the final
artifact produced from an amount of this material obtained from a previous quarry visit or could have been acquired through indirect procurement, i.e. trade.

A settlement pattern characterized by a high degree of mobility may also be revealed by the proportion of bifaces relative to other artifact types. Bifaces often are considered to be multi-functional tools suited for the needs of highly mobile groups of hunter-gatherers (Kelly 1988; Kelly and Todd 1988). These needs include lightweight, easily portable stores of lithic raw material that maximize amount and versatility of the necessary tools. A reliance upon formalized rather than expedient tools emerges as a result.

Bifaces are the ideal tools that may fit the needs described above (see Kelly 1988; Kelly and Todd 1988). The largest bifaces in the Anzick and other assemblages would have served exceedingly well as bifacial cores (cf. Kelly 1988; Frison 1991). Similar artifacts recovered from Folsom assemblages have been interpreted as bifacial cores as well (Boldurian 1991; Hofman 1992). As technologically efficient artifacts (cf. Bamforth 1986; Kelly 1988), these bifacial cores would have been unsurpassed. Easily portable compared to other core types, the amount of raw material available was maximized with these artifacts. Large flakes from bifacial cores were used for production of projectile points and other tool types while the bifaces themselves may also be used in a number of functional contexts typical of formal tool types. Not all the bifaces in the Anzick assemblage were utilized as cores. Many of the thin bifaces were reliable, formal tool types that could be employed for the needs at hand. As such, bifaces do fulfill the adaptive needs of highly mobile hunter-gatherers. The abundance of bifaces in Anzick assemblage can be explained in this manner.

11.5 Conclusions

The Anzick assemblage is interpreted as a functional tool kit that also was used as an heirloom burial assemblage. Ritual activity is indicated by red ochre used to coat the entire assemblage, deliberate breakage of the bone foreshafts, and the burial association with young children. These were functional artifacts used in daily life and interred with the graves of the children for use in the afterlife. All the
necessary information needed to survive in the afterlife from a Paleoindian hunter's view is present in material form in the Anzick assemblage.

Extrapolating this interpretation to the other assemblages like the Anzick assemblage is not unreasonable. The similarities cross-cutting all the assemblages such as tool forms, red ochre use, and contextual information suggests all had very similar roles in Paleoindian culture in the Northern Plains-Intermontane U.S. Nevertheless, until reports of the Drake, Fenn, Simon, and East Wenatchee assemblages are available, a complete understanding of this phenomenon will not be possible. This report provides a first step in understanding this unique aspect of Paleoindian culture.
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Appendix A: Projectile Point Images
Figure A.1. Anzick Clovis point #6, A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 6
Class: projectile point

Frame No.: 1
Shap: St
Location: BL
Forc: Pr
(Morph: Mc; Sz: Vm; Frm: cnd; Spac: 0-1; Ang: cnd)

Frame No.: 2
Shap: St
Location: BL
Forc: Pr
(Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 4-5; Ang: 90°; Patt: CoTh)

Frame No.: 3
Shap: Cc
Location: BS
Forc: Pr
(Morph: Th; Sz: Md; Frm: 1/3 ol; Spac: 1-2; Ang: 90°; Patt: CoTh)

Frame No.: 4
Shap: Tr
Location: TP
Forc: Pr
(Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 0-1; Ang: 75°; Patt: CoTh)

Frame No.: 5
Shap: Cc
Location: BS
Forc: Pr
(Morph: Sh; Sz: cnd; Frm: cnd; Spac: 5-6; Ang: 180°)

Frame No.: 6
Shap: Cc
Location: BS
Forc: Pr
(Morph: Fl; Sz: Vs; Frm: no ol; Spac: --; Ang: 180°)

Frame No.: 7
Shap: Cc
Location: BS
Forc: Eg
(Morph: Ge; Sz: Vm; Frm: cnd; Spac: r; Ang: cnd)

Production Strategy Flowchart:

```
Edge Preparation  Flake Removal  Final Edge Dulling

1  ←→  2, 3

5  ↓

4

6  →  7
```
Figure A.2. Anzick Clovis Point #25, A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 25
Class: projectile point

Frame No.: 1  Location: BL  Shap: St  Forc: PnFlkRnt

Frame No.: 2  Location: BL  Shap: St  Forc: Eg  (Morph: Ge; Sz: Vm; Frm: cnd; Spac: 0-1; Ang: cnd)

Frame No.: 3  Location: BL  Shap: St  Forc: Pr  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 1-2; Ang: 90°; Patt: CoTh)

Frame No.: 4  Location: Bs  Shap: Cnd  Forc: Pr  (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 0-1; Ang: 90°)

Frame No.: 5  Location: BS  Shap: Cnd  Forc: Pr  (Morph: Th; Sz: Md; Frm: 1/3 ol; Spac: 0-1; Ang: 180°)

Frame No.: 6  Location: TP  Shap: Tr  Forc: Pr  (Morph: Sh; Sz: Md; Frm: cnd; Spac: 0-1; Ang: 40°)

Production Strategy Flowchart:

Edge Preparation  Flake Removal  Final Edge Dulling

absent

3, 4

5

6
Figure A.3. Anzick Clovis point #36, A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 36
Class: projectile point

Frame No.: 1  Location: BL  Shap: St  Forc: Pr  (Morph: Mc; Sz: Vm; Frm: cnd; Spac: 0-1; Ang: cnd)

Frame No.: 2  Location: BL, BS  Shap: St, Cc  Forc: Pr  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 3-4; Ang: 90°; Patt: CoTh)

Frame No.: 3  Location: BS  Shap: Cc  Forc: Pr  (Morph: Fl; Sz: Vs; Frm: no ol; Spac: --; Ang: 180°)

Frame No.: 4  Location: BS  Shap: Cc  Forc: Eg  (Morph: Ge; Sz: Vm; Frm: cnd; Spac: cnd; Ang: cnd)

Production Strategy Flowchart:

<table>
<thead>
<tr>
<th>Edge Preparation</th>
<th>Flake Removal</th>
<th>Final Edge Dulling</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>2</td>
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<td></td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Figure A.4. Anzick Clovis point #68, A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 68
Class: projectile point

Frame No.: 1  Location: BL  Shap: Ex  Forc: Pr  (Morph: Mc; Sz: Ml; Frm: cnd; Spac: 0-1; Ang: cnd)

Frame No.: 2  Location: BL, BS  Shap: Ex, Cc  Forc: Pr  (Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: 3-4; Ang: 90°; Patt: CoTh)

Frame No.: 3  Location: TP  Shap: Tr  Forc: Pr  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 2-3; Ang: 68°)

Frame No.: 4  Location: BS  Shap: Cc  Forc: Pr  (Morph: Sh; Sz: cnd; Frm: cnd; Spac: 5; Ang: r)

Frame No.: 5  Location: BS  Shap: Cc  Forc: Pr  (Morph: Fl; Sz: Vs; Frm: no ol; Spac: --; Ang: 180°)

Frame No.: 6  Location: BS  Shap: Cc  Forc: Eg  (Morph: Ge; Sz: Vm; Frm: cnd; Spac: cnd; Ang: cnd)

Production Strategy Flowchart:

Edge Preparation  Flake Removal  Final Edge Dulling

1  ←→  2  

4  ←→  3  

5  →  6
Figure A.5. Anzick Clovis point #69, A. ventral, B. dorsal
Artifact Production Code: Anzick Assemblage
Catalog #: 69
Class: projectile point

Frame No.: 1 Location: BL
Shap: As Forc: PrThRnt

Frame No.: 2 Location: BL
Shap: As Forc: Pr (Morph: Th; Sz: Vs-Op; Frm: 1/3 ol; Spac: 3-4; Ang: 90°; Patt: ReTh)

Frame No.: 3 Location: BS
Shap: Cc Forc: Pr (Morph: Sh; Sz: cnd; Frm: cnd; Spac: 5; Ang: 180°)

Frame No.: 4 Location: BS
Shap: Cc Forc: Pr (Morph: Fl; Sz: Vs; Frm: no ol; Spac: --; Ang: 180°)

Frame No.: 5 Location: TP
Shap: Tr Forc: Pr (Morph: Th; Sz: Op; Frm: no ol; Spac: NA; Ang: 60°)

Frame No.: 6 Location: BS
Shap: Cc Forc: Eg (Morph: Ge; Sz: Vm; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 7 Location: BL
Shap: As Forc: Pr (Morph: Mc; Sz: Ml; Frm: r; Spac: r; Ang: 90°; Patt:ReTh)

Production Strategy Flowchart:

Edge Preparation Flake Removal Final Edge Dulling

1

3 2

4

5 → 6

7
Figure A.6. Anzick Clovis point #70, A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 70
Class: projectile point

Frame No.: 1  Location: BL, BS
Shap: Ex, Cc  Forc: Pr  (Morph: Th; Sz: SI-Vs; Frm: 1/3 ol; Spac: 3-4; Ang: 90°; Patt: CoTh)

Frame No.: 2  Location: TP
Shap: Tr  Forc: Pr  (Morph: Th; Sz: SI; Frm: 1/2 ol; Spac: 0-1; Ang: 60°)

Frame No.: 3  Location: BS
Shap: Cc  Forc: Pr  (Morph: Sh; Sz: cnd; Frm: no ol; Spac: cnd; Ang: cnd)

Frame No.: 4  Location: BS
Shap: Cc  Forc: Pr  (Morph: Fl; Sz: Vs; Frm: 1/2 ol; Spac: 0-1; Ang: 180°)

Frame No.: 5  Location: BS
Shap: Cc  Forc: Eg  (Morph: Ge; Sz: Vm; Frm: cnd; Spac: cnd; Ang: cnd)

Production Strategy Flowchart:

Edge Preparation  Flake Removal  Final Edge Dulling
Figure A.7. Anzick Clovis point #82, A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 82
Class: projectile point

Frame No.: 1  Location: BL  Forc: PnFlkRnt
Shap: St

Frame No.: 2  Location: BL  (Morph: Ge; Sz: Vm; Frm: cnd; Spac: 0-1; Ang: NA)
Shap: St  Forc: Eg

Frame No.: 3  Location: BL
Shap: St  Forc: Pn (Morph: Th; Sz: Vs; Frm: no ol; Spac: 3-5; Ang: 90°; Patt: CoTh)

Frame No.: 4  Location: BL
Shap: St  Forc: Pr (Morph: Th; Sz: Md-Sl; Frm: 1/3 ol; Spac: 0-1; Ang: 90°; Patt: CoTh)

Frame No.: 5  Location: TP
Shap: Tr  Forc: Pr (Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: 1-2; Ang: 90°; Patt: CoTh)

Frame No.: 6  Location: BS
Shap: Cc  Forc: Pr (Morph: Fl; Sz: Vs; Frm: 1/3 ol; Spac: --; Ang: 180°)

Frame No.: 7  Location: BS
Shap: Cc  Forc: Pr (Morph: Th; Sz: Md; Frm: cnd; Spac: 3-4; Ang: 180°; Patt: CoTh)

Frame No.: 8  Location: BS
Shap: Cc  Forc: Eg (Morph: Ge; Sz: Vm; Frm: cnd; Spac: cnd; Ang: cnd)

Production Strategy Flowchart:

Edge Preparation  Flake Removal  Final Edge Dulling
Figure A.8. Anzick Clovis point #83, A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 83
Class: projectile point

Frame No.: 1  Location: TP
Shap: Tr  Forc: Pr  (Morph: Th; Sz: S1; Frm: 1/3 ol; Spac: 1-2; Ang: 75°)

Production Strategy Flowchart:

Flake Removal

[Diagram of Flake Removal]
Appendix B: Biface Images
Figure B.1. Anzick biface #1, A. ventral, B. dorsal
Artifact Production Code: Anzick Assemblage
Catalog #: 1
Class: biface

Production Strategy Flowchart:

edge preparation  flake removal

1 ——> 2

3

4
Figure B.2. Anzick biface #2; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 2
Class: biface

Frame No.: 1 Location: TP, BS
Shap: Tr, Cv Fore: Pn (Morph: Flk; Sz: Rnt; Frm: end; Spac: end; Ang: end)

Frame No.: 2 Location: BL
Shap: Ex Fore: Pn (Morph: Th; Sz: Rnt; Frm: >1/2 ol; Spac: end Ang: 90°)

Frame No.: 3 Location: BL
Shap: Ex Fore: Pr (Morph: Sh; Sz: Vm; Frm: r; Spac: 0; Ang: r)

Frame No.: 4 Location: BL
Shap: Ex Fore: Pn (Morph: Th; Sz: Sl-Vs; Frm: 1/2 ol; Spac: end Ang: 90°; Patt: CoTh)

Frame No.: 5 Location: BL
Shap: Ex Fore: Pr (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 0-1; Ang: 90°; Patt: CoTh)

Frame No.: 6 Location: BS
Shap: Cv Fore: Pr (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 0-1; Ang: 180°)

Frame No.: 7 Location: TP
Shap: Tr Fore: Pr (Morph: Mb; Sz: Md; Frm: 1/2 ol; Spac: 0; Ang: 52°)

Frame No.: 8 Location: BL
Shap: Ex Fore: Pr (Morph: Nt; Sz: Vm; Frm: end; Spac: 0; Ang: r)

Production Strategy Flowchart:

original surface edge preparation flake removal

1 → 2

3 ← 4

5, 6

7 ← 8
Figure B.3. Anzick biface #3; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 3
Class: biface

Frame No.: 1  Location: TP
Shap: Tr  Forc: Pn  (Morph: Th; Sz: Rnt; Frm: cnd; Spac: 0; Ang: 90°)

Frame No.: 2  Location: BL
Shap: St  Forc: Pn  (Morph: Th; Sz: Op; Frm: 2/3 ol; Spac: 0; Ang: 90°)

Frame No.: 3  Location: BL
Shap: St  Forc: Pn  (Morph: Th; Sz: Sl; Frm: cnd; Spac: r; Ang: r)

Frame No.: 4  Location: BL
Shap: St  Forc: Pr  (Morph: Sh; Sz: Vm-Ml; Frm: cnd; Spac: cnd; Ang: 121°-13°)

Frame No.: 5  Location: BS
Shap: Cv  Forc: Pn  (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: 0; Ang: 180°)

Production Strategy Flowchart:

```
edge preparation  flake removal

1

2

4  3

5
```
Figure B.4. Anzick biface #4; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 4
Class: biface

Frame No.: 1 Location: TP
Shap: Tr
Forc: Pn (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2 Location: BL
Shap: St
Forc: Pn (Morph: Th; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 3 Location: BS
Shap: St
Forc: Pn (Morph: Th; Sz: Sl; Frm: cnd; Spac: 0; Ang: 180°)

Frame No.: 4 Location: BL
Shap: St
Forc: Pr (Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: r; Ang: r)

Frame No.: 5 Location: BL
Shap: St
Forc: Pn (Morph: Th; Sz: Sl; Frm: no - 1/2 ol; Spac: r; Ang: 90°; Patt: CoTh)

Frame No.: 6 Location: TP
Shap: Tr
Forc: Pr (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1 ————> 2

3 ————> 4

5 ————> 6
Figure B.5. Anzick biface #7; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 7
Class: biface

Frame No.: 1  Location: BL
Shap: Ex  Force: Pn  
\(\text{Morph: Flk}; \text{Sz: Rnt}; \text{Frm: cnd}; \text{Spac: -}; \text{Ang: -}\)

Frame No.: 2  Location: BS
Shap: Cv  Force: Pn  
\(\text{Morph: Th}; \text{Sz: Vs}; \text{Frm: 1/3 ol}; \text{Spac: 0}; \text{Ang: 160}^\circ\)

Frame No.: 3  Location: BL
Shap: Ex  Force: Pn  
\(\text{Morph: Th}; \text{Sz: Op}; \text{Frm: no ol}; \text{Spac: 0}; \text{Ang: 61}^\circ\)

Frame No.: 4  Location: TP, BL
Shap: Tr, Ex  Force: Pn  
\(\text{Morph: Mb}; \text{Sz: Ml}; \text{Frm: 1/3 ol}; \text{Spac: r}; \text{Ang: r}\)

Frame No.: 5  Location: BL
Shap: Ex  Force: Pn  
\(\text{Morph: Th}; \text{Sz: Sl}; \text{Frm: 1/3 ol}; \text{Spac: 3-4}; \text{Ang: 49}^\circ\)

Frame No.: 6  Location: TP, BL
Shap: Tr, Ex  Force: Pr  
\(\text{Morph: Sh}; \text{Sz: Vm-Ml}; \text{Frm: r}; \text{Spac: r}; \text{Ang: r}\)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

\[
1 \quad 2 \\
\downarrow \\
3 \quad 4 \\
5 \\
\downarrow \\
6
\]
Figure B.6. Anzick biface #8; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 8
Class: biface

Frame No.: 1  Location: BL
Shap: St   Fore: Pn  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 5; Ang: 90°)

Frame No.: 2  Location: TP
Shap: Tr   Fore: Pn  (Morph: Th; Sz: Op; Frm: 1/3 ol; Spac: NA; Ang: 37°)

Frame No.: 3  Location: BL, BS
Shap: St, Cc  Fore: Eg  (Morph: Mb; Sz: Ml; Frm: cnd; Spac:0-1; Ang: r)

Frame No.: 4  Location: BS
Shap: Cc   Fore: Pn  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 0; Ang: 180°)

Production Strategy Flowchart:

edge preparation  flake removal

1

3 ← 2

4
Figure B.7. Anzick biface #9; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 9
Class: biface

Frame No.: 1
Location: BL
Shap: As
Forc: Pn (Morph: Th; Sz: Op; Frm: 1/3 ol; Spac: cnd; Ang: 63°)

Frame No.: 2
Location: BL
Shap: As
Forc: Pn (Morph: Th; Sz: Sl; Frm: no ol; Spac: 0; Ang: 84°)

Frame No.: 3
Location: TP
Shap: Tr
Forc: Pn (Morph: Th; Sz: Rnt; Frm: 1/3 ol; Spac: cnd; Ang: cnd)

Frame No.: 4
Location: TP
Shap: Tr
Forc: Pr (Morph: Sh; Sz: Vm; Frm: cnd; Spac: 0; Ang: cnd)

Frame No.: 5
Location: BS
Shap: As
Forc: Pn (Morph: Th; Sz: Vs; Frm: 1/2 ol; Spac: NA; Ang: 173°)

Frame No.: 6
Location: BS
Shap: As
Forc: Gr (Morph: Eg; Sz: Vm; Frm: cnd; Spac: 0; Ang: r)

Production Strategy Flowchart:

edge preparation  flake removal

1

2

3 4

5

6
Figure B.8. Anzick biface #10; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 10
Class: biface

Frame No.: 1  Location: BL  Shap: Ex  Forc: Pn  (Morph: Th; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 5  Location: TP  Shap: Tr  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 6  Location: TP  Shap: Tr  Forc: Pn  (Morph: Th; Sz: Sl; Frm: no ol; Spac: 0; Ang: 57°)

Frame No.: 7  Location: TP  Shap: Tr  Forc: Pr  (Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: NA; Ang: 27°; Patt: CoTh)

Frame No.: 2  Location: BL, BS  Shap: Ex, Cv  Forc: Pr  (Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 3  Location: BL  Shap: Ex  Forc: Pn  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 10+; Ang: 90°; Patt: CoTh)

Frame No.: 4  Location: BS  Shap: Cv  Forc: Pr  (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 3-4; Ang: 143°; Patt: CoTh)

Production Strategy Flowchart:

```
edge preparation  tip production  blade production  base production
```

```
1 → 2 → 3 → 5 → 6
```

```
↑
```

```
4
```

Figure B.9. Anzick biface #12; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 12
Class: biface

Frame No.: 1 Location: BL
Shap: Ex Forc: Pn (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2 Location: TP, BL
Shap: Tr, Ex Forc: Pr (Morph: Sh; Sz: Ml; Frm: r; Spac: 0-1; Ang: r)

Frame No.: 3 Location: TP, BL
Shap: Tr, Ex Forc: Pn (Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: 8+; Ang: 82°; Patt: CoTh)

Frame No.: 4 Location: BS
Shap: Cv Forc: Pr (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 5 Location: BS
Shap: Cv Forc: Pn (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: cnd; Ang: 148°)

Frame No.: 6 Location: TP
Shap: Tr Forc: Pr (Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: 0; Ang: 58°; Patt: CoTh)

Production Strategy Flowchart:

original surface edge preparation flake removal

1 → 2, 4 → 3, 5 → 6
Figure B.10. Anzick biface #13; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 13
Class: biface

Frame No.: 1 Location: TP
Shap: Tr  Fore: Pn  (Morph: Flk; Sz: Rnt; Frm: end; Spac: end; Ang: end)

Frame No.: 2 Location: BL
Shap: Tr  Fore: Pn  (Morph: Th; Sz: Rnt; Frm: no ol; Spac: 0; Ang: 90°)

Frame No.: 3 Location: BL
Shap: St  Fore: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0-1; Ang: r)

Frame No.: 4 Location: BL
Shap: St  Fore: Pn  (Morph: Th; Sz: Md-Sl; Frm: no ol; Spac: 0; Ang: 90°)

Frame No.: 5 Location: BS
Shap: St  Fore: Pn  (Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 134°)

Frame No.: 6 Location: TP
Shap: Tr  Fore: Pn  (Morph: Th; Sz: Sl; Frm: no ol; Spac: 0; Ang: 35°)

Frame No.: 7 Location: TP
Shap: Tr  Fore: Pr  (Morph: Sh; Sz: Md; Frm: 1/2 ol; Spac: 0-1; Ang: 35°)

Production Strategy Flowchart:

original surface  edge preparation  flake removal
Figure B.11. Anzick biface #14; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 14
Class: biface

Frame No.: 1 Location: BL  
Shap: St Forc: Pr  (Morph: Sh; Sz: Vm; Frm: r; Spac: 0; Ang: 90°)

Frame No.: 2 Location: BL  
Shap: St Forc: Pn  (Morph: Th; Sz: Sl-Vs; Frm: r; Spac: 10+; Ang: 90°)

Frame No.: 3 Location: BS  
Shap: St Forc: Pr  (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 0; Ang: 90°-180°)

Frame No.: 4 Location: BS  
Shap: St Forc: Pn  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 0; Ang: 180°)

Frame No.: 5 Location: TP  
Shap: Tr Forc: Pn  (Morph: Th; Sz: Rnt; Frm: >1/2 ol; Spac: end; Ang: end)

Frame No.: 6 Location: TP  
Shap: Tr Forc: Pr  (Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: 0; Ang: 49°)

Production Strategy Flowchart:

edge preparation  flake removal

1  2
   ↓  ↓
3  4
   ↓  ↓
5  6
Figure B.12. Anzick biface #15; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 15
Class: biface

Frame No.: 1  Location: BL  Shap: As  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: cnd; Spac: r; Ang: r)
Frame No.: 2  Location: BL  Shap: As  Forc: Pn  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 5+; Ang: 57°-90°; Patt: CoTh)
Frame No.: 3  Location: BS  Shap: St  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: 0; Ang: 180°)
Frame No.: 4  Location: BS  Shap: St  Forc: Pn  (Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 180°)
Frame No.: 5  Location: TP  Shap: Tr  Forc: Pr  (Morph: Sh; Sz: Ml-Md; Frm: r; Spac: r; Ang: r)
Frame No.: 6  Location: TP  Shap: Tr  Forc: Pn  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 5; Ang: 68°)

Production Strategy Flowchart:

edge preparation  flake removal

1, 3, 5  ←→  2, 4, 6
Figure B.13. Anzick biface #16; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 16
Class: biface

Frame No.: 1 Location: BL
Shap: Tr Forc: Pn (Morph: Fk; Sz: Rnt; Frm: -; Spac: -; Ang: -)

Frame No.: 2 Location: BS
Shap: Cv Forc: Pn (Morph: Th; Sz: Op; Frm: 1/3 ol; Spac: 0-1; Ang: 90°)

Frame No.: 3 Location: BS
Shap: Cv Forc: Pn (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 1-2; Ang: 143°)

Frame No.: 4 Location: BL
Shap: Ex Forc: Pn (Morph: Mbl; Sz: Ml; Frm: r; Spac: 0-1; Ang: 90°)

Frame No.: 5 Location: BL
Shap: Ex Forc: Pn (Morph: Th; Sz: Sl; Frm: 2/3 ol; Spac: 0-1; Ang: 90°; Patr: CoTh)

Frame No.: 6 Location: TP
Shap: Tr Forc: Pr (Morph: Sh; Sz: Ml; Frm: cnd; Spac: 0-1; Ang: 38°)

Production Strategy Flowchart:

original surface flake removal edge preparation

1 → 2

3 → 4

5

6
Figure B.14. Anzick biface #17; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 17
Class: biface

Frame No.: 1  Location: TP, BL, BS
Shap: all AS  Forc: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: BL
Shap: As  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 3  Location: BL, BS
Shap: As  Forc: Pn  (Morph: Th; Sz: Md-SI; Frm: no ol; Spac: r; Ang: 63°)

Production Strategy Flowchart:

edge preparation  flake removal

2  →  1

→  3
Figure B.15. Anzick biface #18; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 18
Class: biface

Frame No.: 1  Location: BL
Shap: Tr  Forc: Pn  (Morph: Th; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: BL
Shap: St  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: 1/3 ol; Spac:0-1; Ang: r)

Frame No.: 3  Location: BS
Shap: Cv  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: 180°)

Frame No.: 4  Location: BL
Shap: St  Forc: Pn  (Morph: Th; Sz: Op; Frm: no ol; Spac: 0; Ang: 90°)

Frame No.: 5  Location: BL
Shap: St  Forc: Pn  (Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: 10+; Ang: 81°-117°)

Frame No.: 6  Location: TP
Shap: St  Forc: Pr  (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 0; Ang: 52°)

Production Strategy Flowchart:

edge preparation  flake removal

1

2  4

3  5

6
Figure B.16. Anzick biface #20; A. ventral; B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 20
Class: biface

Frame No.: 1 Location: BL
Shap: St Forc: Pn (Morph: Flk; Sz: Rnt; Frm: end; Spac: end; Ang: end)

Frame No.: 2 Location: BL
Shap: Tr Forc: Pn (Morph: Th; Sz: Op; Frm: >1/2 ol; Spac: end; Ang: end)

Frame No.: 3 Location: BS
Shap: St Forc: Pn (Morph: Th; Sz: Vs; Frm: end; Spac: 0; Ang: 165°)

Frame No.: 4 Location: BL, BS
Shap: St, St Forc: Pr (Morph: Sh; Sz: Mi-Md; Frm: r; Spac: 0-1; Ang: r)

Frame No.: 5 Location: BL
Shap: St Forc: Pn (Morph: Th; Sz: Vs; Frm: r; Spac: -; Ang: 90°; Patt: CoTh)

Frame No.: 6 Location: Tp
Shap: Tr Forc: Pn (Morph: Th; Sz: Vs; Frm: end; Spac: 0; Ang: 90°)

Frame No.: 7 Location: Tp
Shap: St Forc: Pr (Morph: Sh; Sz: Sl; Frm: end; Spac: 1-2; Ang: r)

Production Strategy Flowchart:

original surface edge preparation flake removal

1 —— 2 —— 3 —— 4 —— 5 —— 6 —— 7
Figure B.17. Anzick biface #21; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 21
Class: biface

Frame No.: 1 Location: TP
Shap: Tr  Forc: Pn  (Morph: Flk; Sz: Rnt; Frm: end; Spac: end; Ang: end)

Frame No.: 2 Location: BL
Shap: St  Forc: Pr  (Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 3 Location: BL
Shap: St  Forc: Pn  (Morph: Th; Sz: Vs; Frm: 1/2 ol; Spac: end; Ang: 90°; Patt: CoTh)

Frame No.: 4 Location: BL
Shap: St  Forc: Pr  (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 1-2; Ang: 90°; Patt: CoTh)

Frame No.: 5 Location: BS
Shap: Cv  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 6 Location: BS
Shap: Cv  Forc: Pn  (Morph: Th; Sz: sl; Frm: end; Spac: 0; Ang: 170°)

Frame No.: 7 Location: TP
Shap: Tr  Forc: Pn  (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: 5; Ang: 90°)

Frame No.: 8 Location: TP
Shap: Tr  Forc: Pr  (Morph: Th; Sz: Md-Sl; Frm: 1/2 ol; Spac: 0-1; Ang: 90°)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1 → 2, 5 ← 3, 6

4

7

8
Figure B.18. Anzick biface #22; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 22
Class: biface

Frame No.: 1  Location: BL  Shap: As  Forc: Pn  (*Morph: Fk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd*)

Frame No.: 2  Location: BL  Shap: As  Forc: Pn  (*Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: 8+; Ang: 77°; Patt: CoTh*)

Frame No.: 3  Location: BL  Shap: As  Forc: Pr  (*Morph: Sh; Sz: Md-SI; Frm: r; Spac: r; Ang: r*)

Frame No.: 4  Location: BS  Shap: Cv  Forc: Pr  (*Morph: Sh; Sz: Md-SI; Frm: r; Spac: r; Ang: r*)

Frame No.: 5  Location: BS  Shap: Cv  Forc: Pn  (*Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 180°*)

Frame No.: 6  Location: TP  Shap: Tr  Forc: Pr  (*Morph: Mb; Sz: Vm; Frm: 1/3 ol; Spac: 0; Ang: 40°*)

Frame No.: 7  Location: TP  Shap: Tr  Forc: Pn  (*Morph: Th; Sz: Op; Frm: 1/3 ol; Spac: cnd; Ang: 56°*)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

```
1  -------------------------  2, 5

3, 4  \  \\
   \  \\
   \  \\
   6  \  \\
    \  \\
     \  \\
      7
```
Figure B.19. Anzick biface #24; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 24
Class: biface

Frame No.: 1  Location: BL  Shap: Ex  Forc: Pn  (Morph: Th; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)
Frame No.: 2  Location: BL  Shap: Ex  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: r; Ang: r)
Frame No.: 3  Location: BL  Shap: Ex  Forc: Pn  (Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: 10+; Ang: 90°)
Frame No.: 4  Location: BS  Shap: Cv  Forc: Pr  (Morph: Sh; Sz: Ml-Md; Frm: r; Spac: 0; Ang: r)

Production Strategy Flowchart:

edge preparation  flake removal

```
  2  ←  1
   ↑  ↓  3
    ↓  ↓
     ↓  4
```
Figure B.20. Anzick biface #26; A. ventral; B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 26
Artifact class: biface

Frame No.: 1  Location: TP, BL
Shap: As, Ex  Forc: Prn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: BL
Shap: Ex  Forc: Pr  (Morph: Mb; Sz: Vm; Frm: cnd; Spac: r; Ang: r)

Frame No.: 3  Location: BL
Shap: Ex  Forc: Prn  (Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: cnd; Ang: ca. 90°; Patt: CoTh)

Frame No.: 4  Location: BS
Shap: Cv  Forc: Pr  (Morph: Mb; Sz: Vm; Frm: cnd; Spac: r; Ang: r)

Frame No.: 5  Location: BS
Shap: Cv  Forc: Pr  (Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 180°)

Frame No.: 6  Location: TP
Shap: As  Forc: Pr  (Morph: Sh; Sz: Vm; Frm: r; Spac: 0; Ang: r)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1 → 2,4 ← 3,5

...↓

6
Figure B.21. Anzick biface #27; A. ventral, B. dorsal
Artifact Production Code: Anzick Assemblage
Catalog #: 27
Class: biface

Frame No.: 1  Location Tp, Bl, BS
Shap: Cv       Forc: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: BL
Shap: Ex      Forc: Pr  (Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: 0; Ang: 90°)

Frame No.: 3  Location: BL
Shap: Ex      Forc: Pn  (Morph: Th; Sz: Sl; Frm: no ol; Spac: 2-3; Ang: 90°; Patt: CoTh)

Frame No.: 4  Location: TP
Shap: Tr      Forc: Pr  (Morph: Sh; Sz: Ml; Frm: cnd; Spac: 0-1; Ang: r)

Production Strategy Flowchart:

```
original surface edge preparation flake removal

1  2  3
   ↓
  4
```

Forc: Pn (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Forc: Pr (Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: 0; Ang: 90°)

Forc: Pn (Morph: Th; Sz: Sl; Frm: no ol; Spac: 2-3; Ang: 90°; Patt: CoTh)

Forc: Pr (Morph: Sh; Sz: Ml; Frm: cnd; Spac: 0-1; Ang: r)
Figure B.22. Anzick biface #28; A. ventral; B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 28
Class: biface

Frame No.: 1  Location: TP
  Shap: Tr  Fore: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: BL
  Shap: St  Fore: Pn  (Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: 5-10; Ang: 90°; Patt: CoTh)

Frame No.: 3  Location: BL
  Shap: St  Fore: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 1-5; Ang: r)

Frame No.: 4  Location: BL
  Shap: St  Fore: Pr  (Morph: Th; Sz: Sl; Frm: r; Spac: 0-3; Ang: ca. 90°)

Frame No.: 5  Location: BS
  Shap: St  Fore: Pr  (Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: 0; Ang: ca. 180°)

Frame No.: 6  Location: BS
  Shap: St  Fore: Pn  (Morph: Th; Sz: Vs; Frm: no ol; Spac: NA; Ang: 142°)

Frame No.: 7  Location: TP
  Shap: Tr  Fore: Pn  (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: cnd; Ang: 90°)

Frame No.: 8  Location: TP
  Shap: Tr  Fore: Pr  (Morph: Th; Sz: Md; Frm: 1/3 ol; Spac: 0; Ang: 65°)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1  \rightarrow 2

\downarrow 3,5

\leftrightarrow 4, 6

\downarrow 7

\downarrow 8
Figure B.23. Anzick biface #30; A. ventral; B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 30
Artifact class: biface

Frame No.: 1 Location: BS  
Shap: St  
Forc: Pr (Morph: Sh; Sz: Ml; Frm: r; Spac: r; Ang: r)

Frame No.: 2 Location: BS  
Shap: St  
Forc: Pn (Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 180°)

Frame No.: 3 Location: BL  
Shap: St  
Forc: Pr (Morph: Mb; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: 90°)

Frame No.: 4 Location: BL  
Shap: St  
Forc: Pn (Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: cnd; Ang: ca. 90°; Patt: CoTh)

Frame No.: 5 Location: TP  
Shap: Tr  
Forc: Pr (Morph: Sh; Sz: Ml; Frm: 1/3 ol; Spac: 0-2; Ang: r)

Frame No.: 6 Location: TP  
Shap: Tr  
Forc: Pn (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 5; Ang: 48°)

Production Strategy Flowchart:

edge preparation  flake removal

1, 3, 5 ←→ 2, 4, 6
Figure B.24. Anzick biface #31; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 31
Class: biface

Frame No.: 1 Location: BL
Shap: As Forc: Pn (Morph: Th; Sz: Op; Frm: Rnt; Spac: end; Ang: end)

Frame No.: 2 Location: BL
Shap: As Forc: Pn (Morph: Th; Sz: Md-SI; Frm: 1/2 ol; Spac: r; Ang: r)

Frame No.: 3 Location: BL
Shap: As Forc: Pr (Morph: Sh; Sz: MI-Md; Frm: 1/2 ol; Spac: o; Ang: r)

Frame No.: 4 Location: BL
Shap: As Forc: Pn (Morph: Th; Sz: Md; Frm: no ol; Spac: 0; Ang: 56°)

Frame No.: 5 Location: BS
Shap: Cv Forc: Pr (Morph: Sh; Sz: MI-Md; Frm: 1/2 ol; Spac: o; Ang: r)

Frame No.: 6 Location: TP
Shap: Tr Forc: Pn (Morph: Th; Sz: Sl; Frm: no ol; Spac: 0; Ang: 53°)

Production Strategy Flowchart:

```
tip production  | blade production | edge preparation | base production
1               | 2               | 3               | 5
```

Diagram:
```
1 --|--   2 --> 3 --> 5
   |     |     |
   |     |     |
   |     |     |
   3    4   5
```
Artifact Production Code: Anzick Assemblage
Catalog #:
Class:

Frame No.: 1  Location: BL
  Shap: St  Force: Pn  (Morph: Th; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: BL
  Shap: St  Force: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 3  Location: BL
  Shap: St  Force: Pn  (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: 4-5; Ang: 90°)

Frame No.: 4  Location: BL
  Shap: St  Force: Pr  (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 0; Ang: 90°)

Production Strategy Flowchart:

```
  edge preparation  flake removal

  2  ←  1
      ↓
      ↓
  3  ←

  4
```
Figure B.26. Anzick biface #33; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 33
Class: biface

<table>
<thead>
<tr>
<th>Frame No.</th>
<th>Location</th>
<th>Shap.</th>
<th>Force</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BL</td>
<td>Ex</td>
<td>Pr</td>
<td>(Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: r)</td>
</tr>
<tr>
<td>2</td>
<td>BL</td>
<td>Ex</td>
<td>Pn</td>
<td>(Morph: Th; Sz: Op; Frm: 1/2 ol; Spac: 7-10; Ang: 67°; Patt: CoTh)</td>
</tr>
<tr>
<td>3</td>
<td>BL</td>
<td>Ex</td>
<td>Pn</td>
<td>(Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 90°)</td>
</tr>
<tr>
<td>4</td>
<td>BS</td>
<td>Cv</td>
<td>Pr</td>
<td>(Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: 0; Ang: r)</td>
</tr>
<tr>
<td>5</td>
<td>BS</td>
<td>Cv</td>
<td>Pn</td>
<td>(Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 146°)</td>
</tr>
<tr>
<td>6</td>
<td>TP</td>
<td>Tr</td>
<td>Pr</td>
<td>(Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: r)</td>
</tr>
<tr>
<td>7</td>
<td>TP</td>
<td>Tr</td>
<td>Pn</td>
<td>(Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 57°)</td>
</tr>
</tbody>
</table>

Production Strategy Flowchart:

edge preparation  flake removal

1 2

3
4

5
6

7
Figure B.27. Anzick biface #34; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 34
Class: biface

Frame No.: 1 Location: TP
Shap: Tr Forc: Pn (Morph: Th; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2 Location: BL
Shap: Ex Forc: Pr (Morph: Sh; Sz: Ml; Frm: cnd; Spac: r; Ang: cnd)

Frame No.: 3 Location: BL
Shap: Ex Forc: Pn (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 5+; Ang: 90°; Patt: CoTh)

Frame No.: 4 Location: BS
Shap: St Forc: Pr (Morph: Sh; Sz: Ml; Frm: cnd; Spac: r; Ang: ca. 180°)

Frame No.: 5 Location: BS
Shap: St Forc: Pn (Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: 2; Ang: 180°)

Frame No.: 6 Location: TP
Shap: Tr Forc: Pr (Morph: Sh; Sz: Ml; Frm: cnd; Spac: r; Ang: r)

Frame No.: 7 Location: TP
Shap: Tr Forc: Pn (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: 10+; Ang: 43°)

Production Strategy Flowchart:

```
edge preparation flake removal

1

2, 4, 6 3, 5, 7
```

Location: TP
Fore: Pr (Morph: Sh; Sz: MI; Frm: 1/3 ol; Spac: 10+; Ang: 43°)
Figure B.28. Anzick biface #35; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 35
Class: biface

Frame No.: 1  Location: TP
Shap: As  Forec: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: -; Ang: -)

Frame No.: 2  Location: BL
Shap: As  Forec: Pn  (Morph: Th; Sz: Op; Frm: >1/2 ol; Spac: cnd; Ang: cnd)

Frame No.: 3  Location: BL
Shap: As  Forec: Pn  (Morph: Th; Sz: Sl; Frm: no ol; Spac: r; Ang: r)

Frame No.: 4  Location: BL
Shap: As  Forec: Pr  (Morph: Sh; Sz: MI-Md; Frm: r; Spac: 0-1; Ang: r)

Production Strategy Flowchart:

\[
\begin{array}{ccc}
\text{original surface} & \text{edge production} & \text{flake removal} \\
1 & \rightarrow & 2 \\
2 & \rightarrow & 3 \\
3 & \leftarrow & 4 \\
\end{array}
\]
Figure B.29. Anzick biface #41; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 41
Class: biface

Frame No.: 1  Location: BS
Shap: Cv    Forc: Pn  (Morph: Th; Sz: Rnt; Frm: cnd; Spac: NA; Ang: 180°)

Frame No.: 2  Location: BL, BS
Shap: St, Cv  Forc: Pn  (Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: 10+; Ang: 90°; Patt: CoTh)

Frame No.: 3  Location: BL
Shap: St    Forc: Pr  (Morph: Th; Sz: Md-Sl; Frm: 1/2 ol; Spac: 1-3; Ang: 90°; Patt: CoTh)

Frame No.: 4  Location: TP
Shap: Tr    Forc: Pr  (Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: 0; Ang: 60°)

Production Strategy Flowchart:

flake removal

1

↓

2

↓

3

↓

4
Figure B.30. Anzick biface #42; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 42
Class: biface

Frame No.: 1  Location: TP
Shap: Tr   Fore: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: BL
Shap: St   Fore: Pn  (Morph: Th; Sz: SI-Vs; Frm: 1/3 ol; Spac: 10+; Ang: 90⁰; Patt: CoTh)

Frame No.: 3  Location: BL
Shap: St   Fore: Pr  (Morph: Th; Sz: Mi-md; Frm: r; Spac: r; Ang: 90⁰)

Frame No.: 4  Location: BS
Shap: St   Fore: Pr  (Morph: Mb; Sz: Vm; Frm: r; Spac: 0; Ang: 180⁰)

Frame No.: 5  Location: BS
Shap: St   Fore: Pn  (Morph: Th; Sz: Sl; Frm: no ol; Spac: 0; Ang: 180⁰)

Frame No.: 6  Location: TP
Shap: Tr   Fore: Pr  (Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: 0-1; Ang: 55⁰)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1   2

3

4

5

6
Figure B.31. Anzick biface #43; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 43
Class: biface

Frame No.: 1 Location: TP
Shap: Tr
Forc: Pn (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2 Location: BL
Shap: St
Forc: Pr (Morph: Sh; Sz: Mi-Md; Frm: r; Spac: 0; Ang: 90°)

Frame No.: 3 Location: BL
Shap: St
Forc: Pn (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 10+; Ang: 90°; Patt: CoTh)

Frame No.: 4 Location: BS
Shap: Cv
Forc: Pr (Morph: Sh; Sz: Mi; Frm: r; Spac: 0-2; Ang: r)

Frame No.: 5 Location: TP
Shap: Tr
Forc: Pn (Morph: Th; Sz: Op; Frm: 1/3 ol; Spac: NA; Ang: 90°)

Frame No.: 6 Location: TP
Shap: Tr
Forc: Pr (Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: 1-2; Ang: 52°; Patt: CoTh)

Production Strategy Flowchart:

original surface  edge preparation  flake removal
Figure B.32. Anzick biface #44; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 44
Class: biface

Frame No.: 1 Location: BL
Shap: St Forc: Pn (Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: 10+; Ang: 90°; Patt: CoTh)

Frame No.: 2 Location: BL
Shap: St Forc: Pr (Morph: Th; Sz: Md-Sl; Frm: 1/2 ol; Spac: 0-4; Ang: 90°; Patt: CoTh)

Frame No.: 3 Location: BS
Shap: Cv Forc: Pr (Morph: Sh; Sz: Mi; Frm: r; Spac: 0; Ang: r)

Frame No.: 4 Location: BS
Shap: Cv Forc: Pn (Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 151°)

Frame No.: 5 Location: TP
Shap: St Forc: Pn (Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: 2-3; Ang: 90°; Patt: CoTh)

Frame No.: 6 Location: TP
Shap: St Forc: Pr (Morph: Th; Sz: Md-Sl; Frm: 1/2 ol; Spac: 0-2; Ang: 90°; Patt: CoTh)

Production Strategy Flowchart:

edge preparation flake removal

1

2

3

4

...

5

6
Figure B.33. Anzick biface #45; A. ventral; B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 45
Artifact class: biface

Frame No.: 1  Location: BL
Shap: St  Forc: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: TP, BL, BS
Shap: Tr, St, St  Forc: Pr  (Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 3  Location: BL
Shap: St  Forc: Pn  (Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: 10+; Ang: 90°; Patt: CoTh)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1  →  2  →  3
Figure B.34. Anzick biface #46; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 46
Class: biface

Frame No.: 1 Location: BL
Shap: Ex Forc: Pr (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 2 Location: TP, BL
Shap: Nn Forc: Pn (Morph: Th; Sz: Sl-Vs; Frm: r; Spac: 10+; Ang: 47°, ca. 90°)

Frame No.: 3 Location: BS
Shap: Cv Forc: Pr (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Production Strategy Flowchart:

1. edge preparation
2. flake removal
3. 

Diagram:

edge preparation  flake removal
Figure B.35. Anzick biface #47; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 47
Class: biface

Frame No.: 4 Location: TP
Shap: Tr Forc: Pr (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 1 Location: BL
Shap: Ex Forc: Pn (Morph: Th; Sz: Vs; Frm: r; Spac: >10; Ang: ca. 90°)

Frame No.: 2 Location: BL
Shap: Ex Forc: Pr (Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 3 Location: BL
Shap: Ex Forc: Pn (Morph: Th; Sz: Vs; Frm: r; Spac: end; Ang: 90°; Patt: CoTh)

Production Strategy Flowchart:

edge preparation flake removal
Figure B.36. Anzick biface #48; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 48
Class: biface

Frame No.: 1 Location: BS
Shap: St Forc: Pn (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: NA; Ang: 166°)

Frame No.: 2 Location: BL
Shap: Ex Forc: Pn (Morph: Th; Sz: Op; Frm: 1/2 ol; Spac: r; Ang: 90°)

Frame No.: 3 Location: TP
Shap: Tr Forc: Pn (Morph: Th; Sz: Op; Frm: no ol; Spac: 0; Ang: 68°)

Frame No.: 4 Location: BL
Shap: Ex Forc: Pr (Morph: Sh; Sz: Ml; Frm: 1/3 ol; Spac: 0-1; Ang: r)

Frame No.: 5 Location: BS
Shap: St Forc: Pr (Morph: Sh; Sz: Ml; Frm: 1/3 ol; Spac: 0-1; Ang: r)

Frame No.: 6 Location: TP
Shap: Tr Forc: Pr (Morph: Th; Sz: Md-Ml; Frm: 1/3 ol; Spac: r; Ang: r)

Production Strategy Flowchart:

edge preparation flake removal

1

↓

2

↓

3 ← 4

↓

5 → 6
Figure B.37. Anzick biface #49; A. ventral; B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 49
Class: biface

Frame No.: 1  Location: BL
Shap: St  Forc: Pn  (Morph: Th; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: BL, BS
Shap: St, St  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: 90°)

Frame No.: 3  Location: BS
Shap: St  Forc: Pr  (Morph: Th; Sz: Sli; Frm: cnd; Spac: 0; Ang: 180°)

Frame No.: 4  Location: BL
Shap: St  Forc: Pn  (Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: cnd; Ang: 90°; Patt: CoTh)

Frame No.: 5  Location: TP
Shap: Tr  Forc: Pn  (Morph: Th; Sz: Op; Frm: 1/3 ol; Spac: NA; Ang: 90°)

Frame No.: 6  Location: Tp
Shap: St  Forc: Pr  (Morph: Sh; Sz: Vm; Frm: cnd; Spac: 0; Ang: 79°)

Production Strategy Flowchart:

edge preparation  flake removal

2 1, 4 3 5 6

277
Figure B.38. Anzick biface #50; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 50
Class: biface

Frame No.: 1  Location: BL
Shap: As  Forc: Pn  (Morph: Th; Sz: Op; Frm: 1/3 ol; Spac: 0; Ang: 90°)

Frame No.: 2  Location: BL
Shap: Ex  Forc: Pn  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 0; Ang: 90°)

Frame No.: 3  Location: BS
Shap: Ex  Forc: Pn  (Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 180°)

Frame No.: 4  Location: Tp
Shap: Ex  Forc: Pr  (Morph: Sh; Sz: Md; Frm: cnd; Spac: r; Ang: 35°)

Production Strategy Flowchart:

edge preparation  flake removal

1

2

4 ← 3
Figure B.39. Anzick biface #51; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 51
Class: biface

Frame No.: 1 Location: TP
Shap: Tr Forc: Pn (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2 Location: BL
Shap: Ex Forc: Pr (Morph: Mb; Sz: Ml; Frm: cnd; Spac: 2-3; Ang: 2)

Frame No.: 3 Location: BL
Shap: Ex Forc: Pn (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: cnd; Ang: 71°; Patt: CoTh)

Frame No.: 4 Location: BL, BS
Shap: Ex, Cv Forc: Pr (Morph: Th; Sz: Md; Frm: 1/3 ol; Spac: 0-1; Ang: r)

Frame No.: 5 Location: TP
Shap: Tr Forc: Pr (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac:0-1; Ang: 26°)

Production Strategy Flowchart:

original surface → edge preparation → flake removal

[Diagram showing the flowchart with numbered frames and directions]
Figure B.40. Anzick biface #5/29; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #:
Class:

Frame No.: 1  Location: BL, BS
Shap: As, Cv  Forc: Pr  (Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 2  Location: BL, BS
Shap: As, Cv  Forc: Pn  (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: 10+; Ang: ca. 90°)

Frame No.: 3  Location: TP
Shap: Tr  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 4  Location: TP
Shap: Tr  Forc: Pn  (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: 10+; Ang: ca. 90°)

Frame No.: 5  Location: BL
Shap: BL  Forc: Pr  (Morph: Re; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Production Strategy Flowchart:

edge preparation  flake removal

1, 3  ➔  2, 4

↓

5
Figure B.41. Anzick biface #53; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #:
Class:

Frame No.: 1  Location: BL
Shap: Ex     Fore: Pn  \( (\text{Morph}: \text{Th}; \text{Sz}: \text{Rnt}; \text{Frm}: \text{cnd}; \text{Spac}: \text{cnd}; \text{Ang}: \text{cnd}) \)

Frame No.: 2  Location: BL
Shap: Ex     Fore: Pr  \( (\text{Morph}: \text{Sh}; \text{Sz}: \text{Vm-Ml}; \text{Frm}: \text{r}; \text{Spac}: \text{0}; \text{Ang}: \text{r}) \)

Frame No.: 3  Location: BL
Shap: Ex     Fore: Pn  \( (\text{Morph}: \text{Th}; \text{Sz}: \text{Sl}; \text{Frm}: 1/3 \text{ ol}; \text{Spac}: 10+; \text{Ang}: 90^\circ; \text{Patt}: \text{CoTh}) \)

Production Strategy Flowchart:

```
edge preparation    flake removal
2                   1
\downarrow
3
```
Figure B.42. Anzick biface #59; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 59
Class: biface

Frame No.: 1  Location: TP, BL, BS
Shap: Tr, Ex, As  Forc: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: -; Ang: cnd)

Frame No.: 2  Location: BL
Shap: Ex  Forc: Pr  (Morph: Sh; Sz: Vm; Frm: r; Spac: 0; Ang: r)

Frame No.: 3  Location: BL
Shap: Ex  Forc: Pn  (Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 39°)

Frame No.: 4  Location: BS
Shap: As  Forc: Pn  (Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 180°)

Frame No.: 5  Location: BL
Shap: As  Forc: Pn  (Morph: Th; Sz: Md; Frm: 1/3 ol; Spac: 4-5; Ang: 90°)

Frame No.: 6  Location: TP
Shap: Tr  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: 1/3 ol; Spac: 0-1; Ang: 42°)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1 → 2 → 3 → 4 → 5 → 6
Figure B.43. Anzick biface #60; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 60
Class: biface

Frame No.: 1  Location: BL, BS
Shap: St, St  Fore: Pn  (Morph: Th; Sz: Rnt; Frm: end; Spac: end; Ang: end)

Frame No.: 2  Location: TP
Shap: As  Fore: Pn  (Morph: Th; Sz: Op; Frm: no ol; Spac: 0; Ang: 39°)

Frame No.: 3  Location: BL
Shap: St  Fore: Pn  (Morph: Th; Sz: Op; Frm: 1/3 ol; Spac: 0; Ang: 90°)

Frame No.: 4  Location: TP, BL, BS
Shap: As, St, St  Fore: Pr  (Morph: Sh; Sz: MI-Md; Frm: r; Spac: r; Ang: r)

Production Strategy Flowchart:

edge preparation → flake removal

1

2

3

4
Figure B.44. Anzick biface #61; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 61
Class: biface

Frame No.: 1 Location: BL
Shap: St Fore: Pn (Morph: Th; Sz: Op; Frm: 1/2 ol; Spac: 0; Ang: 90°)

Frame No.: 2 Location: TP, BL, BS
Shap: As, St Ex Fore: Pn (Morph: Th; Sz: Op; Frm: 1/2 ol; Spac: cnd; Ang: 90°)

Frame No.: 3 Location: BL
Shap: St Fore: Pr (Morph: Sh; Sz: Vm-Ml; Frm: 1/3 ol; Spac: 0; Ang: r)

Frame No.: 4 Location: TP
Shap: As Fore: Pr (Morph: Sh; Sz: Ml; Frm: cnd; Spac: 0-1; Ang: r)

Frame No.: 5 Location: BL
Shap: St Fore: Pn (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 2-4; Ang: 86°; Patt: CoTh)

Frame No.: 6 Location: BS
Shap: Ex Fore: Pr (Morph: Th; Sz: Rnt; Frm: cnd; Spac: 10+; Ang: 180°)

Production Strategy Flowchart:

edge preparation flake removal

1

3 2

4 5

6
Figure B.45. Anzick biface #71; A. ventral; B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 71
Class: biface

Frame No.: 1 Location: BL
Shap: Ex Forc: Pn (Morph: Th; Sz: Op; Frm: 1/2 ol; Spac: cnd; Ang: 45°; Patt: CoTh)

Frame No.: 2 Location: BL
Shap: Ex Forc: Pr (Morph: Sh; Sz: Vm-Ml; Frm: cnd; Spac: 0; Ang: r)

Frame No.: 3 Location: BL
Shap: Ex Forc: Pn (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 10+; Ang: 90°; Patt: CoTh)

Frame No.: 4 Location: BS
Shap: Cv Forc: Pr (Morph: Th; Sz: Md; Frm: r; Spac: r; Ang: 90°)

Frame No.: 5 Location: BS
Shap: Cv Forc: Pn (Morph: Th; Sz: Vs; Frm: no ol; Spac: NA; Ang: 160°)

Frame No.: 6 Location: TP
Shap: Tr Forc: Pr (Morph: Sh; Sz: Mi-Md; Frm: cnd; Spac: 0-1; Ang: NA)

Production Strategy Flowchart:

edge preparation flake removal

```
  2  1
  ↓  →
  3  ↓
  ↓  ↓
  4  ↓
  ↓  ↓
  5  ↓
  ↓  ↓
  6
```
Figure B.46. Anzick biface #72; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 72
Class: biface

Frame No.: 1  Location: TP, BL
Shap: Tr, St  Forc: Pn  (*Morph: Th; Sz: Sl-Vs; Frm: 1/3 ol; Spac: 8+; Ang: 90°; Patt: CoTh*)

Frame No.: 2  Location: BL
Shap: St  Forc: Pr  (*Morph: Th; Sz: Mi-Md; Frm: r; Spac: 0; Ang: 90°*)

Frame No.: 3  Location: BS
Shap: St  Forc: Pr  (*Morph: Sh; Sz: Mi; Frm: cnd; Spac: 0; Ang: 180°*)

Frame No.: 4  Location: TP
Shap: Tr  Forc: Pr  (*Morph: Th; Sz: Mi; Frm: 1/2 ol; Spac: 0; Ang: 52°*)

Production Strategy Flowchart:

edge preparation  flake removal

1

3  2

4
Figure B.47. Anzick biface #73; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 73
Class: biface

Frame No.: 1  Location: BL
Shap: St  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: cnd; Spac: 0; Ang: r)

Frame No.: 2  Location: TP, BL
Shap: Tr  Forc: Pn  (Morph: Th; Sz: Vs; Frm: 1/2 ol; Spac: cnd; Ang: 58°)

Frame No.: 3  Location: BL
Shap: St  Forc: Pr  (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: r; Ang: 90°)

Frame No.: 4  Location: BS
Shap: St  Forc: Pn  (Morph: Th; Sz: Vs; Frm: 1/2 ol; Spac: 0; Ang: 180°)

Frame No.: 5  Location: TP
Shap: Tr  Forc: Pr  (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 0; Ang: r)

Production Strategy Flowchart:

edge preparation  flake removal

1  ➔  2
   ▼
  3  ▼
    ▼
  4
    ▼
  5
Figure B.48. Anzick biface #74; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 74
Class: biface

Frame No.: 1 Location: BS
Shap: Cv Forc: Pn (Morph: Flk; Sz: Rnt; Frm: end; Spac: end; Ang: end)

Frame No.: 2 Location: BL
Shap: St Forc: Pn (Morph: Th; Sz: Rnt; Frm: >1/2 ol; Spac: end; Ang: 90°)

Frame No.: 3 Location: BL
Shap: St Forc: Pr (Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: 0-2; Ang: r)

Frame No.: 4 Location: BL
Shap: St Forc: Pn (Morph: Th; Sz: Md-Sl; Frm: end; Spac: 5+; Ang: 90°)

Frame No.: 5 Location: BS
Shap: Cv Forc: Pr (Morph: Sh; Sz: Vm; Frm: r; Spac: 0-1; Ang: r)

Frame No.: 6 Location:
Shap: Cv Forc: Pn (Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 160°)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1  →  2

3, 5  ←

4, 6
Figure B.49. Anzick biface #75; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 75
Class: biface

Frame No.: 1 Location: TP
Shape: Tr
Force: Pn
(Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2 Location: BS
Shape: St
Force: Pn
(Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 180°)

Frame No.: 3 Location: BL
Shape: St
Force: Pr
(Morph: Mb; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 4 Location: BL
Shape: St
Force: Pn
(Morph: Th; Sz: Si-Vs; Frm: cnd; Spac: r; Ang: 90°)

Frame No.: 5 Location: BL, BS
Shape: St, St
Force: Pr
(Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: 1-2; Ang: 90°; Patt: CoTh)

Frame No.: 6 Location: TP
Shape: Tr
Force: Pr
(Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 0; Ang: 37°)

Production Strategy Flowchart:

original surface   edge preparation   flake removal

1 2

3 4

5

6
Figure B.50. Anzick biface #77; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 77
Class: biface

Frame No.: 1  Location: TP
  Shap: Tr    Fore: Pn  (Morph: Flk; Sz: Rnt; Frm: end; Spac: end; Ang: end)

Frame No.: 2  Location: BL
  Shap: St    Fore: Pn  (Morph: Th; Sz: Vs; Frm: no ol; Spac: end; Ang: 90°)

Frame No.: 3  Location: BL
  Shap: St    Fore: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: r; Ang: 90°)

Frame No.: 4  Location: BS
  Shap: St    Fore: Pr  (Morph: Mb; Sz: Vm; Frm: end; Spac: 0; Ang: r)

Frame No.: 5  Location: BS
  Shap: St    Fore: Pn  (Morph: Fl; Sz: Vs; Frm: no ol; Spac: 0; Ang: 180°)

Frame No.: 6  Location: TP
  Shap: Tr    Fore: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0-1; Ang: r)

Frame No.: 7  Location: BL
  Shap: St    Fore: Pr  (Morph: Nt; Sz: Ml; Frm: r; Spac: r; Ang: 90°)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1 -----> 3  <->  2

        ↓

4 ----> 5

       ↓

6

       ↓

7
Figure B.51. Anzick biface #78; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #:
Class:

Frame No.: 1  Location: BL  Shap: As  Forc: Pn  \((\text{Morph: Th; Sz: Rnt}; \text{ Frm: >1/2 ol}; \text{ Spac: end}; \text{ Ang: } 0^\circ; \text{ Patt: CoTh})\)

Frame No.: 2  Location: BL  Shap: As  Forc: Pr  \((\text{Morph: Sh}; \text{ Sz: Vm}; \text{ Frm: } r; \text{ Spac: } 0; \text{ Ang: } r)\)

Frame No.: 3  Location: BL  Shap: As  Forc: Pn  \((\text{Morph: Th}; \text{ Sz: Sl}; \text{ Frm: 1/2-no ol}; \text{ Spac: 10+}; \text{ Ang: } 0^\circ; \text{ Patt: CoTh})\)

Frame No.: 4  Location: BL  Shap: As  Forc: Pr  \((\text{Morph: Nt}; \text{ Sz: Vm}; \text{ Frm: } r; \text{ Spac: } 0; \text{ Ang: } r)\)

Production Strategy Flowchart:

```
edge preparation  flake removal

2  \rightarrow  1,3

\downarrow

4
```
Figure B.52. Anzick biface #79; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 79
Class: biface

Frame No.: 1 Location: BL
  Shap: Ex  Forc: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2 Location: BL
  Shap: Ex  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: 0-1; Ang: r)

Frame No.: 3 Location: BL
  Shap: Ex  Forc: Pn  (Morph: Th; Sz: Sl-Op; Frm: 1/3 ol; Spac: cnd; Ang: 112°)

Frame No.: 4 Location: BL, BS
  Shap: Cv  Forc: Pr  (Morph: Th; Sz: Md-Sl; Frm: r; Spac: r; Ang: 90°)

Frame No.: 5 Location: TP
  Shap: Tr  Forc: Pr  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: 0-1; Ang: 48°)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1 ———> 2 ———> 3

4 ———> 5
Figure B.53. Anzick biface #80; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 80
Class: biface

Frame No.: 1  Location: TP, BL, BS
Shap: all As  Forc: Pn  (Morph: Flk; Sz: Rnt; Frm: -; Spac: -; Ang: -)

Frame No.: 2  Location: BL
Shap: As  Forc: Pn  (Morph: Th; Sz: Op; Frm: no ol; Spac: cnd; Ang: 90°)

Frame No.: 3  Location: BL
Shap: As  Forc: Pn  (Morph: Th; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 4  Location: BL
Shap: As  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: 1/3 ol; Spac: 0; Ang: r)

Frame No.: 5  Location: BL, BS
Shap: As  Forc: Pn  (Morph: Th; Sz: Sl; Frm: no ol; Spac: 0; Ang: 137°)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1 → 2

3 → 4 → 5
Figure B.54. Anzick biface #84; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 84
Class: biface

Frame No.: 1 Location: TP, BL
Shap: Tr, Ex Forc: Pn (Morph: Th; Sz: Op; Frm: no ol; Spac: 0; Ang: 90°)

Frame No.: 2 Location: BL
Shap: Ex Forc: Pn (Morph: Th; Sz: Op; Frm: 1/2 ol; Spac: cnd; Ang: cnd; Patt: CoTh)

Frame No.: 3 Location: BL
Shap: Ex Forc: Pr (Morph: Sh; Sz: Md; Frm: 1/2 ol; Spac: 0-1; Ang: 90°)

Frame No.: 4 Location: BS
Shap: As Forc: Pn (Morph: Th; Sz: Vs; Frm: no ol; Spac: 0; Ang: 156°)

Frame No.: 5 Location: TP
Shap: Tr Forc: Pr (Morph: Sh; Sz: Mi-Md; Frm: r; Spac: 0-1; Ang: r)

Production Strategy Flowchart:

edge preparation flake removal

1

3 ← 2

4

...↓

5
Figure B.55. Anzick biface #85; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 85
Class: biface

Frame No.: 1 Location: TP, BL
Shap: Tr, Ex  Fore: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2 Location: BL
Shap: Ex  Fore: Pn  (Morph: Th; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: 90°)

Frame No.: 3 Location: BS
Shap: St  Fore: Pr  (Morph: Mb; Sz: Vm; Frm: 1/3 ol; Spac: 0; Ang: 180°)

Frame No.: 4 Location: BS
Shap: St  Fore: Pn  (Morph: Th; Sz: Vs; Frm: 1/2 ol; Spac: 2; Ang: 180°)

Frame No.: 5 Location: BL
Shap: Ex  Fore: Pr  (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 0-1; Ang: r; Patt: r)

Frame No.: 6 Location: TP
Shap: Tr  Fore: Pr  (Morph: Sh; Sz: Vm; Frm: cnd; Spac: 0-1; Ang: r)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

```
1 --|-- 2
 |   |
 |   3
 |   |
 |   |
 |   |
 |   4
 |   |
 |   |
 |   |
 |   |
 |   5
 |   |   ...
 |   |
 |   |
 |   6
```
Figure B.56. Anzick biface #86; A. ventral, B. ventral.
Artifact Production Code: Anzick Assemblage
Catalog #: 86
Class: biface

Frame No.: 1  Location: TP, BL
Shap: Tr, Ex  Forc: Pn  (Morph: Th; Sz: Rnt; Frm: -; Spac: -; Ang: -)

Frame No.: 2  Location: TP, BL, BS
Shap: Tr, Ex, St  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0-1; Ang: r)

Frame No.: 3  Location: BL, BS
Shap: Ex, St  Forc: Pn  (Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: r; Ang: 111°)

Frame No.: 4  Location: TP
Shap: Tr  Forc: Pn  (Morph: Th; Sz: Vs; Frm: cnd; Spac: 0-1; Ang: 45°; Patt: CoTh)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1 → 2 → 3 → 4
Figure B.57. Anzick biface #88; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 88
Class: biface

Frame No.: 1  Location: BL, BS
Shap: As, Cv  Forc: Pr  (Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 2  Location: BL, BS
Shap: As, Cv  Forc: Pn  (Morph: Th; Sz: Op; Frm: 1/3 ol; Spac: cnd; Ang: 59°)

Frame No.: 3  Location: BL, BS
Shap: As, Cv  Forc: Pn  (Morph: Th; Sz: Sl-Vs; Frm: 1/2 ol; Spac: 10+; Ang: 90°; Patt: CoTh)

Frame No.: 4  Location: TP
Shap: Tr  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 5  Location: TP
Shap: Tr  Forc: Pn  (Morph: Th; Sz: Op-Vs; Frm: 1/3 ol; Spac: 10+; Ang: 90°; Patt: CoTh)

Frame No.: 6  Location: TP
Shap: Tr  Forc: Pr  (Morph: Th; Sz: Md; Frm: no ol; Spac: 0; Ang: 43°)

Production Strategy Flowchart:

```
edge preparation  flake removal

1 ----> 2

4 ------ 3

1 ----> 5

6
```
Figure B.58. Anzick biface #89; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 89
Class: biface

Frame No.: 1  Location: TP, BL
Shap: Tr, St  Forc: Pn  (Morph: Th; Sz: Sl-Vs; Frm: 1/2 ol; Spac: end; Ang: 90°; Patt: CoTh)

Frame No.: 2  Location: TP, BL
Shap: Tr, St  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: 0; Ang: 90°)

Frame No.: 3  Location: BL
Shap: St  Forc: Pr  (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 0-5; Ang: 90°)

Frame No.: 4  Location: BS
Shap: Cv  Forc: Pn  (Morph: Th; Sz: Md; Frm: end; Spac: r; Ang: 152°)

Production Strategy Flowchart:

edge preparation  flake removal
Figure B.59. Anzick biface #90; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 90
Class: biface

Frame No.: 1  Location: TP, BL
Shape: Tr, Ex  Force: Pr  (Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: r; Ang: r)

Frame No.: 2  Location: TP, BL
Shape: Tr  Force: Pn  (Morph: Th; Sz: Sl-Vs; Frm: 1/2 ol; Spac: end; Ang: 75°)

Frame No.: 3  Location: BS
Shape: St  Force: Pn  (Morph: Th; Sz: Mi-Md; Frm: r; Spac: r; Ang: r)

Frame No.: 4  Location: BS
Shape: St  Force: Pn  (Morph: Th; Sz: Vs; Frm: 1/2 ol; Spac: 0; Ang: 180°)

Production Strategy Flowchart:

edge preparation  flake removal

1  →  2

3  ↔

4
Figure B.60. Anzick biface #91; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 91
Class: biface

Frame No.: 1  Location: TP
Shap: Tr    Forc: Pn    (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: BL
Shap: St    Forc: Pr    (Morph: Sh/Mb; Sz: Md-Md; Frm: r; Spac: 0-1; Ang: 180°)

Frame No.: 3  Location: BL
Shap: St    Forc: Pn    (Morph: Th; Sz: Vs; Frm: no ol; Spac: cnd; Ang: 90°; Patt: CoTh)

Frame No.: 4  Location: BS
Shap: St    Forc: Pr    (Morph: Th; Sz: Md; Frm: 1/2 ol; Spac: 0-1; Ang: 150°-180°; Patt: CoTh)

Frame No.: 5  Location: TP
Shap: Tr    Forc: Pr    (Morph: Sh; Sz: Vm; Frm: cnd; Spac: 0; Ang: r)

Frame No.: 6  Location: TP
Shap: Tr    Forc: Pn    (Morph: Th; Sz: Op; Frm: no ol; Spac: 0; Ang: 53°)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1 → 2 ↔ 3 → 4 → 5 → 6
Figure B.61. Anzick biface #92/93; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 92/93
Class: biface

Frame No.: 1  Location: TP, BL, BS
Shape: Tr, Ex, cnd  Force: Pr  (Morph: Mb; Sz: Vm; Frm: r; Spac: 0; Ang: r)

Frame No.: 2  Location: TP, BL, BS
Shape: Tr, Ex, cnd  Force: Pn  (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: 5+; Ang: 78°)

Frame No.: 3  Location: BL
Shape: Ex  Force: Pr  (Morph: Th; Sz: Mi-Md; Frm: cnd; Spac: 0-2; Ang: 90°)

Production Strategy Flowchart:

edge preparation  flake removal

1  2

3
Figure B.62. Anzick biface #96; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 96
Class: biface

Frame No.: 1  Location: BL  Shap: Ex  Forc: Pn  (Morph: Th; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)
Frame No.: 2  Location: BL  Shap: Ex  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)
Frame No.: 3  Location: BL  Shap: Ex  Forc: Pn  (Morph: Th; Sz: Vs; Frm: no ol; Spac: >10 ; Ang: 90°)
Frame No.: 4  Location: TP  Shap: Tr  Forc: Pn  (Morph: Th; Sz: Sl; Frm: no ol; Spac: 0; Ang: 90°)
Frame No.: 5  Location: BS  Shap: St  Forc: Pn  (Morph: Th; Sz: Sl; Frm: no ol; Spac: 0; Ang: 180°)

Production Strategy Flowchart:

edge preparation  flake removal

1

2

3

4

5
Figure B.63. Anzick biface #97; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 97
Class: biface

Frame No.: 1  Location: TP
Shap: Tr  Fore: Pr  (Morph: Sh; Sz: Ml; Frm: cnd; Spac: 0-1; Ang: NA)

Frame No.: 2  Location: BL
Shap: Ex  Fore: Pr  (Morph: Mb; Sz: Vm; Frm: cnd; Spac: r; Ang: NA)

Frame No.: 3  Location: BL
Shap: Ex  Fore: Pn  (Morph: Th; Sz: Vs-SI; Frm: 1/3 ol; Spac: r; Ang: 90°)

Frame No.: 4  Location: BS
Shap: Cv  Fore: Pn  (Morph: Mc; Sz: Ml; Frm: cnd; Spac: 0-1; Ang: NA)

Production Strategy Flowchart:

```
tip production edge preparation blade production base production
```

```
1 → 2 → 3 → 4
```
Figure B.64. Anzick biface #98; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 98
Class: biface

Frame No.: 1 Location: BL
Shap: Ex  Forc: Pn  (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: cnd; Ang: 90°; Patt: CoTh)

Frame No.: 2 Location: BL
Shap: Ex  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 3 Location: BS
Shap: cnd  Forc: Pn  (Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: 0; Ang: 180°)

Frame No.: 4 Location: BL
Shap: Ex  Forc: Pr  (Morph: Th; Sz: Ml-Md; Frm: 1/2 ol; Spac: 0; Ang: 90°)

Frame No.: 5 Location: TP
Shap: As  Forc: Pn  (Morph: Th; Sz: Op; Frm: cnd; Spac: cnd; Ang: 39°)

Frame No.: 6 Location: TP
Shap: As  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: 0; Ang: r)

Production Strategy Flowchart:

edge preparation  flake removal

2  1

3

4

5

6
Figure B.65. Anzick biface #101; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #:
Class:

Frame No.: 1  Location: BS
Shap: Cv  Forc: Pn  (Morph: Sh; Sz: Md; Frm: no ol; Spac: 0; Ang: 90°)

Frame No.: 2  Location: BS
Shap: Cv  Forc: Pr  (Morph: Sh; Sz: Mi; Frm: cnd; Spac: 0; Ang: r)

Production Strategy Flowchart:

edge preparation  flake removal

2 ←···→ 1
Figure B.66. Anzick biface #103; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 103
Class: biface

Frame No.: 1 Location: TP, BL
Shap: Tr, Ex Forc: Pn (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2 Location: TP, BL
Shap: Tr, St Forc: Pr (Morph: Sh; Sz: Vm-Ml; Frm: r; Spac: 0; Ang: r)

Frame No.: 3 Location: TP, BL
Shap: Tr, St Forc: Pn (Morph: Th; Sz: Vs; Frm: 1/3 ol; Spac: 0; Ang: 64°)

Frame No.: 4 Location: BS
Shap: ST Forc: Pr (Morph: Sh; Sz: Ml; Frm: cnd; Spac: 0; Ang: 180°)

Production Strategy Flowchart:

original surface  edge preparation  flake removal

1 ———> 2 ———> 3 ———> 4
Figure B.67. Anzick biface #104; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 104
Class: biface

Frame No.: 1  Location: TP  Shap: Tr  Forc: Pr  (Morph: Sh; Sz: Ml; Frm: r; Spac: cnd; Ang: r)

Frame No.: 2  Location: BL  Shap: As  Forc: Pn  (Morph: Th; Sz: Op; Frm: 1/3 ol; Spac: cnd; Ang: 90°)

Frame No.: 3  Location: BL  Shap: As  Forc: Pn  (Morph: Th; Sz: Sl; Frm: no ol; Spac: 0; Ang: 113°)

Frame No.: 4  Location: BS  Shap: As  Forc: Pn  (Morph: Th; Sz: Sl; Frm: no ol; Spac: 0; Ang: 180°)

Production Strategy Flowchart:

edge preparation  flake removal

1 → 2

3 → 4
Figure B.68. Anzick biface #105; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 105
Class: biface

Frame No.: 1 Location: TP
Shap: As Forc: Pr (Morph: Sh; Sz: Ml; Frm: cnd; Spac: 0; Ang: r)

Frame No.: 2 Location: BL
Shap: As Forc: Pr (Morph: Sh; Sz: Vm; Frm: cnd; Spac: 0; Ang: cnd)

Frame No.: 3 Location: BL
Shap: As Forc: Pn (Morph: Th; Sz: Sl; Frm: 1/2 ol; Spac: r; Ang: 90°)

Frame No.: 4 Location: BS
Shap: As Forc: Pn (Morph: Th; Sz: Vs; Frm: no ol; Spac: NA; Ang: 180°)

Production Strategy Flowchart:

1

edge preparation  flake removal

2 → 3

4
Figure B.69. Anzick biface #106; A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 106
Class: biface

Frame No.: 1  Location: BS
Shape: St  Force: Pr  (Morph: Sh; Sz: Vm; Frm: r; Spac: 0; Ang: end)

Frame No.: 2  Location: BS
Shape: St  Force: Pn  (Morph: Th; Sz: Op; Frm: no ol; Spac: 0; Ang: 180°)

Production Strategy Flowchart:

edge preparation  flake removal

1  →  2
Appendix C: Unifacial, Flake Tool, and Flake Images
Figure C.1. Anzick convergent sidescraper #11, A. dorsal, b. ventral.
Artifact Production Code: Anzick Assemblage
Catalog #: 11
Class: uniface

Frame No.: 1  Location: BL
Shap: As  Force: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: TP, BL
Shap: Tr, As  Force: Pr  (Morph: Sh; Sz: Ml; Frm: 1/2 ol; Spac: 0; Ang: 90°)

Frame No.: 3  Location: BL
Shap: As  Force: Pr  (Morph: Nt; Sz: Vm; Frm: cnd; Spac: 0; Ang: cnd)

Production Strategy Flowchart:

original surface  flake removal

1  ➔  2, 3
Figure C.2. Anzick "classic" unifacial endscraper #19; A. unmodified ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 19
Class: uniface

Frame No.: 1 Location: TP, BL, BS
Shape: St, As, As Force: Pn (Morph: Flk; Sz: Rnt; Frm: end; Spac: end; Ang: end)

Frame No.: 2 Location: BL
Shape: As Force: Pn (Morph: Th; Sz: Rnt; Frm: end; Spac: end; Ang: end)

Frame No.: 3 Location: TP, BL, BS
Shape: St, As, As Force: Pr (Morph: Sh; Sz: Vm; Frm: end; Spac: 0; Ang: r)

Production Strategy Flowchart:

original surface  flake removal

1 → 2

↓

3
Figure C.3. Anzick endscraper #99, A. dorsal, B. ventral.
Artifact Production Code: Anzick Assemblage
Catalog #: 99
Class: uniface

Frame No.: 1  Location: TP, BL, BS
Shap: As, As, As  Forc: Pn  \(\text{Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd}\)

Frame No.: 2  Location: BL, BS
Shap: As, As  Forc: Pn  \(\text{Morph: Th; Sz: Sl; Frm: 1/3 ol; Spac: cnd; Ang: 65^\circ}\)

Frame No.: 3  Location: TP, BS
Shap: As, As  Forc: Pr  \(\text{Morph: Sh; Sz: Vm; Frm: cnd; Spac: 0; Ang: r}\)

Production Strategy Flowchart:

```
original surface  flake removal

  1  \rightarrow  2

  \downarrow

  3
```
Figure C.4. Anzick sidescraper #100, A. dorsal, B. ventral.
Artifact Production Code: Anzick Assemblage
Catalog #: 100
Class: uniface

Frame No.: 1  Location: TP, BL, BS
Shap: As, St, As  Forc: Pn  \( (\text{Morph: Fik}; \text{Sz: Rnt}; \text{Frm: end}; \text{Spac: end}; \text{Ang: end}) \)

Frame No.: 2  Location: TP, BS
Shap: As, As  Forc: Pn  \( (\text{Morph: Th}; \text{Sz: Sl}; \text{Frm: no ol}; \text{Spac: end}; \text{Ang: 155}^\circ) \)

Frame No.: 3  Location: BL
Shap: St  Forc: Pr  \( (\text{Morph: Sh}; \text{Sz: Vm}; \text{Frm: end}; \text{Spac: 0}; \text{Ang: r}) \)

Production Strategy Flowchart:

```
original surface  flake removal
```

![Flowchart Image]
Figure C.5. Anzick flake tool #52, A. dorsal, B. ventral.
Artifact Production Code: Anzick Assemblage
Catalog #: 52
Class: flake tool

Frame No.: 1 Location: entire artifact
Shap: As Forc: Pn \((Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)\)

Frame No.: 2 Location: entire dorsal
Shap: As Forc: Pn \((Morph: Th; Sz: cnd; Frm: cnd; Spac: cnd; Ang: cnd)\)

Frame No.: 3 Location: BL
Shap: St Forc: Pr \((Morph: Eg; Sz: Vm; Frm: cnd; Spac: 0; Ang: cnd)\)

Production Strategy Flowchart:

1. original surface
2. flake removal
3. use (?)
Figure C.6. Anzick blade-like flake #66, A. ventral, B. dorsal.
Artifact Production Code: Anzick Assemblage
Catalog #: 66
Class: flake tool

Frame No.: 1  Location: entire artifact
Shap: As    Forc: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: cnd; Ang: cnd)

Frame No.: 2  Location: BL
Shap: As    Forc: Pr  (Morph: Sh; Sz: Vm; Frm: 1/2 ol; Spac: 0; Ang: 90°)

Production Strategy Flowchart:

original surface  flake removal

1  →  2
Figure C.7. Anzick flake tool #81, A. dorsal, B. ventral.
Artifact Production Code: Anzick Assemblage
Catalog #: 81
Class: flake tool

Frame No.: 1  Location: entire artifact
Shap: As  Forc: Pn  (Morph: Flk; Sz: Rnt; Frm: cnd; Spac: 0; Ang: cnd)

Frame No.: 2  Location: BL
Shap: As  Forc: Pn  (Morph: Th; Sz: Op; Frm: >1/3 ol; Spac: 10+; Ang: r)

Production Strategy Flowchart:

original surface  flake removal

1 → 2
Figure C.8. Small flakes associated with the Anzick assemblage (#'s 114-116).
Appendix D: Bone Foreshaft Images
Figure D.1. Anzick bone tool #37, A. ventral, B. dorsal.
Figure D.2. Anzick bone tool fragments #38, A. ventral, B. dorsal; and #120, C. ventral, D. side.
Figure D.3. Anzick bone tool #39, A. ventral, B. dorsal.
Figure D.4. Anzick bone tool #67, A. ventral, B. dorsal, C. side.
Figure D.5. Anzick bone tool #94, A. ventral, B. dorsal, C. side.
Figure D.6. Anzick bone tool #95, A. ventral, B. dorsal, C. side.
Figure D.7. Anzick bone tool #118/119, A. ventral, B. dorsal, C. side. Arrows point to impact fractures.
Figure D.8. Anzick bone tool fragments #122, A. ventral, B. dorsal; and #123, C. ventral, D. dorsal.