Manual for Archaeological Analysis: Field and Laboratory Analysis Procedures.

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HOW DO WE DO IT?

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Archaeology Defined: Goals and Frameworks

Archaeology is simply the study of the material things of the past. There is over a century of jargon that can and will be applied, but in very simplest terms, archaeologists study stuff that is preserved so that we may decipher something of the culture, beliefs, and values of past societies. Archaeology is ANTHROPOLOGY, not really a subdiscipline, but perhaps a body of methods and techniques that are applied to the analysis of MATERIAL CULTURE (cf. Gardin and Peebles 1992; Leone and Potter 1988; Malina and Vasicek 1990; Renfrew and Zubrow 1994; Tilley 1990). Material culture is that whole domain of things made and used by people. Material culture studies embody analyses of technology, design, function, social organization, history, religion, ritual and belief. People use things to encode and inculcate behavior, to express values and feelings, as well as to extract energy and meet nutritional requirements. Archaeologists expect to be able to find out a great deal about past societies through careful systematic analyses of the objects those societies created. The record of the past is most often incomplete. Many objects are perishable, and they simply are not preserved in archaeological sites. Patterns in artifacts are found, however, and this patterning preserves much of the original context of use and meaning that surrounded the creation and use of every object.

Archaeology's history is a checkered one (Trigger 1989; Willey and Sabloff 1993). The first archaeologists were avocational explorers, diggers, and speculators. Some were fascinated by holding bits of the past. Others were driven by the desire to make money off of exotic treasures. This was the era of Indian Jones. Archaeologists were active fieldworkers, certainly better than theorizing anthropologists permanently glued to armchairs in upper class Victorian sitting rooms, but they were destructive collectors who intended to amass neat objects for display in museums.

By the middle 1900s, archaeologists began to try to preserve more information about the things they found. Elaborate strategies were designed for classification of things. Complete descriptions were the goal, and archaeology became more and more systematic, as well as more and more scientific in view and approach. This was the rise of the CULTURE-HISTORICAL SCHOOL of archaeology in the United States. Things were carefully excavated to standards of stratigraphic recording and reports emphasized the location and dating of things. Digs, often facilitated through Works Projects of America funding, were massive in scale. Entire sites were excavated and collections of things numbered in the hundreds of thousands.

Construction of local and regional chronologies was the goal, and distributions of objects in SPACE and TIME were held indicative of past societies and the movements of cultures and cultural ideas across the landscape (cf. Willey and Phillips 1958). Cultural TRAITS were defined that had demonstrated importance in defining the stringers of time and space, and these became the major rubrics for analysis and discussion of archaeological CULTURES. Emphasis was on description, CLASSIFICATION, and construction of narratives that explained the ARCHAEOLOGICAL RECORD in terms of alleged cultures that moved through space of time. Changes in traits became axiomatically associated with changes in basic elements of socioeconomic organization and earmarks of changing adaptive systems as well as labels for specific ethnic and linguistic groups in the past.

WHAM - BAM! CAME THE 60s! Old, traditional culture history was bashed, mashed, chewed, and abused by the NEW ARCHAEOLOGISTS. These Mad Dog-, hell-bent-for-science PROCESSUALISTS would truck no more lengthy descriptions of stuff and tedious typological constructions (Binford 1962, 1964, 1965, 1968; Leone 1972; Watson et al. 1971). Their rallying cry was that there must be more to archaeology than a slavish adherence to the old kulturkreise school. Processualists would emphasize use of basic scientific method, with reliance on explicit HYPOTHESIS TESTING and characterization of human societies as ADAPTIVE SYSTEMS (e.g., Binford and Sabloff 1982; Clarke 1977; Flannery 1967, 1968, 1982; Hodder 1978). Culture-historical reconstructions were declared to be pseudo explanatory frameworks and definition of traits though useful for placing past societies in the basic framework of time and space could not be the declared end-products of archaeological research. CULTURAL CHRONOLOGIES were simply the beginning, serving as useful classificatory frameworks, in which more compelling questions of adaptation and CULTURAL CHANGE could be MODELED and addressed (cf. Clarke 1978; Sabloff 1981). The archaeological record was seen as archaeology's laboratory for studying HUMAN BEHAVIOR over the long expanse of time. Processual archaeology was firmly based in CULTURAL MATERIALISM in the mode of Leslie White and Marvin Harris, and asserted that the only suitable approach was to focus on the relationships between society and the physical environment. TECHNOLOGY was the principal means of human adaptation. SOCIAL ORGANIZATION facilitated the extraction of resources through use of technology. IDEOLOGY simply justified what had to be done to accommodate production (Harris 1968, 1979; White 1959, 1969, 1975). This view holds that cultures are inherently or overwhelmingly rational: CULTURE is defined as man's extrasomatic means of adaptation to his environment. Proponents asserted that archaeology was uniquely suited to establish patterns in how humans chose to adapt to their physical environments, and that archaeologists would contribute to knowledge of human behavior by identifying UNIVERSALS that would address behavior in terms of past-present-future.

In the early '80s a group of pragmatic archaeologists, leery of dooming culture-historical reconstructions to the trash heap and appalled by POSITIVIST materialist dogmas, advocated a HOLISTIC inspection of all facets of culture (technology, social organization, ideology) by archaeologists. These anthropologists were tagged as POST-PROCESSUALISTS (e.g., Hodder 1982, 1986, 1993; Shanks and Tilley 1987; Tilley 1990). This label actually encompasses a wide range of anthropological approaches that are grouped only when considered in contrast to the more narrowly defined materialist approach of the processualists. Post-Processualists emphasize study of patterns in material culture and insist that archaeologists can extract meaningful inferences about values, beliefs, religion, and social structure, as well as the more obvious socioeconomic or technological elements of human adaptation.

Archaeology for Post-Processualists is often defined as the anthropology of material culture, and encompasses but is not limited to Materialist positivistic approaches to study of past societies. Key words for Post-Processual approaches include material culture study, with key concepts being CONTEXT and CRITICAL THEORY. As the anthropology of things, Post-Processualist theory draws upon a vast array of anthropological theories, including Structuralism, Symbolic Anthropology, and tenets of Critical Marxism. Archaeology emerges in its P-P guise as a social anthropology of the past, not purely Western Science and not purely History, but a holistic study of humans in the past, including their institutions, their beliefs, and their culture in all its many facets.

Post-Processual approaches build on Culture History and on the New Archaeology of the Processualist school, but seek to broaden the field of study dramatically. P-p archaeologists are anthropologists who study material culture (Past-Present-Future). Under this definition, archaeologists no longer have to excavate sites. They might explore dumps, analyze gravestones, perform surveys of extant architecture, or canvas wearing apparel in shopping malls. P-P types dig though, and the analytical framework presented here addresses the tenets of the old school and applies method of the new.

Terms and Concepts

Archaeology as a discipline predicated on the analysis of a complex subject, has evolved a jargon or lexicon all its own. In these cartoons, reproduced from Malina and Vasicek (1990:Figs.3,4), the archaeologist attempts to sort out all the myriad jargon terms that have become shorthand referents to theories and concepts. All deal with what the archaeologist finds, and how the archaeologist constructs inferences.

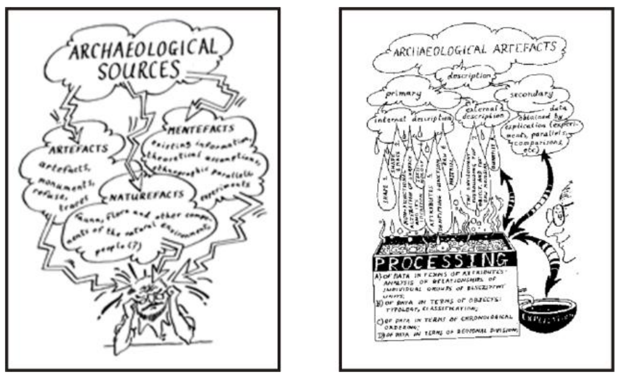

Figure 1. Cartoons showing the jargonized process of description and classification (from Malina and Vasicek 1990: Figs. 3 and 4).

ARTIFACTS are things made, used, and modified by people. The term refers to tools, residues of tool manufacture, residues of processing plants and animals, and by-products of tool manufacture, processing, or other human activities.

NATUREFACTS are parts of plants or animals not modified by man, but indicative of man's physical environment. For example, seeds, plant parts or small animal remains found in an archaeological site can be analyzed to determine season of the year for man's occupation or indicate the climate and environment of a given period.

MENTEFACTS are the ideas and values that govern the creation of artifacts. Also called "mental templates" or "cognitive maps" or "cognitive frameworks," these structures are not beyond archaeological inference. Recognition of Mentefacts allows archaeologists to explore nonmaterial aspects of culture through analysis of the material manifestations of cultural needs and beliefs.

How Do We Get To Inference from Things?

These cartoons depict the inner recesses of the researcher's mind: things found, categories applied, inferences drawn, facts elicited. Artifact applies to the totality of the object or thing found. To find patterns indicative of human behavior, and hence, culture, we must have a finer level of measurement: the ATTRIBUTE. Attributes are measurements or observations drawn or about artifacts. The attribute measured may be one zone of wear on a formed tool. So, a given tool form may have dozens of measurable attributes. No description is adequate without measurements taken at the attribute level of analysis. Attributes may record basic morphology, alterations of surfaces, signposts of manufacture, indicators of depositional environment, quantities or frequencies, and any number of other variable dimensions. Malina and Vasicek (1990), Neustupny (1993) and Shennan (1988) offer excellent discussions of the need for rigorous measurement frameworks in archaeological research (see also Clarke 1968, 1972 and 1977).

Inferences about past human behavior are constructed by correlating and cross-tabulating attribute lists. Our inferential patterns are then arranged in shifting hierarchies, with one form or focus simply being the level of measurement at which the pattern analysis is performed:

- Gross: distribution of artifact types within the site.
- Moderate: patterns of selected features observed on artifacts.
- Fine: patterns defined by careful correlations of descriptive dimensions outlining attribute characteristics across tool types.
- Very Fine: microscopic examination of working edges and working surfaces and physical and chemical examination of surfaces and residues, which result in pattern analysis performed on parts of a single artifact. Here, the artifact becomes directly analogous to the archaeological site.

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Concepts to Review

- Adaptive Systems
- Anthropology
- Archaeological Record
- Artifacts
- Attribute
- Classification
- Context
- Critical Theory
- Cultural Change
- Cultural Chronologies
- Cultural Materialism
- Culture-Historical School
- Culture
- Cultures
- Holistic
- Human Behavior
- Hypothesis Testing
- Ideology
- Material Culture
- Mentefacts
- Models
- Naturefacts
- New Archaeologist
- Positivist
- Post-Positivist
- Processualists

- Social Organization
- Space
- Technology
- Time
- Universals

2. Southeastern Idaho Native American Prehistory and History

Systematic archaeological research in southeastern Idaho began in 1958 with the advent of Earl Swanson's archaeological program at Idaho State University. At that time, highly stratified cave and rockshelter sites were selected for examination because they had potential for yielding a broad range of geological and biogeographical data essential for understanding human ecology on the Snake River Plain and in bordering upland regions. Other overriding concerns of this early work involved determining the antiquity of the Northern Shoshone in this area, clarifying the relationships between this region and the surrounding Great Basin, Plains, and Plateau cultural areas, and setting up a regional cultural sequence.

Swanson (1972) defined a series of local cultural phases marked by distinctive projectile point types, associations of faunal remains, and changes in natural deposition in stratified sites. Butler (1986) has grouped these phases into three broad cultural periods labeled Early Big Game Hunting, Archaic, and Late. This cultural sequence spans the last 14,000 years.

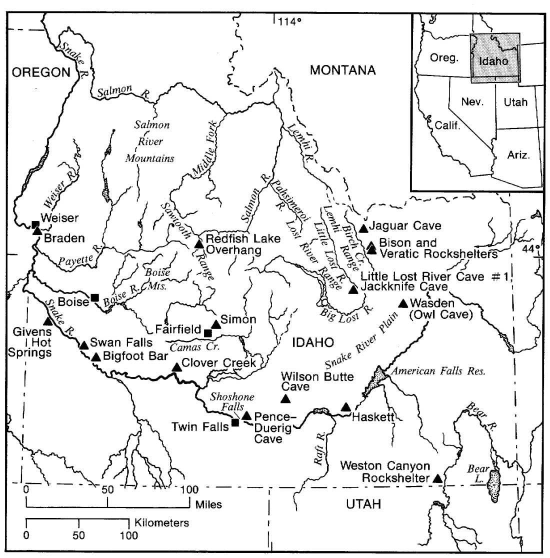

Figure 1. Map of Idaho region showing significant archaeological sites. Butler 1986:fig.1.

Early Big Game Hunting Period, ca. 14,000-7,800 B.P.

Cultural adaptations during this period are marked by a focus on hunting large game animals that became extinct during the terminal phase of Late Pleistocene or in the early Holocene. Species taken included *Mammuthus, B. Antiquus, Camelops, Equus, Ovis, Cervus,* *and Odocoileus*. It is assumed that these peoples' diet also included plants and small game. Butler (1986:128) subdivides this period into three divisions based on the presence of distinctive projectile point types: Clovis, Folsom, Plano.

Clovis Subperiod, ca. 12,000-11,000 B.P.

Evidence of this period in the Upper Snake and Salmon River country is largely confined to surface sites lacking good stratified deposits. Some stratified sites like Jaguar Cave in southcentral Idaho have deposits radiocarbon dated to this period but lack diagnostic artifacts (Sadek-Kooros 1966). In general, surface finds have been without any associated patterning in cultural remains. Butler (1963) reported a unique Clovis find at the Simon Site northwest of Wilson Butte Cave. A number of Clovis points were found with 26-30 bifaces in this cache. Butler (1986:128) reports that Clovis materials were found during construction of fish ponds on the Snake River below Twin Falls.

Folsom Subperiod, ca. 11,000-10,600 B.P.

This period is found in one excavated stratified site and abundant widespread surface finds. Owl Cave is a deeply stratified lava tube on the Snake River Plain (Butler 1978; Miller 1982). Radiocarbon dates on bone from a Folsom component ranged from about 12,850-10,920 B.P. Parts of four Folsom points were found in association with elephant, bison and camel remains. Isolated surface finds of Folsom points are common in this region.

Plano Subperiod, ca. 10,600-7,800 B.P.

This period is the most abundantly represented in this region, and is found in excavated contexts as well as surface finds. There is a fairly wide diversity of generalized lanceolate projectile point forms. Prehistoric economy seems to have been geared toward hunting bison at lower elevations, and mountain sheep in higher zones (Swanson 1972: Table 18). Remarkable Late Plano period kills of *B. antiquus* ca. 8000 B.P. were preserved at Owl Cave. These include the skeletons of more than 70 bulls, cows, and calves of different ages (Butler, Gildersleeve and Sommers 1971). It seems that two separate kills were involved: one before calving season and one just after. Butler (1978) reports that a single bison nasal bone flesher and about 30 projectile points comprise the recovered tool kit. Two of the points were reworked bases of Birch Creek series lanceolate points, indicative of the earliest occupations at Veratic Rockshelter in the Birch Creek Valley (Butler 1978; Swanson 1972)

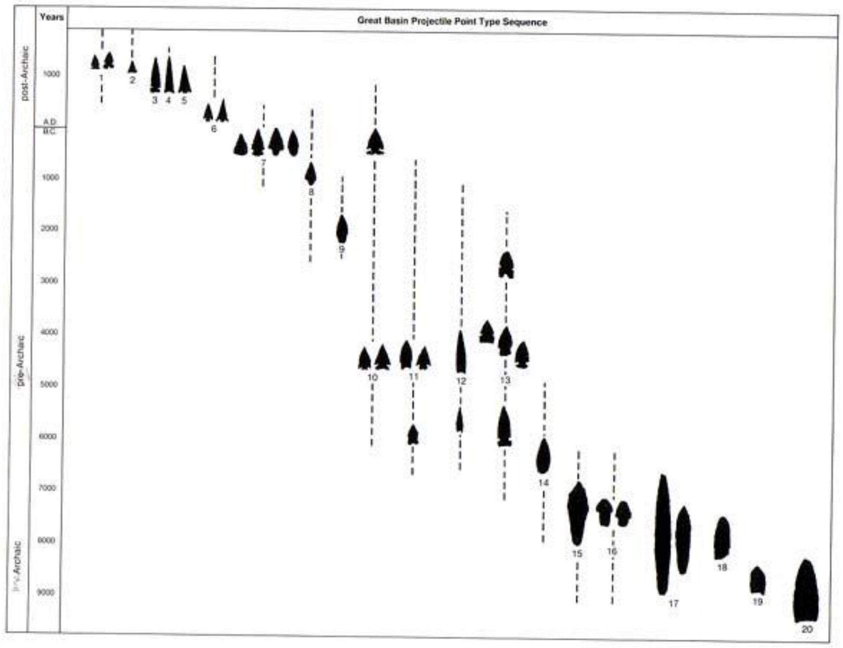

Figure 2. Schematic of projectile point types. Jennings 1986:Fig.1.

Archaic Period, ca. 7800-1300 B.P.

Shortly after about 8000 B.P., the lanceolate point types characteristic of the preceding Plano Period were replaced by Bitterroot or Northern Side-notched points and stemmed-indented base points. As defined by Willey and Phillips (1958), the Archaic Period is the stage in North American prehistory characterised by generalized hunting-and-gathering economies in physical environments basically similar to those of today. Hunters took modern forms of bison, mountain sheep, deer, and small game. Plant resources were an important, dominant part of the diet. It is assumed that the atlatl and dart weapon system enters the archaeological record during the Archaic Period, and that this is reflected in the smaller and more variable types of projectile point types.

The stemmed-indented base point type appears to be older than the Northern Side-notched. It is found in deposits immediately overlying the Late Plano occupation at Owl Cave, and radiocarbon dated at about 7750 B.P. Stemmed-indented base points were also recovered from occupations at Wilson Butte Cave radiocarbon dated at 6890 B.P. Northern Side-notched points enter the sequence at Wilson Butte Cave in deposits dated about 6500 B.P. (Gruhn 1961). At Veratic Rockshelter in the Birch Creek Valley, Northern Side-notched points are found in strata thought to have dated about 8200 B.P. and continue on in the record to about 3450

B.P. (Swanson 1972). An excellent stratigraphic context is preserved for Northern Side-notched points at the Jimmy Olsen Rockshelter, where characteristic Northern Side-notched points were found in multiple activity surfaces lying just above redeposited layers of what is thought to be Mazama Ash. The bottom two strata have been radiocarbon dated at about 5420 B.P. and 5300 B.P. (Lohse 1991; Beta Analytic 43627 and 43626). Similar sequences have been recorded at Weston Canyon Rockshelter, southern Idaho, where stemmed-indented base points mark the earliest occupation dated about 8000 B.P., are replaced later by Northern Side-notched points from about 7800-5500 B.P., and then Humboldt Concave Base points after 5500 B.P. (Miller 1972).

The "Western Idaho Burial Complex" is distinctive pattern of burial marking the Archaic Period (Pavesic 1983). The best known site is the Braden burial site near Weiser, ID (Butler 1980; Harten 1980). Large bifaces, some of the "Turkey-tail type" with very low side notches, large corner-notched points, large side-notched points, obsidian preforms, and red ochre were found as characteristic burial associations. This complex is thought to date about 6000-4000 B.P. Similar point types have been found in southeastern Idaho, but without the obvious burial context.

The earliest use of subterranean dwellings is found at the Givens Hot Springs site on the Snake River in southwestern Idaho, dated at least 4300 B.P. (Green 1982). The houses are 6-8 meters in diameter, have floors over 1 meter in depth, and multiple roof support posts. Northern Side-notched and Humboldt Concave base projectile points were found in association with hopper mortar bases on the house floors. Later house floors have Elko point types in association with hopper mortar bases. Occupations appear to have been during the winter months, and the inhabitants ate deer, rabbits, and river mussels (*Gonidea angulata*). Dwelling sites appear to have been small during this time, consisting of two or three houses at locations scattered up and down the Snake River and its tributaries.

Reed et al. (1986) have divided the Archaic Period into three subperiods: an Early Archaic (7500-500 B.P.), marked by use of Northern Side-notched type projectile points and the large bifurcate or stemmed-indented base projectile points also labeled Pinto series; a Middle Archaic period (5000-3500 B.P.), marked by a proliferation of projectile point types rather than any one point type but including McKean like lanceolate and stemmed points, Elko series points, and Humboldt series points; and a Late Archaic (3500-1300 B.P.), marked by a number of projectile point types including Pelican Lake points, Besant points, and Elko series points.

The Archaic is characterized by an Altithermal climatic shift toward warmer and drier conditions, which Reed et al. (1986:110) suggest prompted bison hunting populations of the Plains to enter the upper Snake River Basin and begin hunting mountain sheep as well as bison. Certainly, as defined by Willey and Phillips (1958), the Archaic in this region documents a highly diversified subsistence. Butler (1978) argues that as the Altithermal reached its maximum about 3800 B.P., grasses essential to large bison herds began to fail, and bison hunting populations must have experienced some dietary stress than could be expected to prompt changes in subsistence strategy. As documented by Green's (1982) work at the Givens Hot Spring site our earliest evidence of the use of housepits is roughly coincident with the proposed Altithermal maximum as well, and is fully characteristic of significant changes in human adaptive strategy emerging during the Archaic period on the Snake River drainage.

Late Period, ca. 1300-150 B.P.

The Late Period is better known than any of the preceding periods in regional prehistory, and most likely represents prehistoric and protohistoric Shoshoneans occupying the Upper Snake and Salmon River country. Two cultural hallmarks are indicative of this period: Shoshonean Intermountain Ware pottery tradition and use of the bow and arrow.

A radiocarbon date from Dagger Falls on the middle fork of the Salmon River for Intermountain Ware pottery fragments places the earliest known use of pottery at about 2010 B.P. (Torgler n.d.). The temper of these sherds is crushed andesite, basalt, and quartzite in composition, most like sherd profiles for Thomas Shelter, Sudden Shelter, and Danger Cave in Utah (Dean 1988, 1991a, 1991b). Fremont pot sherds were also found in these same levels. Distinctions between Shoshonean and Fremont pottery traditions have been difficult to draw in the past. Butler (1983, 1986) has argued that pottery found in southeastern Idaho has often been misidentified as Shoshonean when in fact it is Fremont. It now appears that Fremont pottery types are rarely found in our region, and that the finer Shoshonean wares are similar to Fremont types in surface finish, temper, and rim curvature.

The Late Prehistoric Period is marked by a range of small triangular projectile point types. Corner-notched Rosegate series points extend throughout the period, as do Desert Side-notched series, and Cottonwood triangular points.

Ahvish Phase: The "Ahvish" Phase has deen defined for demonstrably Numic or Shoshonean occupation at the Wahmuza site at Cedar Butte, on the Fort Hall Indian Reservation (Holmer 1986). "Ahvish" was chosen by the excavators because it translates in Shoshone as "people from long ago" (Jimenez 1986:227). The phase is suggested to range from about A.D.1300 to 1850 or the arrival of European trade goods in the archaeological record.

Cultural diagnostics include Desert Side-notched and Rosegate series projectile points and grey-ware pottery. Two vessel forms have been identified: a crude flat-bottomed conical pot with coarse surface finish and coarse temper typical of the Shoshonean or Intermountain Ware Tradition, and finely finished globular bowls with fine temper.

Comparable Shoshonean cultural materials have been found in the Dietrich Phase occupation at Wilson Butte Cave, a lava blister on the Snake River Plain in northeast Jerome County, ID (Gruhn 1961). Dietrich Phase materials comprise the uppermost stratigraphic layer radiocarbon dated to about A.D. 1535. Projectile point types included Rosegate series, Desert Side-notched and Cottonwood triangular. Twelve pottery sherds were termed "Wilson Butte Plain Ware" by Gruhn, and are now considered to be representative of Shoshonean Intermountain Ware (Jimenez 1986:229).

Diagnostic Shoshonean materials were also identified in the Lemhi Phase defined by Swanson et al. (1964) for the Birch Creek Valley of eastern Idaho. This was described as part of the Bitterroot Cultural pattern, and based largely on excavation at Bison Rockshelter. The phase is dated at about A.D. 1250-1850. Diagnostic projectile point types are Desert Side-notched and Cottonwood triangular. Grey ware sherds were found at another rockshelter in the Birch Creek Valley, 10-CL-100, and are considered diagnostic of the Lemhi Phase.

Other excavated sites with late Shoshonean components include Polly's Place (10-LH-44), a rockshelter in Meadow Canyon, Birch Creek Valley (Ranere 1971); Jackknife Cave (10-BT-46), southern end of the Lemhi Range overlooking the Snake River Plain (Swanson and Sneed 1971); Meadow Creek (10-BV-22) and Willow Creek (10-BV-32) rockshelters in the Willow Creek Canyon of southeastern Idaho (Powers 1969); Poison Creek (10-BM-50), a large open site on Wilson Creek at the north end of Blackfoot Reservoir (Miss 1974); the Meacham Site, a rockshelter burial in the Snake Rive Canyon above Shoshone Falls; Pence-Duerig Cave (10-JE-4), a large deep alcove in the basalt rim of the Snake River Canyon northeast of Twin Falls (Gruhn 1961); site 10-AA-15, a rockshelter in the Snake River Canyon below Swan Falls Dam in southwestern Idaho (Tuohy and Swanson 1960); the Monida Pass Tipi Ring Site (10-CL-85), an open site on a terrace overlooking the conlfuence of Beaver, Stoddard and Daisy Creeks south of the Continental Divide in eastern Idaho (Ranere et al. 1969); the Challis Bison Jump (10-CR-196), a multicomponent site at the base of the Salmon River Mountains overlooking the Salmon River south of Challis (Butler 1971); and Aviators' Cave (10-BT-1582), a collapsed lava tube on the Snake River Plain, National Engineering Laboratory, southeastern Idaho (Lohse 1990; Lohse 1991).

Aviators' Cave is a unique site with phenomenal preservation of perishable materials. Analysis has not been completed, but stratified deposits reveal an upper activity surface with Desert Side-notched Sierra subtype, general Desert Side-notched, and Cottonwood triangular projectile point types, and finely finished, fine-tempered grey ware pottery of the Shoshonean Intermountain Ware Tradition. The artifact inventory is typical of the Ahvish Phase, and includes feathers, hair, fur, hide, and seed and other plant parts absent from the Wahmuza site. Identification of these items to species level should supply dramatic insights into Shoshonean subsistence strategies in southeastern Idaho in the late prehistoric or protohistoric period.

Protohistoric and Historic Shoshone Period

The transition from protohistoric to historic Shoshonean groups, which hinges on finding European trade goods in association with aboriginal materials, has not been well demonstrated in the archaeological record of this region. Some time after about 300 B.P. or during the Ahvish Phase horses came to the Shoshone and other Plateau tribes. At about the same time, trade goods of metal and glass were passing north in trade from the Spanish Southwest. To date, no professionally excavated stratified site with early European trade goods in definitive association with aboriginal Shoshonean assemblages has been recorded.

The boundary between protohistoric and historic periods for Shoshone has been arbitrarily set at the year 1805, when the first written records of the Upper Snake River Basin were produced by Lewis and Clark (Reed et al. 1986:114).

Prehistoric Site Types

Reed et al. (1986) have identified classes of archaeological site types for the Idaho National Engineering Laboratory grounds.

Residential bases. These sites contain artifacts indicative of processing of multiple natural resources and stays of fairly long duration. They may contain evidence of dwellings, storage facilities, hearths, and a broad artifact inventory including non-portable items like heavy grinding stones and pottery, and variable small tool types from projectile points to simple utilized flakes. Site stratigraphy can be predicted to be patterned and relatively complex in both vertical and horizontal dimensions. These sites should be situated within short distance of multiple overlapping resource arrays including access to water, firewood, sheltered location, and high density clusters of plant and animal resources.

Field camps. These sites may or may not contain smaller scale artifact assemblages comparable to those predicted for residential bases. Field camps are defined as being on a smaller scale than the residential bases, as having fewer people involved generally and perhaps reflecting more specialized activities. These sites will most often reflect extraction of single rather than multiple resources. They will include hunting camps where game was butchered and lightly processed, seed-gathering camps where plant parts were reduced and processed for easy transport, and good fishing locations where fish might be filleted and dried for hauling back to a residential base. Field camps will have less patterned site structure with fewer instances of elaborate cultural features beyond simple hearths. Recurrent visits will tend to make occupations difficult to define, and will result in dense artifact concentrations with little pronounced clustering reflecting temporal or functional differences in the assemblage. These sites should be situated within fairly direct proximity to the resources being tapped, often with less concern for access of water, firewood, or sheltered location.

Procurement locations. These sites will contain evidence of focused extraction of a single important resource, and should not reflect stays of any duration. There will be no evidence of processing beyond that required for immediate extraction and transport to a field camp, and no evidence of camping activity reflected in features like hearths. Quarry areas for procurement of stone to work into tools and hunting sites exemplified in broken projectile points and light contained scatters of simple expedient tools like utilized flakes will dominate this site type. It is expected that plant extraction sites and fishing sites will be hard to recognize simply because the artifact inventory to procure these resources is highly perishable and suffers little loss in the extractive process. These sites should be located on the resource being extracted with no concern at all for water, firewood, or shelter, except as these may coincide with the distribution of natural resource arrays.

Caches. Cache sites are defined as isolated storage locales for significant raw and finished resources. They may not be in direct association with any other site type. These sites may consist of patterned cultural features like prepared holes or cists, or they may be simply natural features like crevices or small overhangs in rock walls. Cultural context supplied in the limited overt patterning of these sites can be invaluable, since it represents discrete prehistoric or historic activity with cultural materials preserved in meaningful temporal and functional association. Artifact assemblages will characteristically show little variability within each cache, but the range across cache sites could show a broad range of economic and social or ideological activities. Encounter of these sites can be judged to be infrequent given their small size and prehistoric and historic efforts to obscure their location. Eroded banks along the reservoir and rock faces or areas of large tumbled stone should be routinely scoured for these types of features.

Stations. These sites are defined as information gathering and information transmittal locations like vantage points, cairns, or rock art faces. Portable artifacts may be found and some evidence of camping might be observed, but in general, these sites will be lightly marked by artifact associations and will tend to have obvious correlates with landscape characteristics.

All of these site types may be encountered in archaeological surveys in southeastern Idaho.

Most sites in the residential base or field camp category would have been located where multiple resource arrays emerged. Sources of water, firewood, and sheltered locations will tend to cluster where rivers and streams bend, slow, widen out, or where small to large side streams or drainages feed into main channels, or where constrictions or geological features have altered the river and stream courses. The variables described above would also have enticed historic European activities to overlap with Native American activities. Often, sites selected for homesteads, towns, fishing, grazing, or hunting are those selected for in the past by prehistoric peoples.

To date, there has been little effective, systematic archaeological survey of any significant topographic features on or near the Snake River Plain other than intensive survey work done on the Idaho National Engineering Laboratory. The natural environment on the INEL consists of a relatively flat, unbroken volcanic landscape overlain by dunes and flanked by high buttes. Collapsed lava tubes and restricted riparian zones associated with seasonally inundated playas dot the landscape. Prehistoric human activity was channeled by the natural landscape, and therefore limited in scale and scope.

Other major productive resource zones on or associated with the Snake River Plain include the major river drainages and the surrounding mountain masses. Neither major topographic feature has been systematically surveyed for archaeological resources. Swanson's (1972) work in the Birch Creek Valley was limited to understanding geological deposition, environmental change, and cultural chronology. Holmer's (1986) work at Wahmuza in the Fort Hall Bottoms along the Snake River, is invaluable because it sampled a resource environment heretofore untapped, but the work was seriously limited by restrictions put on survey of larger sections of the bottoms along the river and dunes and terraces away from the river or drainages flowing into the Snake.

Any major riverine resource area should produce a variety of prehistoric hunting, fishing, plant gathering, and residential sites of some scale and complexity. The prehistoric record for southeastern Idaho is a relative unknown in this regard simply due to the selective restrictions of past research. The ethnohistoric and ethnographic records offer some tantalizing clues on how Shoshonean peoples used the river or related to it, but to date we have had little opportunity to explore these relationships in any detail. The historical record of early exploration and contact offers some very biased yet invaluable descriptions of Shoshoneans using the riverine environments, describing large camps down on the Snake River, with Shoshone taking fish, gathering plants, and hunting (Clark 1986). The record of early trappers and explorers has also created the opportunity for historical archaeology focused on finding sites of this early historic activity. We know that the Astorians were the first to traverse the Snake River, and that they had multiple accidents, canoe turn-overs, and camp sites along the river. Later trappers were known to have exploited resources along the Snake, and immigrants travelling down the Oregon Trail touched upon the river environments. Still later, early farms and ranches were placed in sheltered, watered locations on the river. So, the riverine environments were an attraction for both prehistoric and historic populations.

Historical Record

The first written description of Shoshone peoples resident in Idaho appears in the journals of Lewis and Clark (1805-1806), with their encounter of Shoshone on the Lemhi River in northeastern Idaho. Fur companies lost little time in exploiting the region. In 1808-1810, Canadian fur trader David Thompson visited the Kutenai, Pend d'Oreille, and Coeur d'Alene of northern Idaho. Washington Irving compiled records of the Astoria party who travelled down the

Snake River in 1811-1812. The journals of Peter Skene Ogden, chief trader of the Hudson's Bay Company, for 1825-1828, describe lives of Shoshone on the Snake River. Captain Bonneville's journal for this expedition in 1832-1834 supplies insight into the lives of the Indians of the region. Other accounts include written records of fur traders Nathaniel Wyeth and Osborne Russell, and clergyman Samuel Parker.

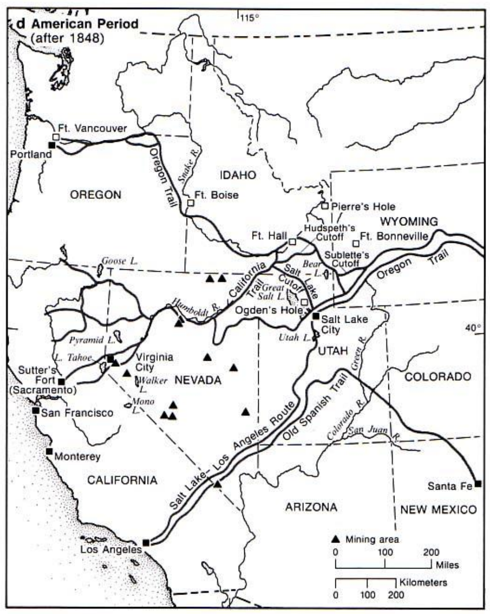

Figure 3. Historical map of the Northern Intermountain West. Malouf and Findlay 1986:Fig.1d.

<u>Fur Trade Period, ca. 1808-1842.</u>

Direct impact on aboriginal societies during this early phase of contact in this area was slight, but developments were taking place that would have dramatic impacts on Shoshonean and other Idaho groups (Lohse 1991). The first permanent fur trading establishment was Fort Henry, built by the Missouri Fur Company on the North Fork of the Snake River in the fall of 1810. In the fall of 1811, the Wilson Price Hunt Expedition or "Overland Astorians" encountered a Shoshone camp near the confluence of the Portneuf and Snake Rivers or near the present day "bottoms" on the Fort Hall Indian Reservation. This same expedition continued down the Snake River, making a successful portage at American Falls. Travel down the river beyond that point was dangerous, and there are numerous accounts of goods lost in capsizings of canoes. Finally, some distance down from "Devil's Scuttle Hole" the party broke up, leaving behind sixteen caches of goods (Beal and Welles 1959:101). The Hunt party was to reach Astoria, and then return back along the route they had pioneered. In fact, the route discovered and explored by the Overland and Returning Astorians was to become the Oregon Trail, a travel route for tens of thousands of American settlers headed for California and Oregon Territory.

Although the Astorians' venture had proven abortive, and their post at Astoria on the mouth of the Columbia River was sold to the Canadian North West Fur Company on November 12, 1813, they had established a link for the Upper Snake and Salmon River country to the Columbia River drainage and the Pacific Northwest that was never broken. Early American fur companies in this region had difficulty maintaining the extenuated lines of supply that came up the Missouri River system into the Intermountain West. Canadian and British companies on the other hand, began to establish posts on the Columbia River system that were to dominate trade in this region for the next half-century.

Donald Mackenzie was assigned to head the newly created North West Company's interior department of the Columbia in June, 1816. An unusual leader, full of energy, and knowledgable of Indian societies, Mackenzie was to dominate the trade in the Snake River country in ensuing years. It was his expressed goal to expand North West Company fur trading operations up the Snake River drainage into what is now Idaho. Staging operations out of Fort George (Astoria), Mackenzie led fur brigades up the Snake River in 1816-1817 and up the lower Snake in 1817-1818. Fort Nez Perce, established in July, 1818, became the staging point for Mackenzies' Snake brigades. The expedition of 1818-1819 brought Mackenzie and a large brigade across the Blue Mountains, down the Snake River on to the Bear River, and to the headwaters of the Snake. On his return, he came back to the Boise, and described how rich the region was in furs. He was prompted to establish a navigable route up the Snake RIver from Fort Nez Perce to the Boise area in 1819. Mackenzie did succeed in ascending in a boat from the Columbia through the Grand Canyon of the Snake past Hells Canyon, though he concluded that land transport was probably safest.

Mackenzie held the first rendezvous in the region on the Boise River in 1819. William Kittson was dispatched up the Columbia with a large party and supplies to outfit the Snake country fur brigades. Kittson then hauled the Snake brigades furs back to Fort Nez Perce, and reported success of the expeditions at Fort George. Shoshone hostility, however, ruled out construction of the fur trading post Mackenzie envisioned on the Boise. Mackenzie spent the winter of 1819-1820 on the Little Lost River.

On April 6, 1821, the North West Company joined with the Hudson's Bay Company. Donald Mackenzie was appointed chief factor and left the Snake River country for the Red River in

Canada. The furs of the Snake River country were never taken in quantity again, and it seems that the Hudson's Bay Company viewed the Columbia River and Snake RIver drainages of the Pacific Northwest largely as a buffer against Russian and American expansion. They intended to hold on to the Oregon country as long as possible and ensure continued control of the profitable New Caledonia or British Columbia trading area.

Two St. Louis fur companies sent expeditions to the Rocky Mountains in 1822 that attracted Hudson's Bay Company attention. The Ashley-Henry Rocky Mountain expedition reached this region in 1824, and prompted Alexander Kennedy at Spokane House to revitalize the Snake brigade. Two Snake brigade expeditions traveled past Flathead House and the Bitterroot to the upper Missouri, returning south by way of the Lemhi to Henry's Fork, the Blackfoot, and down the Green or Bear River in one instance. Hostilities with Blackfoot bands were marked, and in all, trapping and trade were not intensely profitable for the British or American companies. Several years brought relative peace for the HBC brigades in working their way through Indian territory, but by 1824, Rocky Mountain Fur Company trappers were on the Salmon. This marked the date of contest between British and American companies for the furs of the Snake country.

President James Monroe's doctrine initiated in his message to Congress in 1823 had clearly indicated the United States' interest in expanding into the Oregon country. The London directors of the Hudson's Bay Company instructed Governor George Simpson to control the Snake country as an effective boundary to American economic encroachment. It was the expressed interest of the company to extract furs as quickly as possible, and that the resources of the Snake country which probably could not be kept by the HBC should not be conserved.

Rocky Mountain Fur Company expeditions were on the Portneuf and Bear Rivers in 1824. Perceived American threat on the Snake country led to Peter Skene Ogden's appointment to head the Snake brigades. Establishment of Fort Vancouver on the lower Columbia River and replacement of Spokane House by Fort Colville near Kettle Falls were HBC attempts to create greater self-sufficiency for the Columbia River operations. It was Ogden's explicit object to leave the Snake country barren of fur and unattractive to American fur companies. Ogden's fur brigade left Spokane House in December of 1824 in cooperation with Jedediah Smith and his Rocky Mountain Fur Company trappers. These men trapped southeastern Idaho with fair success throughout 1825. Ogden was to find his brigade unreliable and willing to go over to American interests. Jedediah Smith reported that his 1824 and 1826 expeditions had shown profitable resources still left in the Snake country. Review of Ogden's work was less favorable, and the HBC concluded that little fur was left south of the Snake River.

Agreement between the United States and Great Britain on August 6, 1827, to continue the Oregon boundary convention of 1818 for an indefinite period left exploitation of the Oregon country by Americans open. By his fourth expedition in 1827, Ogden found American trappers throughout the country surrounding Boise. Fur quantities were down, but American and British contingents continued to worked the country. Ogden spent the winter of 1827 on the Portneuf. Fur hunts of 1828 faced increased depredations by Blackfoot and Shoshone, increasingly dissatisfied with European presence in their territories. When Ogden left the area in 1828, work by British and American companies had seriously diminished the fur resources of the Snake country.

By 1830, neither the HBC nor the American companies were in control of the Snake country. Depredations by Blackfoot and Shoshone and low returns on furs discouraged further intensive work. Yet, an American Fur Company expedition and another Snake brigade under the direction of John Work were in the region again in the fall of 1830. Work's brigade scoured the Weiser, Payette, and Boise country thoroughly. Work went up the Lost River to the Salmon, and over to the Blackfoot and onto the Portneuf to winter. Throughout, the brigade extracted little fur. Work's men worked the mountainous country of central Idaho, and scoured the fur devastated country for what little might remain.

American companies continued to work around and in the Snake country. Expeditions led by Walker and Bonneville met in 1834, and concluded that British domination of what little remained in the Snake country was secure. The Rocky Mountain Fur Company dissolved in 1834, and the American Fur Company was left in control of the St. Louis based trade. In 1834, Nathaniel Wyeth, dissatisfied with his fur trade venture, established Fort Hall to dispose of goods rejected at the 1834 rendezvous. As the fur trade was unprofitable, Wyeth thought he might trade with the Indians and recover some of his expenses.

The original Fort Hall was located on the south bank of the Snake River above the mouth of the Portneuf. It was sixty feet square with ten foot high walls and interior rooms of poles thatched with brush and covered with clay. Shortly after the fort was established, it was visited by a large band of Shoshone and Bannock numbering at least 250 lodges. One July 27, 1834, a group of Nez Perce and Cayuse attended Methodist minister Jason Lee's services at the fort with a Hudson's Bay Company fur brigade. The fort continued to be a focus for Shoshone-Bannock tribes over the next twenty-three years.

Trade at the fort worried Hudson's Bay Company officials enough that brigade leader Thomas McKay established Fort Boise near the mouth of the Boise River in 1836. The HBC hoped that Fort Boise would stop any flow of furs from tribes further northwest down to Fort Hall. In 1837, the HBC solved any competition problem by buying Fort Hall. HBC Fort Hall dominated fur traffic in Rocky Mountains for the next twenty years. It also became a primary stopover and supply point for immigrants on the Oregon Trail. The California Gold Rush of 1849 brought thousands of settlers past the fort. Its location above the split off between trails to Oregon and California made the fort a focus of promoters trying to attract settlers to one region or the other. The Hudson's Bay Company closed Fort Hall with the onset of hostilities in the Yakima country in 1855 that closed Fort Walla Walla and threatened lines of supply to the Snake country.

Oregon Trail and Westward Migration, ca. 1842.

Organized migrations to the Oregon Territory began by 1842, prompted in no small part by earlier missions that had set up small agricultural communities in the Pacific Northwest. Oregon missionaries actively encouraged colonization by United States citizens to offset British interests in the region. In 1846, a treaty between the United States and Britain gave all the land west of the Rocky Mountains to the Pacific Coast and between the 42nd and 49th parallels to the United States, with exceptions of holdings of the Hudson's Bay Company and the Puget Sound Agricultural Company which might be purchased at some future date. These holdings were purchased by the United States in 1863.

Immigrants began using the Oregon Trail in large numbers in 1842, when Dr. Elijah White led an expedition of over one hundred people over the rough wagon road to Oregon's Willamette Valley. In 1843, a thousand emigrants crossed the trail in Applegate's wagon train. The trail had received U.S. government recognition with Charles C. Fremont's survey of 1842-43, which demonstrated that the Columbia River drainage provided the only practicable route across the Rocky Mountains to the Pacific Ocean. A dramatic increase in immigrant use of the trail occurred starting in 1848 and 1849. Many were headed for the gold fields in California, many to the rich arable land of the interior valleys of Oregon. This was the period of greatest impact on the Indian societies of the region. Permanent settlements in Idaho would be relatively rare for several decades yet, but effects of fur trading activities and contact with migrating settlers were dramatic.

Effects of European Contact on Shoshone and Bannock Tribes.

The Shoshone or "Snake" were, of course, known outside of present-day Idaho prior to Lewis and Clark's exploration. Thompson (1916) records the Snake as a populous and powerful foe on the Western Plains. Their might in the early 18th century inhibited the expansion of Siouan groups which were being forced west by European advance. Earlier, probably sometime in the 16th century, Shoshoneans had expanded well down into Texas and New Mexico. These Utes and Comanches were Plains tribes dependent upon buffalo for their existence (Forbes 1959; Tyler 1951; Shimkin 1986). In pre-gun times, the early 18th century, it seems that the Shoshone were using a sizable portion of the western Plains. Teit (1930:303-305) relates Flathead and Nez Perce traditions that place large Shoshone bands on the Upper Yellowstone River east of the Bighorn Mountains and along the Upper Missouri River. Apparently, it was smallpox in the late 1700s that first threw the balance of power to the Shoshone's enemies. These epidemics resulted in dramatic population losses, and combined with better armed adversaries expanding onto the western Plains, effectively pushed the Shoshone back into the Rockies (Thwaites 1904-1905, 2: 373). By 1804, when visited by Lewis and Clark, the Shoshoneans were only cautiously venturing out onto the Plains to hunt buffalo. Even their territories in the Rocky Mountain area were not entirely safe, however, and incursions by Blackfeet and others were common.

Shoshone fighting to retain control of their territories was a constant theme throughout the early 19th century. Better armed Blackfeet and Siouan adversaries were constantly encroaching on Shoshone land. Flathead and other Salishan groups to the north often found common cause with the Shoshone, and it was not uncommon to find mixed bands of buffalo hunters or trading parties made up of members of these mountain groups.

Buffalo were not the only lure for Shoshone to continue using the Plains. Long-time trading relationships had been established between Shoshone and other horse breeding tribes of the Rocky Mountains and the Siouan agriculturalists along the lower Missouri River in present-day Nebraska and South Dakota. Trading fairs were held annually between Shoshone and Crow and Hidatsa and Mandan at the latters' villages on the Missouri. Larocque (Burpee 1910:22-37) found Shoshone and Crow at the Mandan villages in 1805. Shoshonean horses formed the basis of a trade conduit that brought hides and other mountain products to the Missouri villagers in exchange for garden produce and other goods. Shoshone were also on the Southern Plains for trade. Jacob Fowler found Shoshones with Comanches at a large trading rendezvous on the upper Arkansas in 1826 (Coues 1898:51-54).

By the late 18th and early 19th centuries, this access to trade was imperiled by incursions of populous non-agricultural Sioux, and Shoshone and other mountain groups found it increasingly dangerous to travel on the Plains except in large groups. The Crow became middlemen and maintained trading relationships with the Hidatsa and Mandan villages, until these too were destroyed by epidemics and relentless Sioux pressure.

European politics and economics obviously conditioned this ebb and flow of Native American interaction in the 18th and 19th centuries. It was European advance that forced the Siouan groups out onto the Plains from the western Woodlands around the Great Lakes. It was industrial age European technology that brought firearms in large numbers to Siouan and Athapascan adversaries of the Shoshone. It was economic interest in furs that initially brought the European market economy out onto the western Plains and Rocky Mountain regions looking for Native American producers and consumers.

The colorful era of the fur trade was expansion of the European market economy (Lohse 1988). Native American groups became suppliers for European entrepreneurs opening new markets predicated on furs. Other elements were traded, such as horses, hides, women, and children, but furs can be seen as the primary motivating force attracting so much European attention in the mid-19th century and before.

The Shoshoneans and the Crow were friendly partners for the European fur traders. This was not a philosophical position so much as a purely pragmatic one. The Crow and Shoshone by the 19th century were in a besieged, marginal position. They had horses but they needed firearms to duel successfully with Blackfeet, Arapaho, Cheyenne and Sioux. It was important for them to form trading alliances with representatives of Industrial Age European societies. The Blackfeet and Sioux had proved troublesome for American traders, and they welcomed the relatively warm reception provided by the Crow, Shoshone, and other mountain tribes. The British too found the mountain tribes hospitable, and the Hudson Bay Company fur brigades operating in the Pacific Northwest worked in relative peace. The Shoshone, like the Flathead and Nez Perce, did not gather many furs. These tribes provided horses and supplies to the HBC brigades. They also supplied some measure of protection by standing between potentially hostile Athapascan and Siouan tribes and the European economic markets. The mountain tribes needed firearms and support from European traders and in return gave support and a covering umbrella of protection for trading operations.

Competition between fur companies resulted in removal of the beaver from the watershed. European hunting parties not only depleted the sought after furs but also eliminated aboriginal food resources. Charles Preuss, cartographer for John C. Fremont, in 1843 observed that "the white people have ruined the country of the Snake Indians and therefore should treat them well. Almost all the natives are now obliged to live on roots, game can scarcely be seen any more" (Gudde and Gudde 1958:86).

By 1840, the fur trade and the buffalo were all but gone from the Shoshone and Bannock country. Interaction with the traders throughout the early 19th century had produced a number of changes in Shoshonean society. Rendezvous or trading fairs, just as in aboriginal times, brought together large numbers of people representing many different mountain tribes as well as Europeans and their allies. An encampment would contain Shoshone, Bannock, Flathead, and Nez Perce, as well as British, French and American traders, and Iroquois and other Native Americans working with the fur brigades. Out of these associations, came marriages between Europeans and Shoshone, and Shoshone and other tribes. Often, these were economic arrangements as well as affairs of the heart. Marriage of a daughter to a trader brought access to European goods. It also brought security since in times of stress a trader could be counted on to support his Shoshone family. Working with the traders also produced sought after firearms, as well as other seductive items of European manufacture like metal pots and pans to replace baskets and pottery, glass beads to replace bone and shell ornaments, metal sewing awls to replace bone splinters, thread and cloth to replace sinew and hide clothing. Brigham Madsen (1980:23, 25) argues that limited Northern Shoshone contact with fur traders brought about a short-lived "cultural golden age" by adding new elements to their way of life, without seriously disrupting their traditional patterns.

Close association with Europeans also produced disastrous changes: disease that decimated aboriginal populations that had no immunity; prostitution of women for access to goods and security; breakdown of traditional tribal sociopolitical organization as intermarriage and economic pressures disrupted old systems. Shoshonean interest in interaction with Europeans was partly pragmatic, a desire to introduce security against hostile encroachments by more populous better armed tribes. Industrial Age technology was an attraction in itself: metal is more durable than stone or pottery; cloth offers more possibilities for clothing than hide;

dyes and glass and other esthetic productions offer greater varieties of artistic expression than limited selections of natural dyes and other unmodified products of nature.

It was in areas of the landscape where aboriginal populations concentrated, and where European economic interests coincided, that Native Americans suffered most. Anglo-American attention to "desert oases," well-watered riverine environments, undermined the fragile desert ecology and disrupted aboriginal economies. Native Americans in these areas often responded by stealing traps and raiding herds of livestock. The Fort Hall Bottoms were just such a sensitive riverine resource zone, rich in vegetation and animal species of utmost importance to Shoshone and Bannock economy.

Fort Hall was founded in this period of social and political flux for Shoshonean societies. The post was established in the river bottoms, now referred to as the Fort Hall bottoms. The bottoms held marshes with attendant wildlife, deer, and feed for the large Shoshone horse herds. They were the scene of winter camps and get-togethers. Placing the fort in the bottoms simply amplified the importance of the area, and intensified Anglo-American and Shoshone-Bannock interaction.

The name was carried over with the U.S. Army's construction of a fort on Lincoln Creek in 1870, some twenty miles to the northeast of the original Fort Hall site. This military post was abandoned shortly thereafter, and the name Fort Hall became applied to the Shoshone-Bannock Indian Reservation that encompassed the original "Fort Hall Bottoms" on the east side of the Snake River.

The end of autonomous life for the Shoshone and Bannock is found in the 1860s, with the disappearance of the buffalo and the beginnings of Mormon settlement in the Bear River Valley. Throughout the 1860s, settlers encroached on Shoshone and Bannock territory. Settlers entered the Boise River Valley. Gold miners entered the mountains. Increasing conflicts between Anglo-Americans and Native Americans led the United States government to pursue a policy of treaty making. Pacts were made at Fort Bridger, Box Elder and Soda Springs in 1863, and at Fort Boise in 1864.

The Fort Hall Reservation was established in 1867 for the Boise River and Bruneau River bands. In 1868, the Fort Bridger Treaty located the Fort Hall Shoshone and Bannock on the same reservation In 1907, the Lemhi and Sheepeater bands were removed to the Fort Hall Reservation as well.

The rich Fort Hall Bottoms had originally attracted Shoshone and Bannock bands. Construction of Fort Hall further concentrated both Native American and Anglo-American interest on the bottoms. The fur trade eventually dissipated, but Fort Hall continued to be used as a supply point for the thousands of settlers that passed through Idaho from the 1840s to the 1860s. Fort Hall and the bottoms then became the heart of the Fort Hall Indian Reservation. A rich panoply of Idaho history, recording the interaction of Indian and White societies, centers on Fort Hall and the surrounding bottoms, a story that is still not fully understood.

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- Ethnohistoric and ethnographic
- Altithermal
- Anadromous fish runs
- Housepits and settlement types
- Settlement systems
- Hunter-gatherers and foragers
- Acculturation and reservation systems

3. The Feature System

Feature System (FS) recording procedures are designed to provide an efficient standardized system for accurately defining archaeological site context, association and provenience. Recording forms are coupled with computerized relational data base managers to facilitate research and report production.

Terms and Concepts

Terms and concepts integral to archaeological excavation recording systems include:

ARTIFACT. An artifact is any portable object made or modified by human activities.

ASSOCIATION. An association is any defined relationship between artifacts or features. An association must be defined. An association is not something that is found.

CONTEXT. Context may be found or it may be defined. Context may also be primary or secondary.

- FOUND CONTEXT. This label is dependent upon recognition of a bounded cultural features, and this in turn is dependent upon recovery of artifacts IN SITU.
- DEFINED CONEXT. This label requires that the extent of diffuse or unbounded cultural be defined, subjectively or objectively.
- PRIMARY CONTEXT. This pattern is the direct result of specific human activities at a particular site, on a specific surface, over a short span of time.
- SECONDARY CONTEXT. This pattern is only indirectly a result of the original human activity, and may in fact be due to considerable cultural or natural disturbance after having been laid down in the archaeological site.

DATUM. This is the designated point on a site from which all vertical and horizontal measurements of provenience are taken. Datums may be

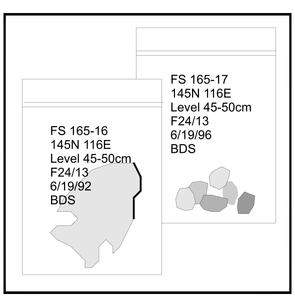
- PRIMARY. The initial or principal point from which all vertical and horizontal measurements of provenience are taken.
- SECONDARY. A second datum set up to facilitate taking of vertical and horizontal measurements. This datum is created for convenience, usually

because of significant changes of slope on the site surface.

FEATURE. A feature is literally anything you feel is pertinent to note or to refer to in your observations. Features seem to indicate connection or association between phenomena observed in the archaeological record. Feature may be cultural or noncultural, and may be bounded or diffuse.

- CULTURAL. Cultural features have residue of human activity, produced either intentionally or unintentionally.
- NONCULTURAL. Noncultural phenomena that cannot be attributed directly nor indirectly to human activity.
- BOUNDED. This is a cultural feature with easily defined extent (e.g., a firepit or a living floor).
- UNBOUNDED. A cultural feature that cannot be clearly defined by the observor (e.g., increasing and decreasing densities of artifacts or diffuse lensing of noncultural depositional layers).

FIELD SPECIMEN NUMBER (FS). The Field Specimen Number of "FS" is the single most important provenience distinction in the recording system after recognition of the feature designation. This number is unique to Feature and excavation level. Artifacts, ecofacts and naturefacts removed from each excavation level are placed in separate excavation bags that are given distinct field specimen numbers. Each artifact will be given a distinct suffix within the field specimen number assigned to the excavation level or feature bag. Complete labeling for an FS bag is shown below:



- **FS 165 - 16**
- **145N 116E**
- **LEVEL 45-50 cm**
- **F24/13**
- **6/19/92**
- **BDS**

- FS= Field Specimen
- 165= sequentially given field specimen number
- -16= unique designation for an artifact from the FS165 field specimen lot

- 145N= SW unit corner on N line at 145 meters north of primary datum
- 116E= SW unit corner on E line at 116 meters east of primary datum
- LEVEL= 45-50 cm= artifacts removed from excavation level 45-50 cm below either the unit datum (b.u.d.) or the site primary datum (b.s.d.)
- F24/13= artifacts removed from Feature 24 of Feature 13
- 6/19/92= placement of artifacts in the field specimen bag
- BDS = initials of the excavator who placed artifacts in the field specimen bag and stapled it shut

IN SITU. Artifacts are found in primary cultural context in a pattern directly representative of past human activities.

PROVENIENCE. The exact vertical and horizontal measurement of an artifact or feature in an archaeological site.

Feature System Practical Methodology

The Feature System was developed by Professor Jesse D. Jennings, University of Utah, to systematize the complex process of archaeological excavation. It was and is a unique approach to excavation, and instills careful recording and puts considerable emphasis on the excavator "remaining in control" of site excavation, i.e. in control of destruction of the archaeological record. Every site excavated, every feature exposed and removed, constitutes destruction of a unique resource. The feature system strives to maintain accurate recording of that destruction, and aids in construction of accurate inferences and analytical decisions.

The ISU feature system carries Jennings' original concept over into computerized analyses, and extends a system intended for field excavation into the laboratory as the most effective means of documenting data analysis. Handwritten field forms are continued as handwritten lab forms, and the results encoded in data management software programs.

The essence of the feature system is that it is flexible, yet systematic, and capable of handling complex problems arising in the course of normal archaeological excavation.

Operating Principles

(1) FEATURE 1 is reserved for daily observations pertinent to documenting decisions made in the course of excavation and analysis. F1's are daily logs or site diaries. They discuss management and strategic decisions made by the site directors, site supervisors, and lab supervisors. These notes declare why things were done, who did them, and why tactics may have changed.

(2) Other Feature Numbers are used as needed. There is no limit to the number of features assigned. Remember, every thing observed should be assigned a feature number.

(3) Assigned feature numbers are never "Closed Out" until:

- The feature has been completely removed through excavation.
- The feature has been reassigned a New Feature Number or has been "Collapsed" into another feature number (e.g., F16 of F4 becomes F4 — it really was not different than F4; e.g., F16 of F4 becomes F32 — it really was part of this feature or association).

(4) This mutability of feature numbers is what allows such great flexibility in the Jennings feature system.

(5) Every feature number must be closed out in the field. You must never, ever wait to close out feature numbers in the lab or in the field camp.

(6) You only write feature notes when you are <u>looking</u> at the thing, feature or association. You never, ever make feature notes after the fact. You may use Feature 1 notes for this purpose.

(7) Print, do <u>not</u> write! Also, only use a ball point pen with indelible ink! No pencils! No soft-tip pens!

Feature numbers assigned in the laboratory are not continuations of feature numbers assigned in the field. Lab feature numbers are assigned separately regardless of provenience and refer specifically to lab procedures and analyses (e.g., a flotation sample from F17 of F4 will be assigned a new feature number when analyzed in the lab). Feature notes taken during laboratory analysis are constructed identically to field notes, describing procedures, things, and features.

Concepts to Review

- ❑ A “feature” is … cultural and non-cultural … bounded and unbounded
- ❑ Artifact
- ❑ Association
- ❑ Contexts … primary, secondary and tertiary …. defined and found
- ❑ Datums … primary and secondary
- ❑ In situ
- ❑ Provenience …. Recording
- ❑ Field specimen numbers
- ❑ ISU Feature System

4. Mapping the Site

Key to successful excavation of an archaeological site is accurate mapping. The archaeological crew arrives on-site and then must record location, topography, and surface artifact distributions. There are no precise formulas for proper mapping since unique site situations require creative solutions.

A general procedure is outlined here.

Site Found: Survey or Testing

Often the field crew will use a hand-held compass or Brunton for laying out site datums, reference lines, and maps.

The archaeological site must be plotted on a U.S.G.S. quad sheet and the legal description (T-R or UTM) noted. Location should include a brief description of site locale, emphasizing easily recognizable landmarks (topography, streams, roads) and describing access to the site area.

The crew will have to decide if reference is to magnetic north or true north, adjusting for declination as indicated on the U.S.G.S. quadrangle (quad sheet).

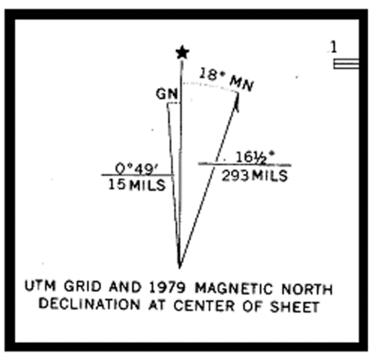


Fig. 1. Declination.

The crew uses the Brunton to shoot a cardinal reference line (N-S or E-W). A stake marks the datum to be established and another marks the end of the line. If this baseline is to be used for a test trench, the crew may run a metric tape from stake to stake, marking off one meter excavation units or squares.

The grid should be numbered within the NE quadrant, assuming a reference datum set well off the site surface to the SW. Usually, the grid datum is set as 100N 100E. This convention will allow for expansion back to the SW if necessary and ensures consistency by allowing only grid references drawn within the quadrant defined by the North and East axes.

A sketch map should be made of the site prior to excavation. This sketch map should indicate major artifact concentrations, locations of stream channels and roads or other features, and the layout of the cardinal grid line.

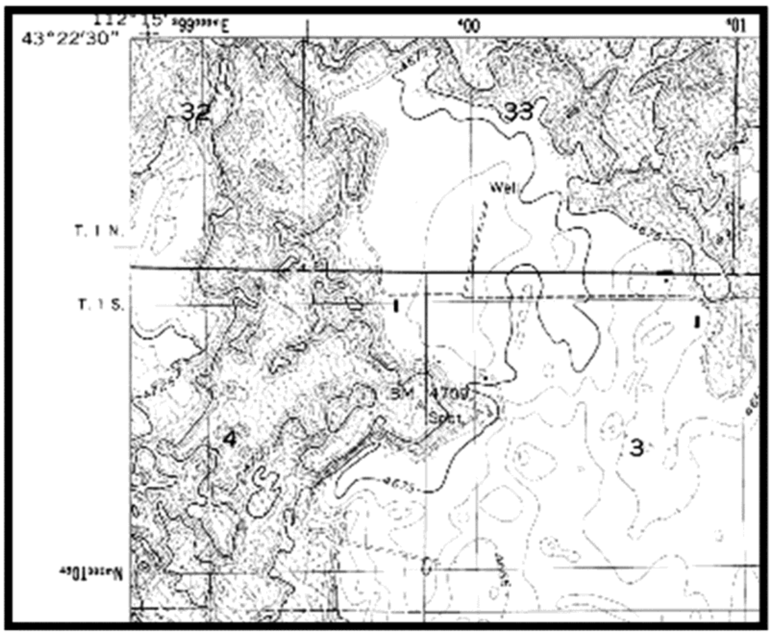


Figure 2. Reproduced section of U.S.G.S. quad "Firth, Idaho." Site locations will typically emphasize topographic landmarks and permanent features like maintained roads, wells, streams, and telephone lines.

It is very important at this juncture that the field crew note all surface evidence that might pertain to the nature of site disturbance.

If testing is required, grid units should now be selected for excavation. Generally, any testing should try to randomize the distribution of excavation units. This proviso should also be interpreted, however, with common sense. If cultural features are visible on the surface or in stream erosion banks, or if artifact distributions show obvious clustering, the sample should be stratified and encompass arbitrary placement of excavation units.

Site Recording Procedures: Keeping Control

The key to successful excavation is maintaining accurate measurements or provenience information throughout the exercise. Two reference systems must be slavishly adhered to:

All horizontal and vertical measurements must be taken from the primary or secondary site datums.

All excavation squares and excavation levels must be labeled within the establish quadrant of one meter grid squares.

In Figure 3, excavators have laid out a one meter by one meter grid system labeled as north and east axes. Seven 50cm by 50cm test units have been selected and diagnostic artifacts have been located as letters a-k. A primary datum has been set at 100N 100E and a secondary datum set at 106N 104E.

Concern for adequate CONTROL must also dictate excavation strategy.

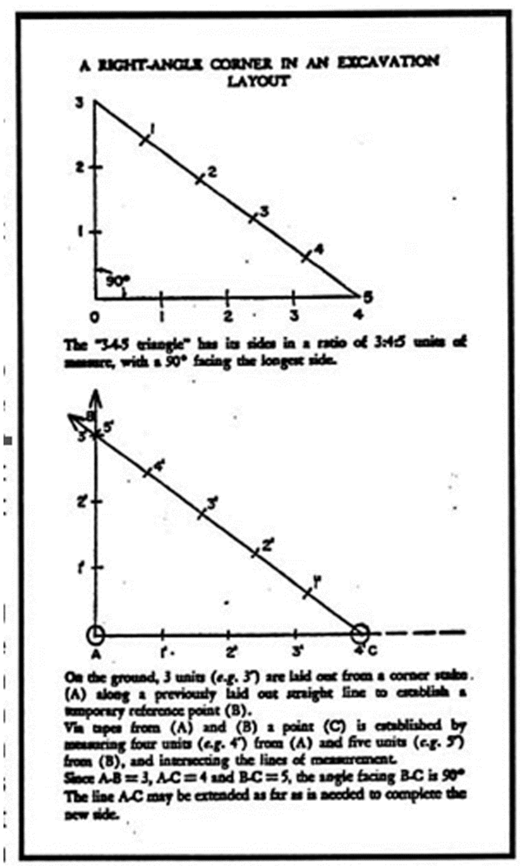


Figure 3. Laying out a square grid.

Mundane but <u>very</u> important: Make sure that the excavation unit is absolutely square (an error at the beginning is a fatal flaw in the analysis and publication). Excavators should use two metric tapes and the concept of a 3-4-5 triangle to square unit corners.

Mundane but equally important: Make sure that all excavation units are designated by their southwest corner referenced within the NE site grid system. A common mistake is to confuse excavation unit coordinates as excavation progresses.

Mundane again, but oh so common a mistake: Make sure that the strings on the stakes are crossed on the inside so that excavation margins do not prematurely remove the stakes.

If level readings are being taken from the SW corner of the excavation unit, be sure to notch the corner stake rather than letting the level string slide down as the site surface erodes. This string elevation will be shot relative to the primary datum elevation.

Excavation will normally proceed in arbitrary 5 cm or 10 cm horizontal levels within the excavation units. As excavation expands into adjacent units, arbitrary levels will generally be abandoned for natural or cultural levels. At this point, elevations will be taken on the surfaces of the naturally sloping and diving strata.

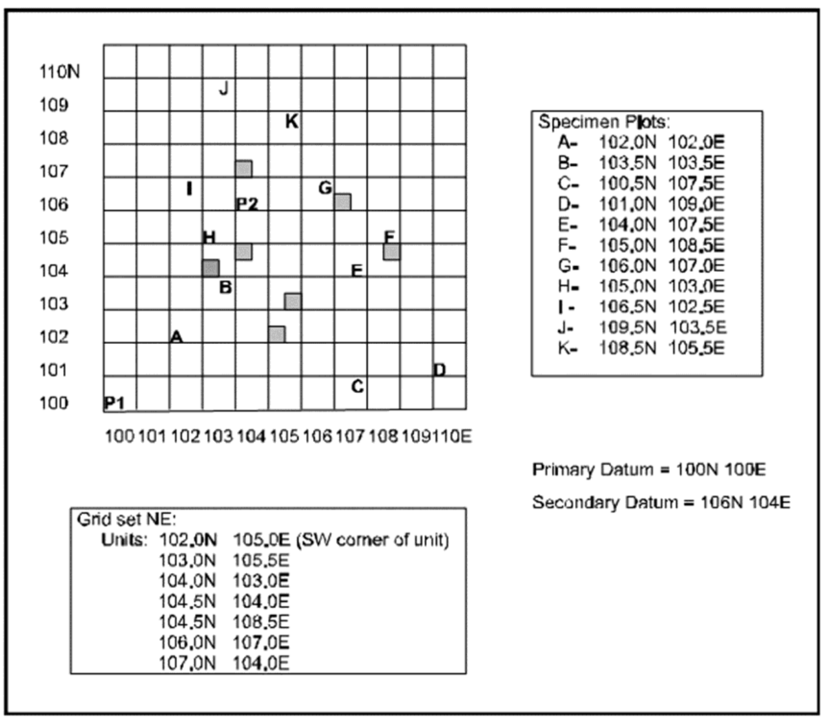


Figure 4. The site grid excavation system.

Figure 5 indicates how control is kept on accurate measurement of the vertical and horizontal provenience of artifacts within the excavation units. A number of artifacts are plotted on the north and east axes of unit 100N 100E. Each artifact has been given a specimen number (FS 160) unique to the unit and stratum. Feature boundaries (F16) are roughed in as indicated.

As excavation proceeds, the crew is recording tactics and observations in the feature system forms. Done correctly, this record supplies the information that will be sought by analysts, report writers, and other researchers.

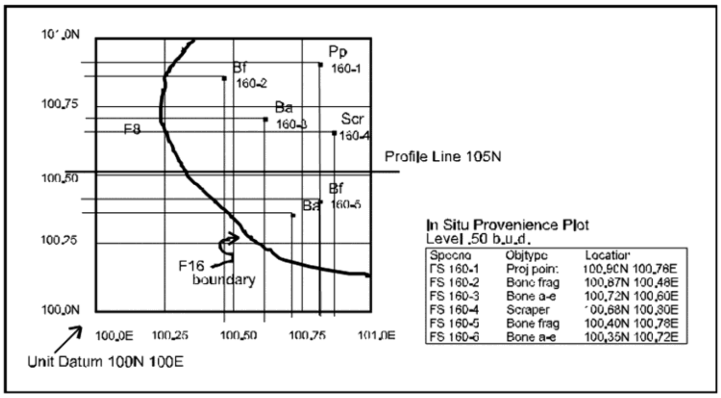


Figure 5. Plotting the position of artifacts on the floor of an excavation unit.

Rigor is essential. Remember that excavation is destruction, and is only justified if the utmost care is taken to record all relevant information.

Recommended References

Barker, Philip

1993 Techniques of archaeological excavation. London: Batson.

Hester, Thomas, Harry J. Shafer and Kenneth L. Feder (eds.)

1997 Field methods in archaeology. 7th ed. Mountain View: Mayfield.

Jaukowsky, Martha

1980 A complete manual of field archaeology. Englewood Cliffs: Prentice Hall.

Concepts to Review

- Bruntons, transits and alidades … which for when?
- T-Rs and UTMs
- USGS quad sheets … quadrangle series
- Excavation grids … northings and eastings
- Site datums and unit datums

5. Stratigraphy

Recording will require drawing a stratigraphic profile. Inevitably, real life distinctions will be simplified, and the lines will only grossly represent significant features and strata.

Excavators will construct their profile excavation unit wall by excavation unit wall. Ideally, the stratigraphic sections will record points of intersection and the angle of repose across the full extent of the unit. Figure 1 presents an idealization of stratigraphic profiling procedures (horizontal and vertical reference lines).

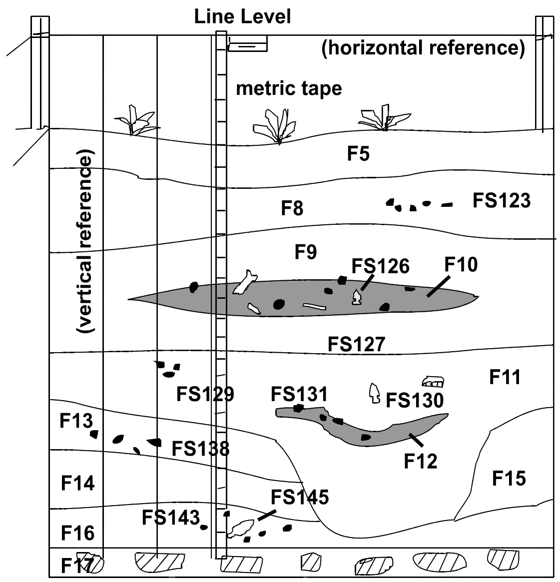


Figure 1. A schematic stratigraphic profile showing drawing and recording conventions.

As shown, a great deal of information can be presented in a properly drawn strat profile. A line level sets the horizontal reference line, which is marked off in 10cm units and vertical reference lines are established along which measurements are taken with a metric tape. Points are established that mark the uppermost, lowermost, and horizontal extent of all cultural and natural features. FS numbers assigned are shown on the profile as symbols indicative of diagnostic artifacts or radiocarbon samples. The profile should supply all information that the excavator or analyst needs to maintain control of the excavation and subsequent analysis. The depiction of key reference points is simplified by conventions like vegetation drawn on the surface and diagonal lines drawn through stones in the sterile level.

Each profile page should have a key to symbols and descriptions of important features and field specimen lots. Notes should be indexable and usable for subsequent analysts. For example, radiocarbon samples with high potential should be identified on the strat and on the accompanying notes section. Similarly, diagnostic artifacts should be located on the strat and listed by their field specimen number.

Profiles are generally drawn on Continuation Sheets to a 1:10 scale consistent with that used in Field recording form #2. This form is used for drawing plan maps of feature extent, surfaces or excavation levels. Use of a consistent scale is key since we want to be able to scan these records into our computer data base and later draw profiles and plan maps depicting broad sections of site stratigraphy and activity surfaces.

Figure 2 shows an example of a completed Form #2 from excavation at Indian Rocks in 1992. The excavator has recorded the location of diagnostic specimens plotted for level 150-155cm b.s.d. in unit 22N1E. Artifacts were recovered as FS 30. A radiocarbon sample was recorded as FS 43. Note that a soil sample was removed from the northeastern corner, that no feature numbers were defined in this level plan, and that no profiles were drawn recording the surface since the level was arbitrary and cut level with the site datum. A continuation sheet was attached to the Feature 2 as a complete listing of all FS lots.

List of Recommended References

Boggs, Sam

1995 Principles of sedimentology and stratigraphy. Englewood Cliffs: Prentice Hall.

Courty, Marie A., Paul Goldberg and Richard Macphail

1989 Soils and micromorphology in archaeology. New York: Cambridge University Press.

Hassan, Fekri

1978 Sediments in archaeology: Methods and implications for paleoenvironmental and cultural analysis. Journal of Field Archaeology 5:197-213.

Keeley, Helen and Richard Macphail

1981 A soil handbook for archaeologists. Bulletin 18. Institute of Archaeology, London.

Stein, Julie

1988 Interpeting sediments in cultural settings. In Julie K. Stein and William Ferrand (eds.), Archaeological sediments in context. Orono: Center for the Study of Early Man.

Concepts to Review

- Profiles and profile walls
- Natural and cultural stratigraphy … difference between arbitrary excavation units and stratigraphic units
- Bsd’s and bud’s

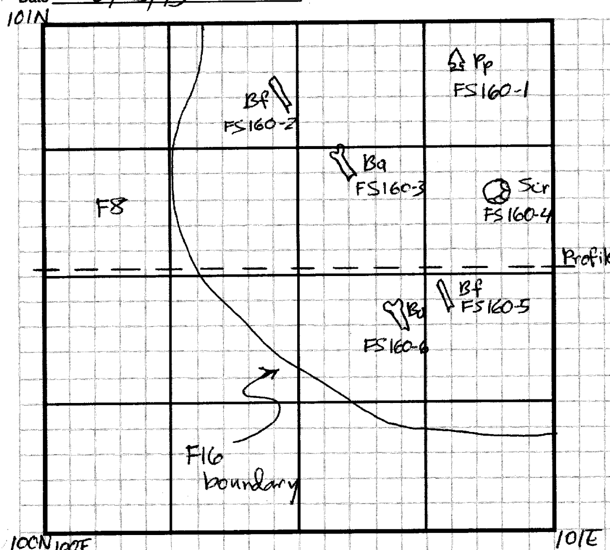
2
Page

IDAHO STATE UNIVERSITY
IDAHO MUSEUM OF
NATURAL HISTORY

(1) FEATURE FORM
(2) PLAN MAP
(3) EXCAVATION LEVEL

Site No. BK-1183

Date 6/3/93



UNIT 100 N 100 E

FEATURE 16 OF —

LEVEL b.u.d. 50cm

b.s.d.

PROFILE LINES:
COORD LOC: 105N
REFERENT:

SW CORNER: 100 N 100 E

SCALE: 2 = 10cm

FEATURE LIST:

FEAT NO:	DESCRIPTION:
16	sandy carbon matrix
8	general fill

SAMPLES:
RADIOCARBON: FS 160 - 21
MATRIX: FS 160 - 11, 160 - 18, 160 - 20

IN SITU PROVENIENCE:

SPEC NO:	OBJ TYPE:	COORD LOC: N	E
FS 160 - 1	DSN proj pt	100.87	100.79
160 - 2	Bone frag	100.82	100.45
160 - 3	Bone art end	100.72	100.57
160 - 4	Scraper	100.63	100.86
160 - 5	Bone frag	100.42	100.77
160 - 6	Bone art end	100.32	100.59

CONTINUATION SHEET ATTACHED YES ☐ NO ☒

RECORDER

Figure 2. Filled-out Form 2 from excavations at the Indian Rocks site, 1992.

6. TECHAN: Technological Analysis

TECHAN is a preliminary technological analysis that produces a gross sort of the artifacts recovered from the field and a general characterization of the assemblage under study in the laboratory. TECHAN is not a final detailed analysis. It is a paradigmatic classification designed to sort artifacts into groups using generally agreed upon diagnostic elements.

Introduction

Examination of prehistoric stone tools requires that the analyst understand the basic properties of stone as a medium for technology. The analyst must also develop a good overview of the range of techniques that prehistoric artisans applied to the manipulation of stone. Technology can be defined as the manipulation of specific materials with particular physical properties by application of a specific level of technological sophistication; the higher the level of sophistication, the greater the range of materials capable of being worked and the more variability in the products made.

There are only four basic methods of fashioning stone: flaking, abrading, pulverizing, and cutting. The success of these methods depends on the physical properties of stone. Two basic important properties are "resilience" and "hardness." Stones like obsidian and flint are very hard but low in resilience. These kinds of stones are easily shaped by flaking. Other stones like quartzite are hard and resilient, and can be worked by pulverizing the surface. Very hard stone with low resilience are shaped by flaking with a soft hammer, while hard stone with high resilience are shaped with hard hammers that reduce the surface. To abrade stone, the abrasive must be as hard as, or harder than, the stone being worked. For example, jade and quartz are comparably hard, and quartz sand can be used as an abrasive to reduce jade. When an abrasive is used as sand or dust, the tool used as a vehicle can be softer than the stone. For example, a bone drill can be employed with a quartz grit to drill granite.

The techniques of stoneworking are directly constrained by the physical properties of the stone being worked. Through experience, simple industries became established in the manufacture of forms from stones of variable resiliency and hardness. Resiliency as a measure is difficult to quantify. Hardness is usually measured by reference to the Mohs' Scale: examples are shown below.

10	Diamond	5	Apatite
9	Corundum	4	Fluorspar
8	Topaz	3	Calcite
7	Quartz	2	Gypsum
6	Feldspar	1	Talc

Fig. 1. Mohs Scale.

The physical properties of the stone conditioned purpose and form as well as manufacture technique. Prehistoric artisans carefully selected stones and the techniques for their reduction and then applied selected forms to certain tasks. For example, jade was an excellent stone for axes, but costly to make, and probably conserved whenever possible. Other stones like fine-grained igneous rocks could also be used for axes, were less hard and durable than jade, but easier to make, and probably saw much more intensive use. Hodges (1976:99) observes that exposition of prehistoric decision-making and technological applications has been one of the most enlightening aspects of recent archaeological work.

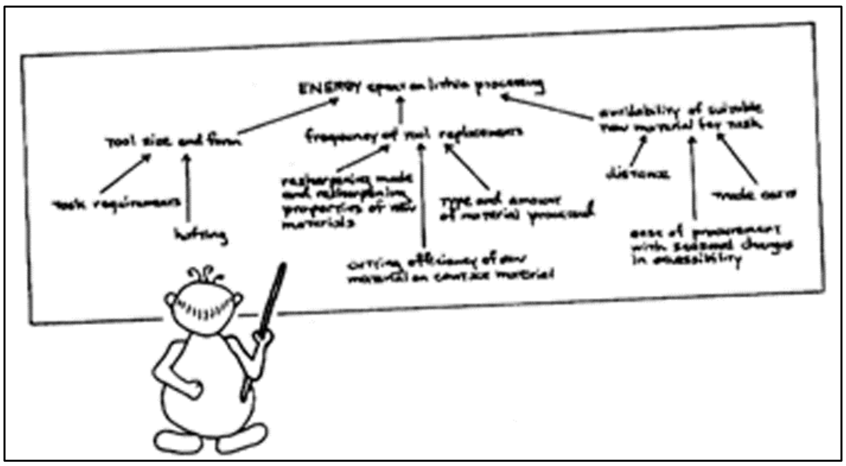


Figure 2. Schematic of modeling prehistoric decision-making.

Flaking

Stones that fractured easily and gave a sharp edge were selected by prehistoric artisans. Cryptocrystalline stones have micro-crystalline structures and are a relatively homogeneous material. A sharp blow directed at right angles to the surface of these stones causes a shock to be transmitted at equal but increasing distance in all directions from the axis of the blow, creating a cone with its apex at the point of impact. By varying the angle of the blow struck at the edge of the stone, the knapper can produce increasingly smaller, narrower and flatter "flakes.” The parent material from which flakes are struck is called the "core." The point on the surface of the core where the blow was struck is the called the "striking platform." The fracture surface generated in this method shows series of concentric rings or ridges that reflect the force traveling through the homogeneous material. These rings radiate out from the point of impact. A bulbous projection on the ventral surface of the flake below the striking platform is termed the "bulb of percussion." This bulb characteristically bears a "bulbar scar" and a number of deep fissures extending out along the length of the flake from the point of impact following the path of transmitted force. The core carries the negative impression of the ventral surface of the flake and mirrors the transfer of force through material that created the flake. Complete flakes obtained from this type of manufacture often have a lamellar or shell shape, and the method is labeled "conchoidal fracture."

Methods of fracture include two basic reductive techniques: "percussion flaking" and "pressure flaking." Percussion flaking implies use of free-swing with a hard implement to detach large flakes from the "objective piece" or core. Pressure flaking implies use of a resilient intermediate tool that remains in contact with the surface of the objective piece throughout the process of flake detachment. Both reductive techniques are seen as steps in an idealized lithic reduction sequence.

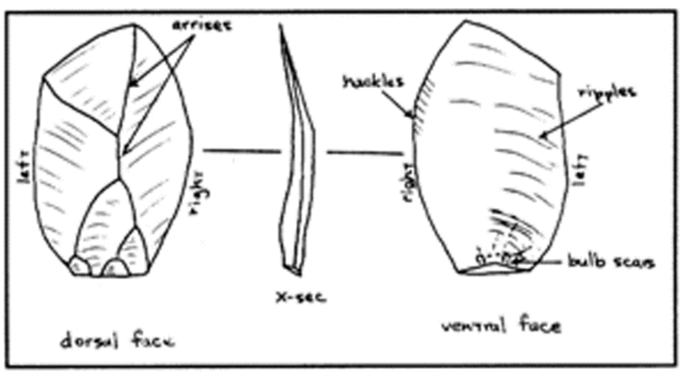


Figure 3. Landmarks on a conchoidal flake

Analysts tend to agree on fundamental aspects of general stages inherent in the process of stone tool manufacturing sequences (Crabtree 1967b, 1972; Sharrock 1966; Muto 1971; Newcomer 1971; Speth 1972; Swanson 1975). At the macroscopic level, it is possible to distinguish between percussion and pressure flaking and use of hard and soft hammers in force transfer. Muto's (1971:57) description of preliminary stages is appropriate.

The first blow is usually struck on a bulge or corner which affords purchase for the hammerstone. The resultant flake has a cortex covered platform and dorsal face, and is termed a primary decortication flake. There can be several primary decortication flakes from a nodule with no way of telling which one was removed first. The decortication continues around the periphery of the objective piece removing adjacent overlapping flakes. These flakes exhibit cortex on part of their dorsal surface and also the scars of a previously removed flake or flakes. They may or may not have cortex covered platforms and are termed secondary decortication flakes.

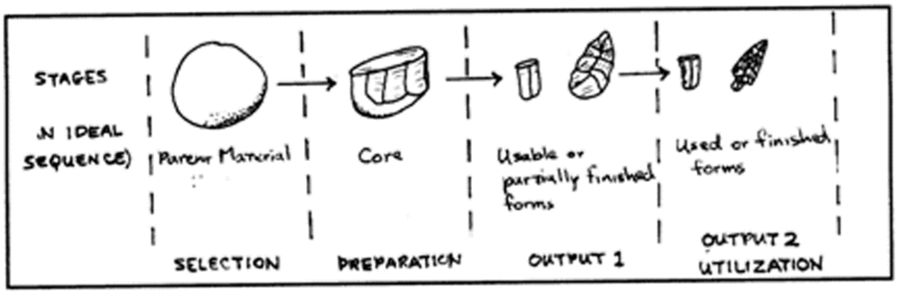


Figure 4. Schematic of an idealized reduction sequence

Sharrock (1966:51) suggested a "threefold division into primary, secondary, and tertiary flakes, with the criteria being based on length, width, and overall size and size-striking platforms." The major indicators of each of these is the relative amount of cortex; primary flakes have 100-50% cortex; secondary flakes have 50-15% cortex; tertiary flakes have less than 1% cortex. Tertiary flakes are small, and are pressure flaked into finished tool forms.

There are a number of possible variations in percussion flaking: the core may be struck against an "anvil stone"; the core may rest on an anvil stone and be struck by a hammer stone in "anvil flaking or block-on-block flaking"; the core may be held in one hand and struck with a hammer held in the other in what is called "direct free-hand percussion;" or the core may be placed on the ground, steadied in a rest, an intermediate tool or punch placed against the surface and struck with a hammer in "punch flaking or indirect percussion."

There are also variants in pressure flaking: the core may be held in one hand and flakes detached by pressing on the edge with a resilient tool of antler, bone or wood held in the other hand in "freehand pressure flaking"; or the core may be placed on the ground, steadied in a rest, and an intermediate tool or punch placed between the surface of the core and the knapper's chest, and pressure applied in "rest or impulsive pressure flaking."

Controlled percussion and pressure flaking, which employs an intermediate tool to direct force through the stone, results in production of patterned flakes. "Blades" are long, narrow flakes with parallel lateral margins. Intentional blades are produced on carefully prepared cores, which have flat striking platforms and fluted margins. Ridges dividing flutes on the margins allow production of even blades as force is applied to the striking platforms and channelled down the lateral margin ridges. As more blades are struck off, the ridges between previous flaking surfaces are preserved on the dorsal surfaces of fresh blades. A characteristic of true blades is the appearance of single and double parallel arrises on the dorsal surfaces that carry the length of the blade. Over the production sequence, the angle between the striking platform and the sides of the blade core approaches a right angle. As this occurs, it becomes increasingly difficult to remove symmetrical blades. A new platform may be produced on a fairly large core at this stage by removing a single large flake at an angle from the original platform surface. The detached flake or “core rejuvenation flake" is a common feature of blade industries.

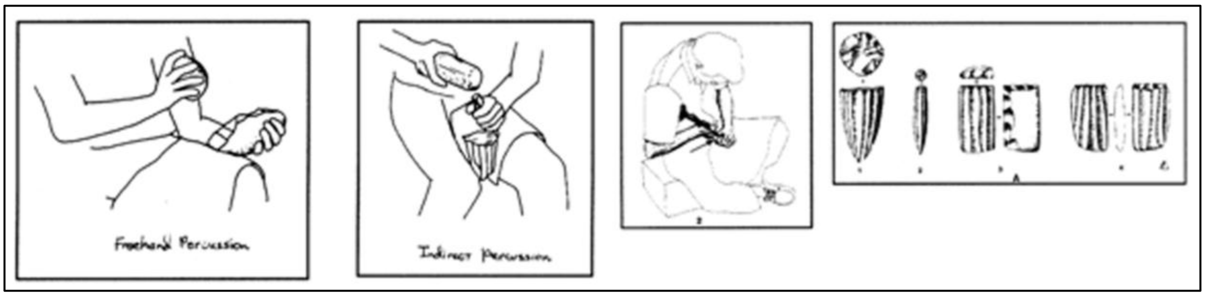


Figure 5. Blade production on carefully prepared cores. Inizan et al. 1992: Figs. 22.1. and 23.A.

In the idealized trajectory outlined above, primary flaking is done to rough out the form of the stone tool or object, and secondary flaking to further refine tool or object form. Secondary flaking will often be in evidence as series of small hinged flake scars on the edge of the tool. It is often done by pressure methods. "Invasive retouch" is secondary retouch that removes the entire primary flaking surface. Invasive retouch can include characterization of surface pattern collateral flaking, transverse flaking, oblique flaking, channel flaking, or random flaking.

Natural fracture can be difficult to distinguish from intentional knapping or mechanical fracture. Stones can be fractured by natural forces like land movements, water transport, and freezing and thawing cycles, and human impacts of various kinds. It is important for the analyst to explicity recognize the axiom that all stone tools or forms are the result of a logical process conditioned by traditional practice (Hodges 1976:104), or what was described previously as a reductive trajectory. Different steps in that process will produce characteristic or diagnostic forms. Recognition of these forms and correlation with reduction patterns will allow the analyst to systematically remove random natural and mechanical fractures from consideration of stone tool manufacture. The flakes and other residue must be oriented physically and abstractly to the idealized reduction sequence. For example, a nodule of cryptocrystalline stone alternately heated and cooled by natural environmental conditions will produce "potlids" from surface contractions. An oval pebble manipulated in this manner may take on the appearance of a stone tool of some sort, but the flake scars will not evidence bulbs of percussion, ripple marks or other diagnostics of the patterned application of force in knapping.

Abrading

Stone can be abraded by using a solid block of abrasive material or by using a powdered abrasive and a tool as the vehicle for application. Water will generally be used as the slurry for the abrasive. The water acts as simple lubricant and to emulsify and carry off the waste. Often, the tool being worked is held in the hand and rubbed against the abrasive block. An efficient abrasive block is a sharp-grained quartz sandstone, however, organic materials also can be effective. A sawing string or thong of leather held in a taut bow and used with a powdered abrasive can successfully cut and shape stone.

Drilling may be done with a solid or hollow point like a cane, wood, bone or metal. The softer drill will degrade fairly rapidly, and the hole will taper. Hollow drilling will produce waste products as cylinders.

Sand was the abrasive most commonly used. Sand can only be used on stones with a hardness of 7 on the Mohs Scale or less, which is the rating for quartz.

Cutting

Cutting describes the shaping of stone with a tool harder than the material being worked, and which leaves little or no wear on the tool itsell The simplest method of cutting is "carving or paring." Carving may use thin-edged knives or chisel-ended blades. The chisel-ended tools were more durable and efficient for most uses. Softer stones like steatite, calcite, and alabaster could be cut with flint or crude metal tools.

Pulverizing

This method is used for gross shaping, generally of large tools or objects. In antiquity this method produced dressed building stones, decorated flat stone surfaces, and fashioned heavy implements like hammers, mauls, metates and manos, and mortars and pestles. The distinctive "pecked" surface is easy to recognize.

TECHAN

TECHAN or Technological Analysis characterizes the stone artifact assemblage by defining individual specimens relative to the idealized reductive sequence described above.

Types of stones used by knappers will dramatically affect the character of reduction strategies. Characterisation of relative qualities of different raw materials in any stone tool assemblage requires detailed microscopic examination of structure and chemical analysis of constituent elements. These are beyond the scope of TECHAN. Identification of gross categories of stones indicates material differences within broad classes that may be correlated with distinctive reduction strategies. A prominent variable affecting the reduction properties of stone is alteration of crystalline structure through heating (Crabtree and Butler 1964).

Dimensions

Five analytical dimensions are employed in TECHAN to create descriptive data classes: DI: OBJECT TYPE; DII: MATERIAL TYPE; DIII: TECHNOLOGICAL CONDITION; DIV: AMOUNT OF CORTEXT; DV: THERMAL ALTERATION. In addition, quantitative attribute measurements are recorded as DVI: WEIGHT, DVII: WIDTH, DVIII: LENGTH, and DIX: THICKNESS.

Dimension I: TYPE OF OBJECT

1- Conchoidal flake: A non-tabular flake showing conchoidal fracture, concentric rings, platform or definable proximal end, dorsal flake scars, and a bulb of percussion.

2- Core: Object has no ventral surface and at least two negative bulbs of percussion and evidence of platform preparation.

3- Chunk: Object with at least two planes that are not flake scars and not of parent, weathered surface. Category includes fire spalls and mudstone/siltstone objects. Most chunks are considered as complete under CONDITION.

4- Linear Flake: A non-tabular flake at least twice as long as it is wide and exhibiting roughly parallel sides and one or more parallel dorsal ridges.

5- Non-conchoidal Flake: A tabular flake without characteristics of conchoidal fracture.

6- Formed Object: Any object whose original shape has been radically altered through manufacture, including projectile points, steep-ended scrapers, cobble choppers, etc. Utilized flakes are not formed objects. This category includes all groundstone objects, except those labeled "unmodified.".

7- less than 5mm Flakes: All conchoidal flakes that are less than 5mm in diameter (chippage, debris, detritus).

9 - Unmodified: Any object that was probably used, but not deliberately modified. This category includes cobbles, unshaped pestles, hammerstones, and milling stones.

Dimension II: MATERIAL TYPE

1- Basalt: Igneous rock of the gabbro clan; dark color; variable texture. Contains essentially basic plagioclase and a ferromagnesian mineral (augite, hypersthene or hornblende).

2- Cryptocrystalline: Crystalline structure visible only under high magnification. General label includes various folk classifications indicating different microcrystalline structures and chemical natures.

- Chalcedony (agate, flint, myrickite or quartzine): A mixture of crystalline and hydrated silicas; cryptocrystalline structures; very variable color; waxy lustre. Occurs as nodules in limestone and other sedimentary rocks or in cavities in amygdaloidal rocks.
- Chert (variety is novaculite): Grey to black sedimentary rock; homogeneous with flat fracture. Consists of dense aggregates of microcrystalline quartz and chalcedonic silica mixed in any proportion with or without remains of siliceous and other organisms. Occurs as nodules and beds in limestone formations.
- Jasper: Variety of cryptocrystalline silicate that is normally spotted or banded and colored red or brown by iron oxides.

3- Quartzite: Rock composed entirely of granular quartz. Produced by contact or regional metamorphism of pure sandstone.

4- Volcanic Glass: Igneous rock constituent wherein the cryptocrystalline or amorphous material represents the last phase of magma consolidation. It occurs as part of the ground mass and as extrusive igneous rocks (obsidian) when rapid cooling occurs.

- Ignimbrite (or welded tuff): A pyroclastic rock; fine-grained; contains glass and mineral fragments that have been flattened and welded together by impact with the ground.
- Obsidian: An igneous rock wholly composed of black, natural glass.

5- Other:

- Catlinite: Sedimentary rock; red-colored; indurated variety of siliceous clay.
- Granite: Igneous rocks containing at least sixty-six percent silica and an average of at least thirty percent quartz. This clan is subdivided by feldspar composition and environment of formation.
- Pumice: Igneous rock of the granite clan; white or light grey extrusive rock froth.
- Rhyolite: Igneous rock of the granite clan; fine-grained porphyritic extrusive rock with phenocrysts or quartz and sanidine in a groundmass of feldspar, augite and glass.
- Jadeite: Sodium aluminum silicate; monoclinic; granular, columnar, fibrous or compact masses; shades of green and white; subvitreous to available, and these reflect the original dimensions pearly luster; splintery fracture with good cleavage of the object in two directions.
- Jade: White to green tough compact variety of jadeite.

- Sandstone: Lithified arenaceous rocks composed principally of quartz and feldspar fragments cemented by silica, clay minerals, iron minerals or calcite.
- Scoria: Lava containing rough vesicules. Lava is an igneous extrusion from a vent or fissure.
- Serpentine: Hydrous magnesium silicate; monoclinic; white, yellow, brown or shades of green; subresinous to greasy luster; conchoidal or splintery fracture.
- Clay: Finely crystalline, hydrous magnesium or aluminum silicates form the major constituents of clay.
- Slate: Low grade regional metamorphic rock; fine-grained; perfect planar cleavage; enriched in mica.
- Steatite: A course granular variety of talc (soapstone). Talc is hydrous magnesium silicate; monoclinic; crystals are rare but occur as granulated or foliated masses. Varieties of talc completely covered by cortex. include steatite, potstone and minnesotaite.
- Other Igneous Rock: Obvious igneous rock but not assignable to one of the above categories.
- Other Metamorphic Rock: Obvious metamorphic rock, but not assignable to one of the above categories.
- Other Sedimentary Rock: Obvious sedimentary rock, but not assignable to one of the above categories.

9- Indeterminate

Dimension III: TECHNOLOGICAL CONDITION

1- Complete: The three measurements of LENGTH, WIDTH and THICKNESS are available, and these reflect the original dimensions of the object.

2- Proximal fragment: Any nontabular flake that retains or most of its proximal end (point of impact/pressure), but has all or a portion of its distal end broken off. All available measurements should be taken.

3- Distal fragment: Broken object that does not retain the proximal end.

4- Midsection: Broken object that retains neither the proximal end nor the distal end.

5- Broken: Object is a fragment, which cannot be classified as proximal fragment, distal fragment or midsection.

9- Indeterminate: Object cannot be assigned to any of the above categories.

Dimension IV: CORTEX

Cortex is defined as the weathered natural surface of the rock.

1- None: No weathered surfaec is visible on the object.

2- Partial cortex: The dorsal surface partially retains cortex.

3- Complete cortex: The dorsal surface is completely covered by cortex.

9- Indeterminate: The surface relationship to cortex cannot be determined.

<u>Dimension V: THERMAL ALTERATION</u>

1- Altered: The surface of the object shows discoloration and crazing indicative of intense heat.

2- Unaltered: The surface shows no evidence of intense heat.

9- Indeterminate: Assessment cannot be made.

<u>Dimension VI: WEIGHT</u>

Weight is taken as grams on the Ohaus triple beam balance scale.

<u>Dimension VII: WIDTH</u>

Width is taken as the greatest dimension measured in millimeters perpendicular to the axis of length.

<u>Dimension VIII: LENGTH</u>

Length is the greatest measurement in millimeters taken along the axis running from the distal to proximal ends.

<u>Dimension IX: THICKNESS</u>

Thickness is the greatest measurement in millimeters taken at the point of intersection of the measured axes of width and length of at the thickest portion of the proximal end, whichever is greater.

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Concepts to Review

- Methods of reducing stone
- Mohs scale
- Cryptocrystalline and noncryptocrystalline stones
- Dorsal and ventral
- Reduction sequences

- Chaine operatoire
- Primary and secondary decortication
- Direct and indirect percussion
- Blade production and prepared cores
- Generalized flaking
- Hard and soft-hammer
- Measurement dimensions

7. FUNCAN: Functional Analysis

FUNCAN is a sorting procedure that attempts to separate out potential tools in the artifact assemblage. It is not a detailed summary analysis. It is a paradigmatic classification that employs macroscopic examination to flag specimens that require microscopic analysis for adequate assessment in the future.

FUNCAN

FUNCAN or Functional Analysis characterizes the attrition of surfaces and edges on selected specimens drawn from the stone assemblage. Implicit in the analysis is the assumption that we can accurately define attributes of attrition, and that we can correlate these with inferred uses of stone tools. Integral in this exercise is the relationship of the human made artifact to a postulated cultural systemic context (how tools are used), and explicit testing of implications or hypotheses arising from application of this knowledge to the stone tool assemblage under study.

Characterizations arising from application of the paradigmatic FUNCAN classification will be correlated and arranged in summary tables. This basic description may suffice for some report formats, but will often be only a beginning for further detailed analysis and replicative experimentation. FUNCAN is a descriptive grid that will satisfactorily describe the most of an assemblage of stone tools, but exceptions will often be the focus of further research.

Stone tools are commonly encapsulated under the label technology, which can be taken to refer to all activities involved in the acquisition of raw materials, encompassing manufacture, distribution and exchange, maintenance, consumption, and reuse and recycling of stone tools (cf. Torrence 1989:4). industries, by comparison, are best defined as utilization of materials for forms relative to a specified technology and within parameters imposed by the selected raw materials. Tool-using, procurement, production, and maintenance are primary means humans use to reduce potential effects of risk (Torrence 1989:4). Torrence (1989) addresses tool-using as a fundamental aspect of human behavior, wherein optimization theory is argued to be the most relevant mode of analysis (Stephens and Charnov 1982; Stephens and Krebs 1986; Smith 1986; Winterhalder 1986). The assumption is that tool-using is accomplished so as to optimize expenditure of time and energy. Tools are seen to be created and employed to satisfy a perceived need and to accomplish tasks that are susceptible to selective pressures. Successful optimal technologies then arise, which should be discernible in the archaeological record. The caveat is that technology is a particular adaptation created by the operation of general principles of optimization that operate within the strictures of specific local conditions, and within parameters defined by perception of need and physical restraints embodied in different material characteristics. Analysts must remain cognizant that although we often operate on the assumption that tool forms are designed to specific task performance standards, there will be a number of instances where tool forms result from wear or patterned activities, and definition of the specific tasks tools were used for may be significantly different from tool forms resulting from task use. Much of our research is then profoundly inferential in nature, and can only be accomplished within a critical framework requiring explicit assumptions and redundant testing frameworks.

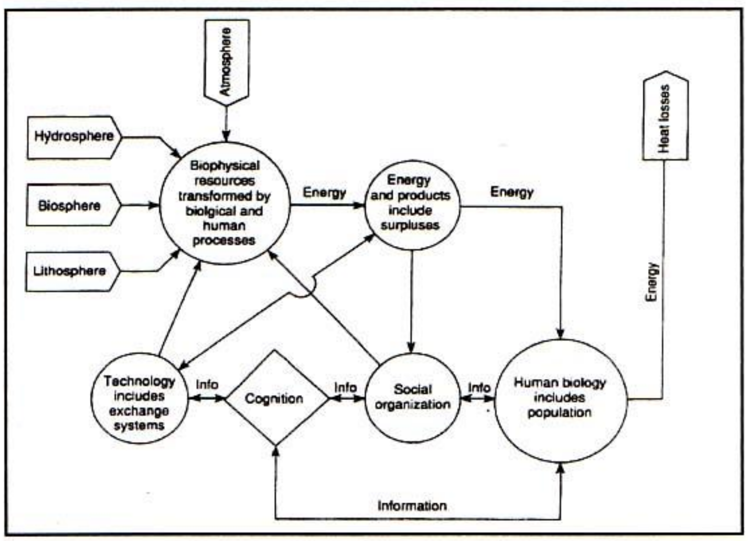

Figure 1. Schematic of cultural-environmental interactions in an idealized adaptive system (Butzer 1982).

Any analysis of stone tools seeking to adequately characterise the range of forms and uses in the research assemblage must first aim to completely describe variation and then define attributes characteristic of basic processes of manufacture and use. The first step in understanding prehistoric stone tool use is FUNCAN.

Use-wear

Many archaeologists persist in assigning "functional" names to prehistoric stone tools based on implicit analogy to the known uses of similarity shaped tools (e.g., a scraper is a scraper). Hayden and Kamminga (1979:3) have termed this the speculative functional approach." Research over the last century, involving replication and experimentation, has demonstrated the value of examining specimens for characteristics of usewear. Invariably, tools will be multi-functional, exhibiting a wide range of uses commensurate with characteristically broad design parameters. Usewear can be identified macroscopically (Bordes 1950b; Witthoft 1955; Brujin 1958-59; Sonnenfeld 1962), but most recent studies demonstrate the value of microscopic analyses focusing on striation patterns (Semenov 1976), chipping (Tringham et al. 1964; Odell 1975), polishes (Keeley 1976, 1977; Keeley and Newcomer 1977), and nonorganic residues (Anderson 1980a,b; Anderson-Gerfaud 1981).

Microwear researchers have demonstrated the value of systematic use-wear experimentation (Keeley 1974; Odell 1975; Odell et al. 1976). Coupled with this systematic, exploratory methodology, has been recognition of the need for systematic and detailed microscopic analysis of wear patterns, emphasizing microchipping, polishes, and nonorganic residues. Tringham et al. (1974:185) viewed experimental flint edges under a 40-60X stereoscopic microscope. They concluded that characterisation of edge attrition yielded information on prehistoric use motion and the relative degree of hardness of the material worked. Odell (1976, 1977, 1979, 1980b, 1981a, 1982a; Odell and Odell-Vereecken 1980) has been an influential advocate of low power microscopic inspection of microchipping. Keeley (1976, 1977, 1978b, 1980; Keeley and Newcomer 1977) used compound microscopes to view micropolishes and striations at magnifications of 200-40OX. This higher power magnification distinguished between worked materials based on reflectivity, surface texture, topographical features, and the distribution of polish on flint working edges and surfaces. Numerous other high power use-wear studies have reach essential agreement on results and inferences made (Anderson-Gerfaud 1981; Beyries 1982; Gysels 1980, 1981; MansurFranchomme 1983a,b; Moss 1978; Plisson 1979, 1982; Cahen 1982; Cauvin 1983). Micropolishes are seen to be indicative of the category of material worked, and not just indicative of the medium's relative hardness as is the case with microchipping. However, as noted by Vaughan (1985), this increased precision comes at considerable expense generated by the need for costlier equipment and greater time in analysis.

Researchers balance the technically possible against practical restraints of time, money, and assistants' training levels. Analysis will inevitably be progressive, moving through stages of examination from gross to fine, and any reasonable analytical system must be checked at different stages dependent upon the limits of these resources. Indications of possible goals, given adequate resources, include Anderson-Gerfaud's (1981) analysis of polishes through use of a scanning electron microscope at up to 10,000 X magnification, which resulted in identification of structured nonorganic residues from within micropolishes on stone tool edges used to work plants and animals (Anderson 1980a,b; AndersonGerfaud 1981, 1982; Mansur 1982; MansurFranchomme 1983a,b). This work demonstrated that these plant and animal residues can retain cell membrane structure and shape under a layer of amorphous silica gell that forms on the stone tool edge as a direct result of the dissolution of silica in the tool surface during contact with the material worked. As noted by Vaughan (1986:6), previous use of scanning electron microscopes failed to rind any surface features on stone tools not already identified under light microscopes (cL Brothwell 1969; Dauvois 1976; Hayden 1979; Hayden and Kamminga 1973; Kamminga 1977; Kelley 1977; Pant 1979a,b; Shiner and Porter 1974).

The practical concern in any stone tool usewear analysis rests in discriminating between attrition characteristics of different stones. For example, research on formation of use-wear on cryptocrystabine silicates seemed directly related to the grain-size or texture of the rock (Curwen 1935:64-65; Kamminga 1977:206; Semenov 1976:11; Sonnenfeld 1962:61). Vaughan (1986) reported on the results of similar analyses aimed at three different types of limestone flint distinguished on the basis of grain size, and called for similar tests on quartzites, volcanic rocks, and obsidian (cL Odell et al. 1976; Beyries 1982; Plisson 1982; Vaughan 1981a, b:186-214).

Another primary variable in inference from attributes of use-wear is the type of material manipulated. These "contact materials" can include stone, bone, antler, wood, reeds, plants, meat, animal carcasses, hides, variable grits, and all manner of soils. Any usable use-wear comparative collection will have to include the broad range of these potential materials, worked in variable documented manners with a range of tool types in specific stones (cf. Vaughan 1986:9; Keeley 1980).

Viewing magnification is still a much debated topic. The two extremes are low and high magnification. In a properly staged analysis (FUNCAN), analysts will begin at the macro level, first by VISUAL EXAMINATION (FUNCAN 1), then move to STEREOSCOPIC MICROSCOPIC examination of edge and surface attrition of selected specimens (FLUNCAN 2), and then move to COMPOUND MICROSCOPES for examination of polishes and residues (FUNCAN 3).

Figure 2. Thinking about thinking.

The following CLASSES OF MICROWEAR need to be defined and described in any functional analysis of stone tools:

<u>Micro-chipping</u>

Micro-chipping refers to scars created along the impact edge of a stone tool. Researchers have labeled similar attrition patterns "microflaking" (Tringham et al. 1974:171), "edge scarring" (Odell 1975:229), "utilization damage" (Keeley and Newcomer 1977:35), and "edge damage" (Keeley 1980:24). Vaughan (1986:11) observes that optimal viewing of microscars is obtained with a stereomicroscope of up to 10OX, although many researchers view this damage at magnifications as low as 10-40X (Odell and Odell-Vereecken 1980:90).

Which attributes of micro-chipping to highlight as most indicative of function or material worked is a matter of considerable debate: scar outline (Odell 1975:232); scar cross-section at the proximal end and at termination (CottereB and Kamminga 1979; Lawrence 1979; Hayden 1979:133-135). Significant variables that affect microchipping characteristics include: edge angle (Hayden and Kamminga 1973a:7; Keeley 1980:59-60; Tringham et al. 1974:180), contact angle, pressure applied, deliberate retouch (Keeley 1980:27-28; Keeley and Newcomer 1977:35; Odell 1977:148-151; Tringham et al. 1974:181), and effects of natural and accidental damage (Moss 1983b; Vaughan 1981b:67-71; Flenniken and Haggarty 1979).

<u>Striations</u>

Striations are linear scratches held to indicate direction of tool use. Deep striations have been classified based on morphology, particularly the width and definition of the sides of the groove (Dauvois 1977:283; Fredje 1979; Kamminga 1979:148; Keeley 1980:23; Pant 1979a,b). Mansur (1982), using a scanning electron microscope, classified striations relative to morphology, width, depth, and quantity. It appears that striations, while invaluable for analysis of kinematics (cf. Semenov 1976), are fortuitous occurrences, and dependent upon inclusion of foreign particles embedded in the worked material (Mansur-Franchomme 1983b; Odell 1975:229; Semenov 1976:15; Keeley 1980; Anderson-Gerfaud 1981).

Smoothing and rounding

Rounding of edges, ridges, and adjacent surfaces is a commonly observed attribute of stone tool use. It will occur on stone tool edges and surfaces relative to the hardness and character of the material worked, presence or absence of grit, and the use motion (Brink 1978a; Keeley 1980; Mansur-Franchomme 1983b; Shackley 1974). Variables inducing rounding are thought to be simple abrasion (Davuois 1976; Diamond 1979), accumulation of silica through frictional fusion (Witthoft 1955, 1967), and dissolution and reformation of the surface silica of the working edge (Anderson 1980a; Anderson-Gerfaud 1981; MansurFranchomme 1983a,b).

Micro-polishing

Keeley (1980) was the pioneering attempt in characterisation of micro-polishes. Prior to his work, research routinely noted micro-polish as indicative of tool use, but no one had related polish attributes to the types of materials being worked. Keeley stressed the need for viewing polishes at a minimum of 200X magnification for characterisation, although initial scanning for polishes is successful at 100X magnification. This requirement forces researchers to move to use of compound or binocular microscopes with a concentrated light beam transmitted through the objective onto the surface of the tool. Keeley (1980:10-11) also recommends cleaning tool surfaces with HCL acid and an NAOH base.

Polishes are thought to arise from abrasion (Crabtree 1974; Dauvois 1977; Kamminga 1979; Masson et al. 1981; Meeks et al. 1982), wherein the surface is worn done due to action of grits such as dust, sand and microchips; frictional fusion (Witthoft 1955:23; 1967), wherein silica on the tool surface is melted or fused by the frictional heat generated in the contact area; or the action of amorphous silica gel (Anderson-Gerfaud 1980a, 1982; MansurFranchomme 1983b; Unger-Hamilton 1984), wherein localised dissolution of silica on the tool surface forms a layer of amorphous silica gel. Anderson (1980a:184) lists variables responsible for the formation of this silica gel: friction-induced heat, abrasion by intrusive particles, structure and hardness of the tool material, water, extreme pH conditions, plant acids, colloidal silica, solid amorphous silica found in plants, and nonsiliceous crystal substances like calcium oxalate.

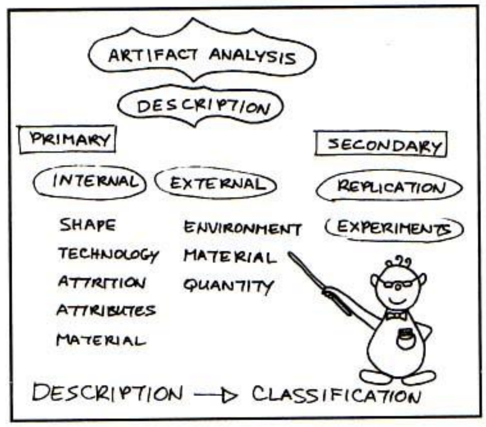

Figure 3. Nomenclatures and ontologies.

Residues

Organic residues like vegetal fibers and amino acids will be found on stone tool surfaces subject to conditions of preservation, and can be subjected to routine chemical or physical examination for identification (Briuer 1976; Broderick 1979; Shafer and Holloway 1979). Nonorganic residues will be present on stone tool surface where preservation conditions have failed to provide organic residues (Anderson-Gerfaud 1981; Anderson 1980a,b; Mansur-Franchomme 1983a,b).

Functional Analysis (FUNCAN)

FUNCAN is a paradigmatic macroscopic classification of use-wear on selected stone tools. Its explicit goal is to create descriptive data classes that include attributes directly related to tool design and use. All stone objects showing evidence of manufacture or wear are sent from TECHAN to FUNCAN 1. Following initial sorting, each are of tool use on an object is characterised within this paradigmatic classification based on correlation of defined attributes.

The theoretical bases of functional classification have been defined by a number of researchers (e.g., Dunnell 1971a, 1977). A functional classification should create classes by systematic reference to wear and characteristics of wear and worn edges and surfaces. Functional classification should exclude the influence of style in creating these classes and ensure that these classes characterise artifacts only in terms of functional attributes. Objects will contain more than one tool. Tools combined on a single object are products of physical requirements of each task performed.The reuse, renewal, and number of individual tool objects depend on the availability of suitable materials for each function.

The relationship between use and manufacture, each of which constitute edge and surface attrition, is important. Shape is a paramount variable in traditional classifications, yet there is no empirical distinction to be made between wear and manufacture as processes of edge and surface attrition on stone tools. FUNCAN I avoids any such assumptions, and will ignore purported differences between the two processes.

Manufacture relates to the functional properties of objects as this process alters the relative frequencies of edges and shapes. Manufacture is held as an independent variable whose association with particular tool types depends upon the frequency of appropriated edges or shapes on debitage and natural stone. Tools with complex functional requirements are more likely to involve deliberate manufacture than those with easily met requirements.

An impressive body of literature has developed concerning analysis of edge damage/attrition on stone artifacts (Sonnenfeld 1962; Frison 1968; White 1968; Wilmsen 1968; 1970; Haler 1971, 1979; Wylie 1975; Odell 1977). Experimental studies replicating tool design and use have allowed inference of function solely on the basis of wear characteristics (Sonnenfeld 1962; Semenov 1964; Keller 1966; Witthoft 1967; Crabtree 1973; Keeley 1974, 1980; Tringham et al. 1974; Wylie 1975; Keeley and Newcomer 1977; Odell 1979; Hayden 1979; Lawrence 1979).

Consideration of polish as well as edge attrition, has proven particularly informative for correctly identifying modes of tool use and the medium on which the tool was used (Keeley 1978; Keeley and Newcomer 1977). Examination of wear polish requires higher magnification that the low power approach of basic FUNCAN and also requires too much investment of time per specimen to be a routine part of the descriptive analysis of large data sets.

Another routine part of an adequate functional analysis is residue recognition. FUNCAN analysts scan for residues, and any specimens exhibiting organic or non-organic residues are tagged for later more in-depth analyses (residue characterization; higher power magnification).

The expressed goal of FUNCAN is to isolate and objectively classify each occurrence of utilization on a stone tool. All objects are examined by eye and selective use of a variable power stereoscopic microscope (5X-50X) for recognition of defined attributes. Each artifact is photocopied, and occurrences of wear recognized indicated on this image. Each area of wear is marked on the periphery of the artifact image to indicate extent and type. Each area of wear is then paradigmatically classified and transferred to the computer data sheet designated FUNCAN 1. The system recognizes "tools" and "tool objects." A tool is a single area of use on an object. A tool object may have more than one tool identified for it.

Wear/Manufacture Relationships

FUNCAN 1 analysts must remain cognizant that relationships of wear or edge or surface attrition to attributes of manufacture can be complex. Flake scars are attributes of pattern of manufacture as well as of wear. Flake scar direction relative reference axes imposed on two dimensional artifact outlines can be indicative of manufacture as well as patterned direction of use of a tool. Stone tool outlines are most often variable or irregular and a single artifact may afford a multiple number of tool edges and surfaces. The analyst must also be alert to viewing the artifact or tool object in more than two dimensions: tool objects have usable edges and surfaces in dimensions of length, width and thickness. Analysis will force still more complexity because it will define analytical dimensions that add directional statements and cluster or spot or attribute areal descriptions that he perpendicular to the three primary dimensions of the tool object, within and across length, width and thickness dimensions. Any tool object is then three-dimensional. When subjected to analysis to define wear and manufacture relationships that produced modification of the original object in three-dimensional space, the tool object and all encapsulated tools assume multidimensional shapes within n-dimensional analytical space.

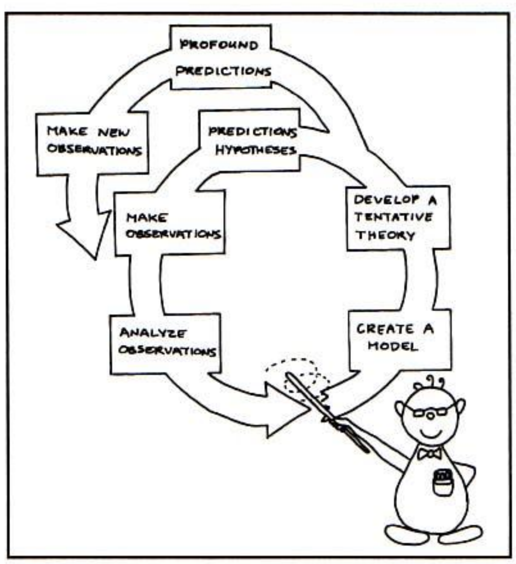

Figure 4. The analytical cycle.

Attached figures depict actual wear patterns observed in controlled replicative studies (Keeley 1977). Critical is recognition that tool object form supplies potentials for tool creation and use, and that wear resulting from use of tool object edges and surface may not relate 1:1 to the extent or location of manufacture, nor will wear be limited to two dimensions of length and width.

Analysis Rationale

<u>Flake Scar Direction</u>

Wear Orientation and Direction of Use: Tool attrition and gross motor or use pattern can be characterised as unidirectional and multidirectional, defined by orientation of flake scars to the length axis of the tool object. If flake scars on a single tool edge or surface align in a uniform direction, the tool use pattern is unidirectional. If flake scars on an edge or surface align in separate or opposite directions, the tool use pattern is multdirectional. These characteristics can be inferred to be indicative of task or function: scraping-UD; chopping-UD; graving-UD; adzing-UD; sawing-MD; wedging-MD; boring-MD; whittling-MD; butchering-MD. Correlation of flake scar direction with use, however, must depend on intersection of directional dimensions with wear dimension attributes encompassing smoothing and polishing of surfaces and edges.

<u>Redundant Use Pattern</u>

Patterned tool use should be preserved in embedded attrition patterns on stone tool working edges and surfaces. It is assumed that prolonged, patterned use of a tool edge or surface will produce attrition of those edge or surfaces in direct proportion to duration of work, force applied, material used for the tool, and the type of material worked.

Multiple biases or variables will intervene in inferring tool use or function, the types of materials worked, and patterns of use reflected. Proper inference will always depend upon intersection of physical and analytical attributes. Reduction of lithic mass to produce smaller tools and tool edges will often result in areas of manufacture that are larger than areas of wear. The analyst must not assume that flaking on a tool object edge or surface represents wear. By extension, the analyst should not assume that a particular tool object form has been used for a specific use or task (e.g., an obvious projectile point form may have been used as a graver-saw-knife, defined kinematically).

The overriding bias in any wear analysis is recognition of the redundant pattern so embedded in the topography of the stone tool that it removes (1) enough of the original edge or surface to conceal its original extent or character and (2) any evidence of prior use patterns. If all use patterns are equally intense and encompassing of edge or surface, the analyst may not be able to define tool use beyond the last documented or obvious application.

Paradigmatic Classification: the FUNCAN Dimensions

FUNCAN 1 analysis includes eleven paradigmatic dimensions that produce descriptive data classes: DI: FRACTURE; DII: MANUFACTURE TYPE; DIII: MANUFACTURE DISPOSITION; DIV: WEAR CONDITION; DV: WF-AR-MANUFACTURE RELATIONSHIP; DVI: KIND OF WEAR; DVII: EXTENT OF WEAR; DVIII: WEAR LOCATION; DIX: STRIATION; DX: POLISH; DXI:TOOL EDGE ANGLE.

Dimension 1: MANUFACTURE-WEAR

This dimension is used to describe the overall disposition of all stone objects pulled as worn or manufactured during the functional sorting. Manufacture is defined as the deliberate modification of an object such that the original shape or size is altered. No differentiation is made in this dimension between retouch and more extensive manufacture. Wear is defined here as the non-deliberate attrition of edges or surfaces on an object as the direct result of patterned tool use.

There is no empirical distinction drawn between wear and manufacture, as both are manifest similarity on different objects. Generally, manufacture is expected to result in more extensive reduction of the original object surface, and analysts are required to make consistent judgements in differentiating between the two phenomena.

1- Manufacture Only: Obvious modification is present, but there are no visible signs of utilization. These objects are not described within the tool specific dimensions.

2- Wear Only: Utilization is present with no evidence of manufacture.

3- Manufacture and Wear: Both wear and manufacture are obvious.

4- Modified/Indeterminate: Obvious modification is visible, but wear cannot be separated from manufacture. The area is classified within the tool specific dimensions.

9- Indeterminate: Label reserved for objects that have been sorted out from unworn objects, but are not assignable as wear or manufacture.

Dimension II: TYPE OF MANUFACTURE

This dimension is used to describe the processes by which an object was purposefully modified.

1- Flaking Only: Reduction of the object surface by removing series of flakes. Edge will retain negative flake scars.

2- Pecking Only: Reduction of the object by pecking producing a pitted or pulverized surface.

3- Grinding Only: Attrition of a surface by abrasion. Surface will be smooth or striated.

4- Flaking and Pecking: Reduction of an object by both flaking and pecking.

5- Flaking and Grinding:Reduction of an object by both flaking and grinding.

6- Flaking-Pecking-Grinding: Reduction of an object by flaking, pecking and grinding.

0- Not Applicable: The object shows no signs of intentional manufacture.

Dimension III: MANUFACTURE DISPOSITION

This dimension forces assessment of the relative degree of manufacture on the object.

1- Partial: Evidence of manufacture covers only a portion of the surface of the object.

2- Total: Manufacture covers all surfaces, completely obscuring the original shape.

0- Not Applicable: The object shows no signs of intentional manufacture.

[TOOL SPECIFIC DIMENSIONS]

Dimension IV: WEAR CONDITION

This dimension describes the completeness of each tool on each tool object without regard to the condition of the object. Complete tools will occur on broken objects. Broken tools cannot occur on complete objects.

1- Complete: Tool edge or surface appears to be intact. There will be no way for the analyst to be sure of the original extent of wear or working surface. The analyst will have to make this assessment based on the type of edge or surface (arrises and straight fine segments can be used as points of reference).

2- Partial: Tool edge or surface appears to be fragmented. The analyst can make this assessment with reference to arrises and straight line segments; if these terminate, the tool is partially intact.

9- Indeterminate: Lack of reference points precludes assignment to either Complete or Partial designation.

0- Not Applicable: Wear does not occur.

<u>Dimension V: WEAR/MANUFACTURE RELATIONSHIP</u>

This dimension describes the position of a tool on an object in relation to the position or extent of obvious manufacture on the object. Wear will obscure or overlay manufactured edges and surfaces.

1- Independent: The wear area appears to have no relationship to the manufactured area.

2- Opposite:The wear area is directly opposite an area of manufacture.

3- Overlapping-total:The wear area is completely contained within the area of manufacture.

4- Overlapping-partial:The wear area is found within and outside of the manufactured area.

9- Indeterminate: Relationship of wear to manufacture cannot be assessed or is irrelevant.

0- Not Applicable: Wear does not occur.

Dimension VI: WEAR TYPE

This dimension describes the physical manifestation of utilization of a stone tool. The wear attributes account for allomorphic variation due to variability in material and duration of tool use. Chipping wear is subdivided into two categories: feathered and stepped. These will identify attributes useful for identifying cutting versus scraping or use on a hard surface from use on a soft surface. If feathered chipping and stepped chipping both occur, the analyst will be required to make a judgement (if stepped chipping is >25% of the tool surface = stepped chipping; if feathered chipping is >25% of the tool surface = feathered chipping). This rule compensates for bias in identifying "wear" that is caused by damage after the period of tool use.

1- Chipping-Feathered: Flake scars terminate in gradual, sloping distal edges of detachment.

2- Chipping-Stepped: Flake scars terminate in stepped or abrupt distal ends.

3- Chipping-Crushed: Flake scars obliterated to point that landmarks are not apparent and the original edge angle is gone.

4- Smoothing-light: Attrition has produced an edge smooth to the analyst's touch. There are no visible striations or gloss. Minimum criterion: light smoothing will leave surface landmarks visible and only partially reduced.

5- Smoothing-pronounced: Smoothing has removed many high points of surface topography, and may have all but obliterated some landmarks.

6- Abrasion-light: Reduction of the tool surface has formed a distinct facet with obvious striations. Minimum criterion: a discernible facet or plane with three parallel striations in close proximity.

7- Abrasion-pronounced: Abrasion of the tool edge or surface has produced a flat facet with strong striations.

8- Chipping-Feathered and Smoothed: Smoothing of surface landmarks is apparent on flake scars with feathered terminations.

10- Chipping-Stepped and Smoothed: Smoothing of surface landmarks is apparent on flake scars with stepped terminations.

11- Chipping-Crushed and Smoothed: Smoothing of surface landmarks is apparent on flake scars exhibiting crushing.

12- Chipping-Feathered and Abraded: Abrasion facets and striations evident on flake scars with feathered terminations.

13- Chipping-Stepped and Abraded: Abrasion facets and striations evident on flake scars with stepped terminations.

14- Chipping-Crushed and Abraded: Abrasion facets and striations evident on flake scars with crushing.

9- Indeterminate: Wear characteristics are not comparable to above designations.

0- Not Applicable: Wear does not occur.

Dimension VII: EXTENT OF WEAR

This dimension defines the areal extent of wear relative to identifiable landmarks on the surface of the tool or tool object.

1- Partial-unifacial: Wear extends across part of a unifacial edge or surface.

2- Partial-bifacial: Wear extends across part of a bifacial edge or surface.

3- Complete-unifacial: Wear extends across all of a bifacial edge or surface.

4- Complete-bifacial: Wear extends across all of a bifacial edge or surface.

5- Confined: Wear clearly coincides with the extent of the topographical feature or landmark.

9- Indeterminate: Relationship of wear extent to surface landmarks cannot be defined.

0- Not applicable: Wear does not occur.

Dimension VIII: WEAR LOCATION

This dimension describes the relative position of wear on the object.

1- Edge-straight: Wear occurs only on a single straight edge formed by the intersection of two surface planes.

2- Edge-concave: Wear occurs only on a single concave edge formed by the intersection of two surface planes.

3- Edge-convex: Wear occurs only on a single convex edge formed by the intersection of two surface planes.

4- Surface-top feature: Wear occurs only on a medial surface feature or landmark other than an arrise.

5- Surface-arrise: Wear occurs only on an arrise on the medial surface.

6- Point: Wear occurs only at the juncture of three or more surface planes. These planes must intersect at an angle of less than ninety degrees.

9- Indeterminate: Wear cannot be characterised.

0- Not applicable: Wear does not occur.

Dimension IX: STRIATION

This dimension describes the relationship of direction of wear to the tool edge or surface, and should be a direct reflection of the direction of use.

1- Parallel to the edge: Scratches run parallel to the lateral margin.

2- Parallel to the top feature: Scratches run parallel to a designated top feature or landmark.

3- Perpendicular to the tool edge: On an edge, scratches intersect the edge at an angle approximating ninety degrees.

4- Perpendicular to the top feature: On a surface, scratches run at approximately ninety degrees oriented to a defined landmark or series of landmarks.

5- Oblique to the tool edge: On a tool edge, scratches intersect the edage at an angle of greater than thirty degrees and less than sixty degrees.

6- Oblique to the top feature: On a surface, scratches run at approximately thirty to sixty degrees oriented to a defined landmark or series of landmarks.

7- Diffuse: Striae run in multiple directions.

9- Indeterminate: Assessment of orientation cannot be made.

0- Not applicable

<u>Dimension X: POLISH</u>

Polish is a relative measure of the intensity of light refracted from the abraded surface of a stone tool.

1- Low: Refracted light is weak from a relatively smooth surface or developing facet.

2- High: Refracted light is bright from an intensely smoothed surface or developing facet.

9- Indeterminate: Assessment cannot be made. Often, the natural luster of the stone will interfere with assessment of polish.

0- Not applicable: Wear does not occur.

<u>Dimension XI: TOOL EDGE</u>

Tool edge angle is a relative measure, roughly characterised in three major groups.

1- Acute: The original tool edge is below 25 degrees.

2- Moderate: The original tool edge is between 25-45 degrees.

3- Obtuse: The original tool edge is above 45 degrees.

9- Indeterminate: The tool edge has undergone severe attrition or breakage that negates assessment of original edge angle.

0- Not Applicable: Wear does not occur.

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Concepts to Review

- Replication
- Optimization theory
- Tools and tool using
- Function and folk labels
- High and low-power microscopy
- Microwear classes
- Smoothing and polishing
- Experimental studies
- Paradigmatic classifications
- Tools and tool objects
- Redundancy in use-wear patterns

Spreadsheet/Database Structure: FUNCAN

Field	Field Name	Type	Width	Index
1	SPECNO	Text	7	Y
2	QUANT	Number	3	N
3	TRADDESCR	Tex	3	Y
4	MANWEAR	Text	1	Y
5	MANTYPE	Text	1	Y
6	MANDISTR	Text	1	Y
7	TOOLNO	Text	1	Y
8	WEARCOND	Text	1	Y
9	WEARMAN	Text	1	Y
10	WEARTYPE	Text	2	Y
11	WEAREXT	Text	1	Y
12	WEARLOC	Text	1	Y
13	STRIATION	Text	1	Y
14	POLISH	Text	2	Y
15	ANGLE	Text	1	Y
16	MEMO	Memo	10	N

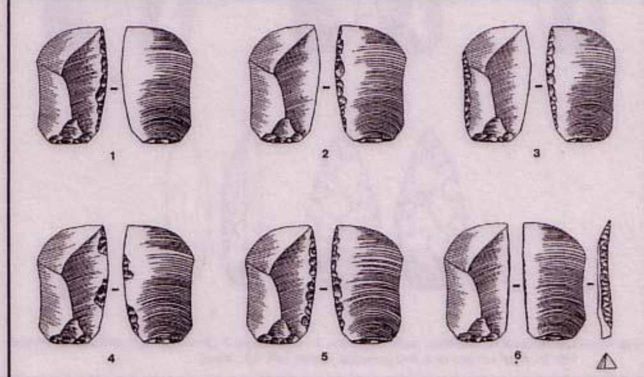

Fig. 44 — Position of removals. 1 : direct. 2 : inverse. 3 : alternate (in this case : direct on the left edge and inverse on the right edge). 4 : alternating. 5 : bifacial. 6 : crossed.

Figure 7. Removal positions (Inizan, Roche and Tixier 1992: Fig. 35).

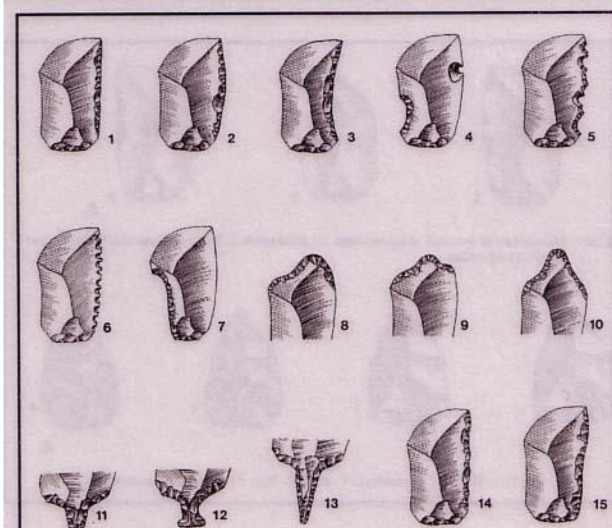

Fig. 35 — Delineation of the edge created by a series of removals. 1 : rectilinear. 2 : convex. 3 : concave. 4 : notches. 5 : denticulated. 6 : saw. 7 : "cran". 8 : shoulder. 9 : nosed. 10 : tongue. 11,12 : tang. 13 : long narrow tang. 14 : irregular. 15 : regular.

Figure 8. Edge definition (Inizan, Roche and Tixier 1992: Fig. 37).

Fig. 36 — Distribution of removals along one edge. 1 : discontinuous. 2 : total on the distal edge. 3 : partial on the right edge.

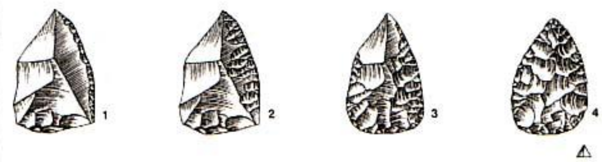

Fig. 37 — Extent of the removals. 1 : short. 2 : long. 3 : invasive. 4 : covering.

Figure 9. Distributions of removals (Inizan, Roche and Tixier 1992).

8. Stylistic Analysis of Projectile Points: STYLAN

STYLAN classifies stone projectile points into morphological types. Use of descriptive classes to characterise variability in projectile points can be used to identify significant discriminating attributes that may or may not verify extant typologies based on intuitive type assignments.

This module presents recognized projectile point sequences for both the Columbia Plateau and Great Basin cultural areas. Idaho, and the Northern Intermountain West, lie on the margins of both areas.

STYLAN 1: Columbia Plateau

Lohse (1985), Leonhardy and Rice (1970) and Nelson (1969) have defined projectile point types for Columbia Plateau prehistory. Lohse (1985) offers the only attempt at explicit definition and quantification of recognized types. Other researchers, for themost part, have accepted extant type identifications, and more or less implicitly have tried to fit attribute clusters into these types. Lohse (1985) imposed a primary SERIES classification of LANCEOLATE, SHOULDERED LANCEOLATE, BASAL-NOTCHED TRIANGULAR, CORNER-NOTCHED TRIANGULAR, CORNER-REMOVED TRIANGULAR, and SIDE-NOTCHED TRIANGULAR, and then defined TYPE VARIANTS within these categories through use of discriminant analysis of defined types shown in Leonhardy and Rice (1970), Rice (1969, 1972), and Nelson (1969), and examination of named specimens from Marmes Rockshelter and sites excavated by Borden on the Fraser River. This discriminant analysis then was used to assign type designations to a collection of fifteen hundred projectile points from sixty cultural components with one-hundred-and-sixty-one radiocarbon dates on the Rufus Woods Lake Reservoir in northeastern Washington state.

Lanceolate
Shouldered Lanceolate
Basal-notched Triangular
Corner-notched Triangular
Corner-removed Triangular
Side-notched Triangular

Figure 1. Descriptive Morphological Classes of Projectile Points (Lohse 1985).

Leonhardy and Rice (1970) defined six phases for the lower Snake River Region of the Columbia Plateau: **[PALEOINDIAN]** Windust Phase (10,000-9000 B.P.), **[EARLY ARCHAIC]** Cascade Phase (8000-5000 B.P.), **[MIDDLE ARCHAIC]** Tucannon Phase (5000-2500 B.P.), **[LATE ARCHAIC]** Harder Phase (2500-500 B.P.), Piqunin Phase (500-250 B.P.), and the ethnographic Numipu Phase (250-50 B.P.). These divisions were based on artifact types excavated in dated contexts at Windust Caves (Rice 1965), Marmes Rockshelter (Fryxell and Daugherty 1962; Rice 1970), and Granite Point Locality 1 (Leonhardy 1970).

The Windust Phase of the Paleoindian Stage is characterised by projectile point forms with relatively short blades, shoulder of varying prominence, principally straight or contracting stems, and straight or slightly concave bases (Leonhardy and Rive 1970:4).

The Cascade Phase of the Early Archaic Stage has two sub-phases defined on the basis of the occurrence of Cold Springs Side-notched projectile points, which are labelled an "horizon marker" (Leonhardy and Rice 1970:6). Projectile points in the earlier subphase are large, well-made lanceolate variants of the Cascade type. These continue into the later subphase, in conjunction with Cold Springs Side-notched points.

The Tucannon Phase of the Middle Archaic Stage is marked by two kinds of projectile points: one has a short shouldered triangular blade with a contracting stem, and the other a barbed triangular blade with expanding stem. Leonhardy and Rice (1970) label both as variants of Snake River Corner-notched.

The Harder Phase of the Late Archaic Stage is characterised by large, basal-notched triangular projectile points called Quilomene Bar Basal-notched and corner-notched triangular forms dubbed Snake River Corner-notched.

The later Piqunin and Numipu Phases of the Late Archaic Stage are characterised by increasingly small corner-notched and basal-notched triangular forms of points called Columbia Valley Corner-notched and Wallula Rectangular types, and introduction of the small Plateau Side-notched triangular point.

The following point types were defined for the Chief Joseph Dam Project by Lohse (1985), and are held indicative of the southeastern Columbia Plateau cultural area.

<u>Windust C</u>

Windust C is a variant of the Windust Type, which is more typically a squat, shouldered lanceolate form with a broad stem. Windust C has been termed "Farrington Basal-notched" (Rice 1965). It is a squat lanceolate point of variable outline with a pronounced basal notch. Flaking patterns are variable to mixed, with many specimens exhibiting a markedly biconvex cross-section.

Type Sites: Windust Caves (Rice 1965); Marmes Rockshelter Rice 1969, 1972).

Temporal Distribution: c.10,000-7000 B.P., Early Archaic.

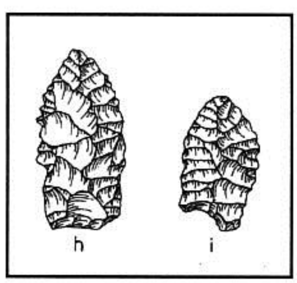

Figure 2. Windust Type (Sappington 1994: Fig.5.4).

<u>Cascade A</u>

Cascade A is a common variant of the classic Cascade projectile point defined by Butler (1961, 1962, 1965). It is a broad, often thick lanceolate point with a rounded to pointed base. Flaking patterns are variable to mixed, although collateral and transverse flaking are present. Serrated margins are common, but not nearly as frequent as on the Cascade C variant. Cross-sections are usually biconvex or planoconvex, but trapezoidal cross-sections are common, and diamond cross-sections also occur.

Type Sites: Indian Well (Butler 1961); Weis Rockshelter (Butler 1962).

Temporal Distribution: c.8000-4000 B.P.; Early Archaic.

Cascade B

Cascade B is not of frequent occurence (cf. Rice 1969, 1972), and is morphologically closest to the Windust C type variant. It is a slender lanceolate point with a slightly concave base. It is thin with a regular outline and cross-section, which creates a delicate appearance. Flaking patterns are variable to mixed. Serrated margins occur, and cross-sections are planoconvex, biconvex and trapezoidal.

Type Site: Marmes Rockshelter (Rice 1969, 1972).

Temporal Distribution: c.8500-6500 B.P.; Early Archaic.

Cascade C

Cascade C is the classic Cascade type defined by Butler (1961, 1962, 1965). It is a slender lanceolate point with a markedly contracting basal margin. Flaking patterns are generally variable, although tending toward mixed. Fin collateral flaking does occur. Serrated margins are common. Cross-sections are primarily biconvex, but the Cascade C speciemns show markedly higher frequencies of diamond and trapezoidal cross-sections that Cascade A and B type variants.

Type Sites: Indian Well (Butler 1961); Weis Rockshelter (Butler 1962).

Temporal Distribution: c.8000-4000 B.P.; Early Archaic.

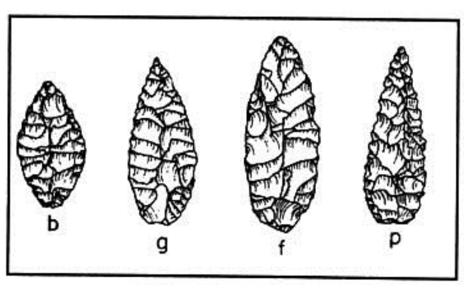

Figure 3. Cascade Type (Sappington 1994: Figs. 5.5, 6.10).

Mahkin Shouldered Lanceolate**:**

The Mahkin Shouldered Lanceolate type was defined by Lohse (1985). It is a common form of projectile point found in excavations across the Columbia Plateau. It is a large shouldered lanceolate point of variable outline and proportion often found in association with Cascade type variants and the Cold Spring Side-notched type. It ranges from a large point with broad stem, similar to the defined Lind Coulee type, to a small squat point very like the corner-removed Rabbit Island Stemmed type variants. Flaking patterns are variable to mixed, although collateral and uniform flaking occur. Mahkin Shouldered points are never serrated. Cross-sections are characteristically thickly biconvex, but can be trapezoidal, planoconvex or arkedly diamond-shaped.

Type Sites: Windust Caves (Rice 1965); Marmes Rockshelter (Rice 1969, 1972); 45-OK-11 (Lohse 1984).

Temporal Distribution: c.8000-3500 B.P.; Early-Middle Archaic.

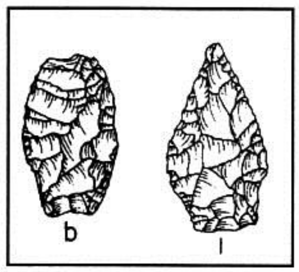

Figure 4. Mahkin Shouldered (Sappington 1994: Figs. 6.10, 6.11).

<u>Cold Springs Side-notched</u>

The Cold Springs Side-notched point type was first identified by Shiner (1961), and later refined by Butler (1962). It is commonly found with Cascade type variants and the Mahkin Shouldered Lanceolate type. It is a large to medium sized point with deep to shallow lateral notches. Outline and proportions differ markedly, as does treatment of the basal margins. Contracting lateral basal margins produce a decidedly lanceolate outline, while straight lateral margins may indicate creation on a triangular blank. Cold Spring Side-notched points will generally have notches placed higher on the lateral margins than the later Plateau Side-notched type variants, and are never basally notched. Flaking pattern is usually variable, though mixed and collateral flaking do occur. Cross-sections are predominantly biconvex, though specimens with planconvex and trapezoidal cross-sections are found.

Type Sites: Cold SPrings (Shiner 1961); Weis Rockshelter (Butler 1962).

Temporal Distribution: c.7000-4000 B.P.; Early Archaic.

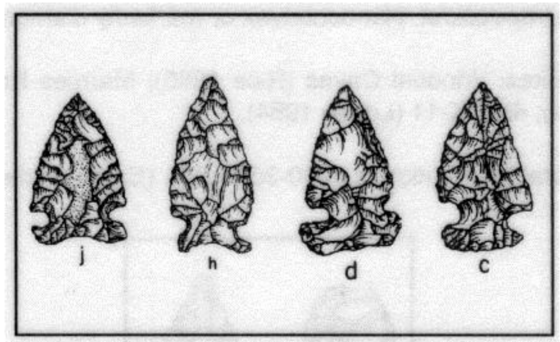

Figure 5. Cold Springs Side-notched Type (Sappington 1994: Fig. 5.6).

Plateau Side-notched

This is a small side-notched triangular point type distinct from the larger Cold Springs Side-notched type, and does not appear to be historically related to that form (cf. Butler 1962). These smaller points do not tend toward convex blade margins like those of the Cold Spring Side-notched type, and generally have side notches placed lower on the lateral margins. Basal treatment on these small forms is variable, with markedly convex, concave and notched bases, and straight to contracting lateral basal margins. These are small, delicate points, usually highly symmetrical, and often exhibiting a characteristic winged appearance. Flaking pattern is variable. Serrated blade margins occur. Cross-sections are almost entirely biconvex.

Type Site: None. This projectile point type has a wide distribution across all of western North America, and the labels small side-notched, Desert Side-notched, Plateau Side-notched and Columbia Side-notched have generally been applied without comment.

Temporal Distribution: c.1500-0 B.P.

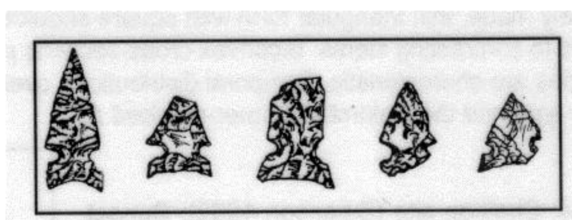

Figure 6. Plateau Side-notched Type (Sappington 1994: Figs. 7.11, 7.31).

Nespelem Bar Type

The Nespelem Bar type is a slightly shouldered triangular projectile point, commonly subsumed under the Rabbit Island Stemmed Series as common variant (cf. Nelson 1969). These were recovered in high numbers in good, dated stratigraphic context in the Rufus Woods Lake Project Area, and were found in position clearly transitional between earlier Mahkin Shouldered types and the Rabbit Island Stemmed Series (Lohse 1985:347). These points are triangular with weak to strongly defined upward sloping shoulders, and generally have thick, irregular cross-sections. The earliest forms are large, approaching the size of the Mahkin Shouldered type, and are distinguished from those forms solely on the basis of their obvious triangular outline. Later versions are smaller, comparable in size to the Rabbit Island A examples, but distinguished from these by their rougher manufacture, irregular surface flaking pattern, and blocky cross-section.

Type Sites: 45-OK-11 (Lohse 1084) and 45-OK-258 (Jaehnig 1984).

Temporal Distribution: c.5000-3000 B.P.

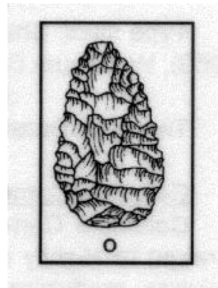

Figure 6. Nespelem Bar Type (Sappington 1994: Fig. 6.10).

<u>Rabbit Island Stemmed A</u>

Rabbit Island Stemmed A was first identified by Daugherty (1952) and Crabtree (1957), and later described by Swanson (1962) and Nelson (1969). This point type is common on the Columbia Plateau c.4000 B.P. It is a distinctive, nicely made, thin triangular form with square shoulders and well-defined straight to contracting stems. Biconvex cross-section predominate. Serrated margins are characteristic. Temporal distributions overlap with the Nespelem Bar type and the Columbia Corner-notched A type.

Type Sites: Shalkop Site (Swanson 1962) and Sunset Creek Site (Nelson 1969).

Temporal Distribution: c.4000-2000 B.P.

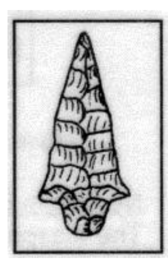

Figure 7. Rabbit Island Stemmed Type A.

<u>Rabbit Island Stemmed B</u>

This is a smaller and more delicate version of the Rabbit Island Stemmed A point type. Lohse (1985:349) notes that it consistently occurs in later cultural contexts than type A. It is a small triangular point with square shoulders, straight to slightly incurvate lateral blade margins, and sharply contracting stems. Short lateral tangs at the juncture of the blade and shoulder are common. Blade margins often are serrated. Flaking patterns are irregular. Cross-sections are biconvex.

Type sites: Shalkop site (Swanson 1962), Sunset Creek site (Nelson 1969) and Wanapum Dam (Greengo 1982).

Temporal Duration: c.3000-1500 B.P.

Columbia Corner-notched A

Columbia Corner-notched A points are large triangular forms with striaght t slightly convex lateral blade margins, and wide, deep corner notches producing thick, expanding stems and downward projecting shoulders. Flaking patterns are variable, but tend to be regular. Serrated blade margins are not present. Cross-sections tend to be thick and biconvex. The most complete descriptions of these forms are found in Nelson (1969) and Leonhardy (1970). This type if contemporaneous with Rabbit Island Stemmed A, though at Rufus Woods Lake, Columbia Corner-notched A was not well represented in strata also containg Rabbit Island Stemmed forms (Lohse 1985:349). It appears that their spatial range also does not overlap. Columbia Corner-notched points are characteristic of southern Columbia Plateau c.4000-2000 B.P., while Rabbit Island Stemmed points are more frequent on the central and nortern Columbia Plateau over the same temporal range.

Type Sites: Marmes Rockshelter (Rice 1969, 1970), Granite Point Locality (Leonhardy 1970), Sunset Creek site (Nelson 1969), and Wanapum Dam (Greengo 1982).

Temporal Distribution: c.4000-2000 B.P.

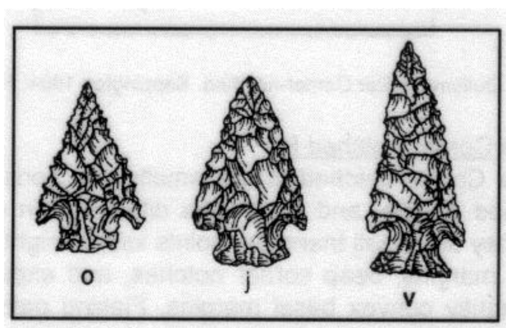

Figure 9. Columbia Corner-notched Type (Sappington 1994: Fig. 7.30).

Quilomene Bar Corner-notched

Quilomene Bar Corner-notched points, while morphologically similar to the Columbia Corner-notched A type, are far larger and more massive. They are big, heavy points, with straight to slightly convex lateral blade margins, deep and broad corner notches, and markedly expanding thick stems. Flaking patterns are variable, but tend toward regular. Margins are not serrated. Cross-sections are characteristically biconvex, but may be trapezoidal or irregular. Nelson (1969) first defined this point type, and it is thought to come into the archaeological record after the Columbia Corner-notched and Rabbit Island Stemmed A types c.3000 B.P. Nelson (1969) suggests that these forms continue well past 2000 B.P., with the latest examples having a basally notched stem.

Type Sites: Marmes Rockshelter (Rice 1969, 1972), Sunset Creek site (Nelson 1969) and Wanapum Dam (Greengo 1982).

Temporal Distribution: c.3000-2000 B.P.

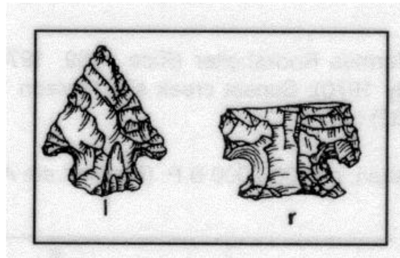

Figure 10. Quilomene Bar Corner-notched Type (Sappington 1994: Figs. 7.15, 7.31).

Columbia Corner-notched B

Columbia Corner-notched B are smaller versions of the Columbia Corner-notched A type, and show little difference in outline or surface treatment. They are small triangular points with straight to slightly convex lateral blade margins, deep corner notches, and expanding stems with straight to slightly convex basal margins. Flaking patterns are generally regular. Cross-sections are biconvex to plano-convex. Serrated blade margins are rare. These points characterise the past 2000 years of Columbia Plateau prehistory, and probably represent a continuation of the Columbia Corner-notched series.

Type Sites: Granite Point Locality (Leonhardy 1970), Sunset Creek site (Nelson 1969) and Wanapum Dam (Greengo 1982).

Temporal Distribution: c. 2000-150 B.P.

Wallula Rectangular Stemmed

Wallula Rectangular Stemmed points are small, delicate triangular forms with essentially straight blade margins, wide and low corner notches, long and straight lateral stem margins, and straight to slightly convex basal margins. Flaking patterns are variable. Cross-sections tend to be biconvex. Osborne et al. (1952) and Crabtree (1957) first described this point form, however Shiner (1961) was the first to define the Wallula type. Crabtree (1957) suggested that it was historically related to the Rabbit Island Stemmed type and Shiner (1961) postulated that Wallula Rectangular Stemmed points bridged the typological gap between the Rabbit Island Stemmed type and the Columbia Stemmed Series. Lohse (1985:351) documented that temporal distribution of the Wallula Rectangular Stemmed type did span between that of Rabbit Island Stemmed and the Columbia Stemmed Series. The Wallula Rectangular Stemmed type is most common on the lower reaches of the Columbia River drainage, but does occur in limited numbers at least as far north as Kettle Falls.

Type Sites: Sunset Creek (Nelson 1969) and Wanapum Dam (Greengo 1982).

Temporal Distribution: c.2000-150 B.P.

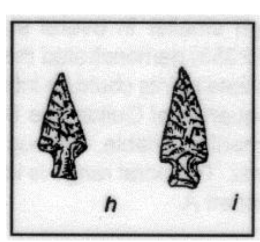

Figure 11. Wallula Rectangular-stemmed Type (Sappington 1994: Fig. 7.11).

Quilomene Bar Basal-notched A

Quilomene Bar Basal-notched A points are thick and heavy, with convex to straight blade margins that terminate in thick, squared barbs that extend fown to the base of the expanding stem. Flaking patterns tend to be variable, although mixed and uniform flaking will occur. Cross-sections will tend to be regularly biconvex. Nelson (1969) described this type. It appears to enter the archaeological record c. 2500 B.P., and with Quilomene Bar Basal-notched B, continues till at least c. 1500 B.P. It has no obvious precursors in the archaeological record, though Nelson (1969) suggests it relates to the later Columbia Stemmed Series.

Type Sites: Granite Point Locality (Leonhardy 1970), Sunset Creek site (Nelson 1969) and Wanapum Dam (Greengo 1982).

Temporal Distribution: c. 2500-1500 B.P.

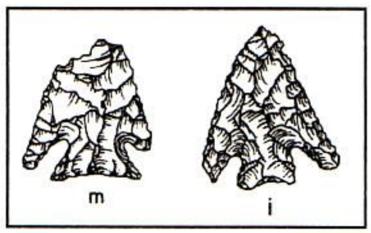

Figure 12. Quilomene Bar Basal-notched Type (Sappington 1994: Figs. 7.15, 7.31).

Quilomene Bar Basal-notched B

Quilomene Bar Basal-notched B are fully comparable to Quilomene Bar Basal-notched A, although smaller in overall size and less square and shorter barbs. Lohse (1985:353) demonstrated that B forms are statistically distinct from A forms, but these points could be interpreted as variants within the normal production sequence of Quilomene Bar Basal-notched points. Flaking patterns are primarily variable, although uniform flaking occurs. Cross-sections are biconvex. Temporal range is identical to that defined for Quilomene Bar Basal-notched A.

Type sites: Sunset Creek site (Nelson 1969) and Wanapum Dam (Greengo 1982).

Temporal Distribution: c. 2500-1500 B.P.

Columbia Stemmed A

Columbia Stemmed A type points are delicate, elongate triangular forms with sharply pointed, downward projecting barbs, and small, narrow expanding stems. Type A variant examples are long and narrow, with generally straight to very slightly concave lateral blade margins. Squared barbs occur, but are not massive in proportion to point size. Flaking patterns are primarily mixed, but may include variable and uniform. Cross-sections are biconvex and very regular. These points are most common in the lower Columbia River drainage, but have been found in numbers as far north as Kettle Falls.

Type Sites: Sunset Creek site (Nelson 1969) and Wanapum Dam (Greengo 1982).

Temporal Distribution: c. 2000-150 B.P.

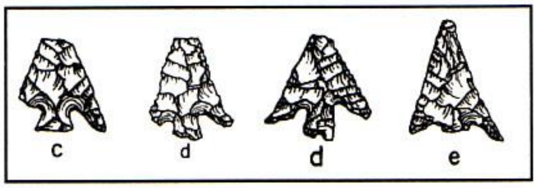

Figure 13. Columbia Stemmed Type (Sappington 1994: Figs. 7.15, 7.31).

Columbia Stemmed B

Columbia Stemmed B points are very similar to Type A variants, except for more open basal notches, a lack of squared barbs, and concave lateral blade margins.

Type Sites: Sunset Creek site (Nelson 1969) and Wanapum Dam (Greengo 1982).

Temporal Distribution: c. 2000-150 B.P.

Columbia Stemmed C

Columbia Stemmed C variants are similar to both Type A and Type B variants. These are small, delicate triangular forms with distinctive basal notches and barbs. They tend to be smaller and squatter than A and B forms, have open basal notches, and barbs that expand laterally rather than projecting downward. Lateral blade margins are variable, but tend toward straight. Flaking patterns are predominantly variable, although examples of uniform and mixed occur. Cross-sections are biconvex, although planoconvex is represented. Type C points occur slightly later in time than Type A or B points, consistent with the dimunition in size through time noted by various researchers for projectile points in the archaeological record of the Columbia Plateau.

Type Sites: Sunset Creek site (Nelson 1969) and Wanapum Dam (Greengo 1982).

Temporal Distribution: c. 1500-150 B.P.

STYLAN 2: Great Basin

Great Basin typologists tend to accept recognized types and attempt to refine these as evidence accumulates. Paradigmatic classification is not used but statistical applications are commonly applied. Table 1 lists major projectile point types defined for the Great Basin by Holmer (1978, 1986), Thomas (1981, 1983) and Jennings (1986). Recognized types occur within type series defined morphologically and chronologically, and as individual types that lack variation within a narrow morphological template.

Lanceolate Series

The earliest known projectile points in the Great Basin belong to the "Fluted Point Tradition" (Hester 1973) and the "Stemmed Point Tradition" (Layton 1970). These have not figured prominently in recent typological exercises because of the relative paucity of specimens from secure dated contexts (Holmer 1986:94). The temporal relationship of the two lanceolate series is unknown, but in North America, fluted simple laceolate points appear to be the earlier.

Simple Laneolate/Fluted: Holmer (1986:94) cites Owl Cave (Wasden) as the only site with fluted points from a secure dated context radiocarbon dated at c. 13000-11,000 B.P. (Miller and Dort 1978; Miller 1982), and with obsidian hydration dates averaging c. 11,000 B.P. (Green 1983). Bedwell (1970:180-181) found a slightly fluted lanceolate point on Pleistocene lake gravels dated c. 13,000 B.P. in the Fort Rock Basin of Oregon (cf. Fagan 1975) and Elmer Smith recovered a similar point in the lowest levels of Danger Cave (Jennings 1957:47).

Simple Lanceolate: Later simple lanceolate forms in the Great Basin cultural area have been classified under a variety of labels: Pinto Shoulderless, Humboldt Concave-base and Humboldt Basal-notched, Triple-T Concave-base, and McKean Lanceolate. Holmer (1986:100) notes that concave-base lanceolate forms often overlap with bifurcate-stemmed points in distribution, but have a far longer time span, and implies that the classification of these forms is far from detailed or complete.

Shouldered Lanceolate: Shouldered lanceolate point variants in the Great Basin may have a roughly comparable age to fluted lanceolates (Holmer 1986:95). Bedwell (1973:142) recovered a stemmed point from the same occupation level as the fluted lanceolate point dated c. 13,000 B.P. Several bases of stemmed points were found at Smith Creek Cave with radiocarbon dates ranging from c. 12,000-10,000 B.P., and found in direct association with extinct Pleistocene fauna. Swanson (1972) found stemmed lanceolate points at Bison Rockshelter in the Birch Creek Valley of Idaho dated before 10,000 B.P. Sargent (1973) reports recovery of Haskett stemmed lanceolate points from Redfish Overhang in central Idaho dated c. 10,000-9000 B.P. Bedwell found Haskett type points at Connley Caves in southeastern Oregon dated c. 11,000-9000 B.P.

Later versions of stemmed lanceolate points include Lake Mohave and Silver Lake variants. These points are usually recovered as surface finds, but Sargent (1973) reports on a Silver Lake point recovered from a stratum at Redfish Overhang dated c. 8000 B.P. Two Lake Mohave or Silver Lake points were recovered at Danger Cave in Stratum DII, dated c. 10,000-9,000 B.P. One Lake Mohave point at Hogup Cave was dated c. 8000 B.P.

The actual chronological sequence of lanceolate and shouldered lanceolate point forms is not well described for the Great Basin, but the transition from Paleoindian to Early Archaic is marked in distinctive point styles. There is a dimunition is size, morphology, and use of projectile points at this transition exemplified in the development of variants of triangular outline and highly variable haft treatment.

Pinto Series

Pinto type points are large triangular forms, often relatively crude, with straight to convex blade margins and straight to expanding stems with marked basal notches producing an eared or flared appearance.

Holmer (1986:97) refers to these points as "large bifurcate-stemmed points," and notes that various labels have been given to this corner-removed type which corresponds to the traditional Pinto Series (Amsden 1935; Harrington 1957). There is considerable formal variation and a wide range in radiocarbon dates from c. 8000-2000 B.P. Confusion over type definition, assignment, and datable contexts, has led researchers like Warren (1980) to refer to the "Pinto Problem." Thomas (1981:37-38) assigned earlier "true Pinto" points to the already defined Pinto Series, and classified morphologically similar by later points to the Gatecliff Split Stem series. Holmer (1986:97) used discriminant analysis to statistically separate these earlier and later variants, and concluded that the deciding difference is the basal treatment of the stem or hafting element: Pinto points have shallow central basal notches and rounded lateral margins or ears with expanding stems, and Gatecliff Split Stem points have deeper and wider central basal notches with more pointed lateral margins or ears and relatively straight stems.

The Pinto points have been recovered at Danger Cave, Hogup Cave, and Sudden Shelter, in strata dated before c. 6000 B.P.

Type Site: Pinto Basin site (Amsden 1935) and Gypsum Cave (Harrington 1933).

Temporal Distribution: 8000-6000 B.P.

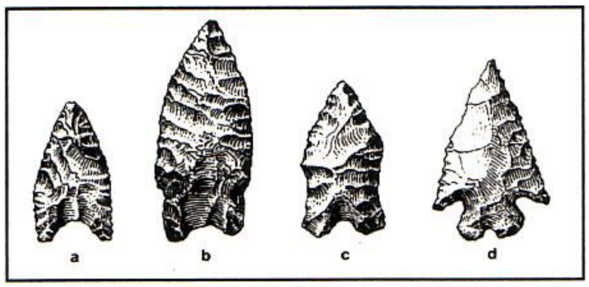

Figure 14. Pinto Type Series (Jennings 1986: Fig. 3).

<u>Large Side-notched Series</u>

Holmer (1978) defines five large side-notched points: Northern Side-notched, Hawken Side-notched, Rocker Side-notched, Sudden Side-notched, and San Raphael Side-notched. Thomas (1981:19) identifies Northern Side-notched, Bitterroot Side-notched, Madeline Dunes Side-notched, Elko Side-notched, and Rose Spring Side-notched, as lumped under his large side-notched designation.

Northern Side-notched are triangular blade forms with slightly convex edges. The horizontal notches are moderately high on the sides, forming a slightly contracting base that is approximately the same width as the blade. The base is usually concave, although straight bases occur.

Type Site: Wilson Butte Cave (Gruhn 1961).

Temporal Distribution: c. 6800-6200 B.P.

Hawken Side-notched are lanceolate blade forms with low, semicircular notches forming slightly contracting stems with flat to slightly convex bases.

Type Site: (Frison et al. 1976).

Temporal Distribution: c. 6500-4500 B.P.

Rocker Side-notched are wide lanceolate blades with moderately high horizontal side notches forming a stem that is often semicircular in outline. Blade and basal edges form a smooth continuous curve.

Type Site: Cowboy Cave (Jennings 1980)

Temporal Distribution: 6500-550 B.P.

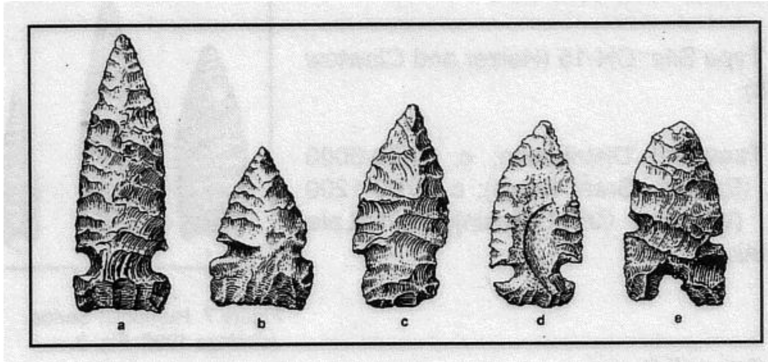

Figure 15. Northern Side-notched Type Series (Jennings 1986: Fig. 3).

Humboldt Series

The Humboldt Series point is defined as an unnotched, lanceolate, concave-base form of variable size (Thomas 1981:17). Thomas (1981:17) proclaims this series a "residual category," with poorly quantified size limits, and encompassing a number of distinctive individual types: Humboldt Concave Base A, Humboldt Concave Base B, and Humboldt Basal-notched. Humboldt Series points were made in the post-Mazama eruption period c. post-6700 B.P., and in Thomas's (1981) typology derived from Monitor Valley extend through time to c. 1200 B.P.

Thomas (1981:18) defined the "Triple-T Concave Base" type as distinct from the Humboldt Series forms. This point is unshouldered with slightly to moderately concave base with distinctively rounded basal projections. These have rounder basal profiles that Humboldt Series points, and more gently curving sides. They are recorded at Gatecliff Shelter as dating c. 3400-3200 B.P., but Thomas notes possible affiliations with earlier pre-Mazama eruption specimens.

Holmer (1978:41-44) distinguishes between Humboldt Concave Base A and Concave Base B on the variable of length: Base A is longer than 3 cm in length amd Base B is shorter). Holmer (1986:101) notes that there are two primary periods of occurrence: Humboldt points at c. 8000-6000 B.P. and McKean Lanceolate points at c. 5000-3000 B.P.

Type Site: CH-15 (Heizer and Clewlow 1968).

Temporal Distribution: c. 7500-6000 B.P. (Eastern Great Basin); c. 6700-1200 B.P. (Western Great Basin).

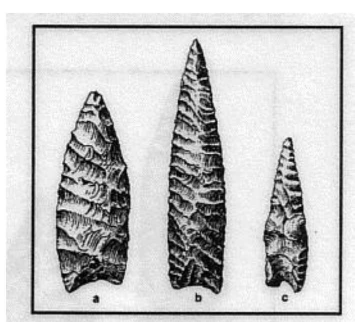

Figure 16. Humboldt Type Series (Jennings 1986: Fig. 3).

Gatecliff Series

Thomas (1981:22-24) defined the Gatecliff Series, which contains previously defined point types: Elko Contracting Stem or Gypsum Cave (cf. Harrington 1933; Fowler, Madsen and Hattori 1973: 20-21; Heizer and Berger 1970) and the Pinto Series or split-stem variants (cf. Clewlow 1967; Thomas 1971:89; Heizer and Hester 1978:157-158). Similar forms have also been classified as the Little Lake Series (Bettinger and Taylor 1974:13), the Silent Snake Series (Layton 1970), and Bare Creek Eared (O'Connell 1971). Similar point forms constitute the so-called "Pinto problem" addressed by Warren (AMNH Gatecliff date). Thomas' (1981:23) definition of the Gatecliff Series simply states that these points have large contracting stems, and include two basic types: Gatecliff Split-stem and Gatecliff Contracting Stem. The split-stem variants correspond to the old Pinto Series, and the contracting stem variants correspond to Elko Contracting Stem or Gypsum Cave points.

Type Sites: Pinto Basin site (Amsden 1935), Wagon Jack Shelter (Heizer and Baumhoff 1961), Gypsum Cave (Harrington 1933), and Gatecliff Shelter (Thomas 1983).

Temporal Distribution: c. 5000-3000 B.P.

Elko Series

Elko series points consist of large, corner-notched triangular forms with variable shoulder and haft treatment. This series has been divided into three types: Elko Corner-notched, Elko Eared, and Elko Contracting-stem (Heizer and Baumhoff 1961:128). A side-notched variety was defined, but has not been accorded temporal or spatial significance (cf. Heizer, Baumhoff and Clewlow 1968; Holmer 1978:35; Thomas 1981:21). Thomas (1981:22) proposed moving the Elko Contracting Stem variant into his Gatecliff Series; Holmer (1878:35) suggested that they were best considered Gypsum type variants. O'Connell (1967) demonstrated the utility of Elko Corner-notched and Eared variants as temporal markers, and these are the two predominant Elko variants.

Elko Corner-notched points are traingular blade forms with straight to slightly convex edges, and corner notches that form tangs or downward sloping shoulders and expanding stems (Holmer 1978:35).

Type Site: Wagon Jack Shelter (Heizer and Baumhoff 1961).

Temporal Duration: c. 4500-1500 B.P.

Elko Eared points are triangular blade forms with straight to convex edges, expanding stems, and markedly concave basal margins or notches.

Type Site: Wagon Jack Shelter (Heizer and Baumhoff 1961).

Temporal Distribution: c. 4500-1500 B.P.

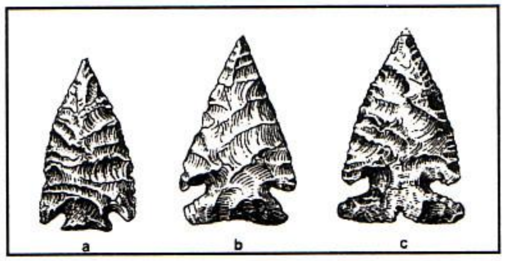

Figure 17. Elko Type Series (Jennings 1986: Fig. 3).

Rosegate Series

The Rosegate Series is a composite of the previously defined Rose Spring and Eastgate point types (Thomas 1981:19). The Rose Spring type was defined by Lanning (1963:252) and the Eastgate type defined by Heizer and Baumhoff (1961). Thomas combined these point types into a series because of morphological similarity, and lack of demonstrable areal separation.

Rosegate series points are small corner-notched triangular forms with expanding stems. Rose Spring Corner-notched points have squared shoulders and narrow, only slightly contracting stems. Eastgate Expanding Stem points have barbed shoulders extending down to the straight basal margin of markedly expanding stems. Eastgate Split-stem points have barbed shoulders and expanding stems with markedly concave or notched basal margins.

Type Sites: Iny-372 (Lanning 1963) and Wagon Jack Shelter (Heizer and Baumhoff 1961).

Temporal Distribution: c. 1200-600 B.P.

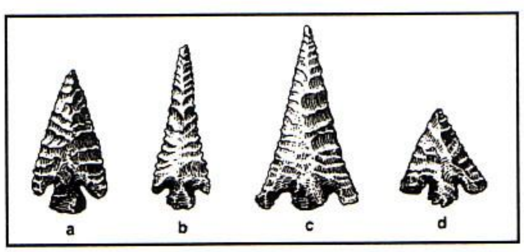

Figure 18. Rosegate Type Series (Jennings 1986: Fig. 3).

Cottonwood Triangular

Cottonwood Triangular points are small, unnotched, thin, triangular forms without discernible haft element. Lanning (1963:252-253) initially defined the Cottonwood Triangular type. It is generally held to date post- c. 700 B.P. (Clewlow 1967; Bettinger and Taylor 1974; Thomas 1981:16). A variant referred to as "Cottonwood Leaf-shaped" show a rounded or convex basal margin, and is held to be of the same age (Thomas 1981:16).

Type Site: Iny-2 (Riddell 1951).

Temporal Distribution: c. post-700 B.P.

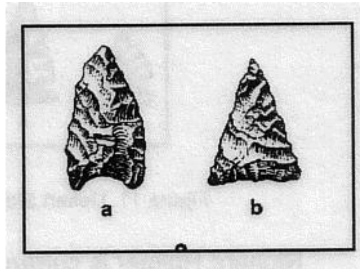

Figure 19. Cottonwood Triangular Type (Jennings 1986: Fig. 3).

Desert Side-notched Series

The Desert Side-notched Series was first defined by Baumhoff and Byrne (1959:37), and encompassed four subtypes: General, Sierra, Delta and Redding (cf. Thomas 1981). Desert Side-notched points are small triangular forms with straight blade margins, markedly flaring or expanding bases, and variable basal margin treatment. Only the General and Sierra subtypes are found in the northern Great Basin. Thomas (1981:27) concludes that the subtypes need not be distinguished for the Desert Side-notched Series to function as a valid temporal type.

General Subtype Desert Side-notched points are small delicate triangular forms, with straight lateral blade margins, and flaring bases with markedly concave basal margins. There is considerable variation within this general subtype designation (Baumhoff and Byrne 1959:37).

Temporal Distribution: c. 1000-100 B.P.

Sierra Subtype points are small, delicate triangular forms, with straight lateral margins, and flaring straight-sided bases with concave basal margins exhibiting a deep central notch. These points show less variability in form than the the General Subtype (Baumhoff and Byrne 1959:38).

Temporal Distribution: c. 500-100 B.P.

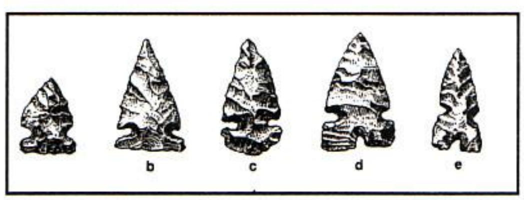

Figure 20. Desert Side-notched Type Series (Jennings 1986: Fig. 3).

STYLAN 3: Northwestern Plains Point Types

In a recent typological summary, Greiser (1984) outlines a general chronology fro the prehistory of southwestern Montana: an Early Prehistoric Period (c. 15,000-7500 B.P.), a Middle Prehistoric Period (Early Middle, c. 7500-4500 B.P.; Middle Middle, c. 4500-3000 B.P.; Late Middle, c. 3000-1500 B.P.), a Late Prehistoric Period (c. 1500-250 B.P.), and a Protohistoric Period (c. 250-150 B.P.). The "breaks" in this sequence are predicated on correlation with purported technological introductions: side-notched and corner-notched points (c. 7500 B.P.) and small points indicative of the bow-and-arrow (c. 1750 B.P).

Large Lanceolate Points

The earliest known lanceolate points are Clovis and Folsom, dating c. 11,500-10,500 B.P. Greiser (1984:37) notes that these are contemporaneous with Windust points (Rice 1965) on the Columbia Plateau.

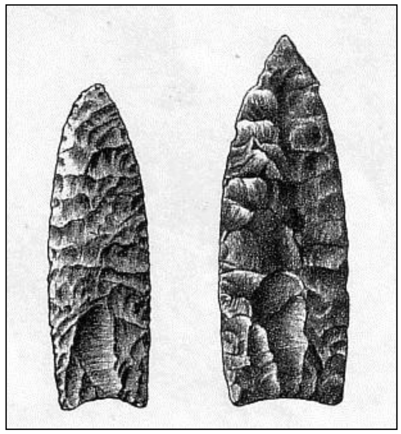

Figure 21. Clovis Type (Fagan 1981: p.80).

Lanceolate points on the Plains became more diversified in form c. 10,500 B.P., and are referred to as Plano. Plano series points include Agate Basin, Hell Gap, Alberta, Scottsbluff, Eden, Frederick, and Lusk. Greiser (1984:38) notes that dated secure Paleoindian components are rare on the Plains. Scottsbluff points were recovered from the MacHaffie site, near Helena, and radicarbon dated to c. 8000 B.P. (Forbis et al. n.d.).

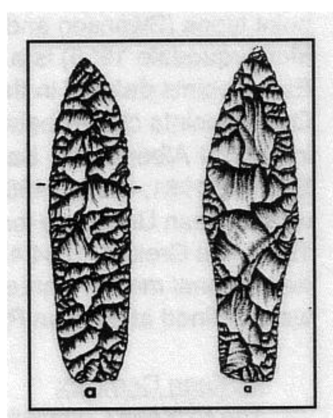

Figure 22. Lanceolate Types: left, Agate Basin; right, Hell Gap (Frison 1978: Figs. 5.7, 5.15).

Large Side-notched Points

Large Side-notched points mark the onset of the Middle Prehistoric Period c. 7500 B.P. Greiser (1984:38) notes that these carry various names dependent upon cultural area: Bitterroot Side-notched in the Northern Rockies (Swanson et al. 1964); Reeves (1969, 1970) subsumed similar points within the Mummy Cave complex for assemblages found east of the Divide; on the Columbia Plateau these points are referred to as Cold Springs Side-notched (Nelson 1969; Lohse 1985); in the Great Basin they are commonly referred to as variants of Northern Side-notched (Holmer 1978, 1986). Benedict (1978:145) suggested that these large side-notched points occur earlier in the Northern Rockies, both above and below Mazama Ash deposits (c. 6700 B.P.). By contrast, on the Plains these types consistently occur after these ash fall deposits.

Figure 23. Hawken Side-notched Type (Frison 1978: Fig. 5.30).

Greiser (1984:41) notes that these Bitterroot Side-notched points often occur in assemblages containing Oxbow and Snake River Corner-notched point types (Swanson and Sneed 1966). The Oxbow point type, defined by Nero and McCorquodale 1958), are side-notched, idented base forms similar to Elko Eared points defined in the Great Basin (Greiser 1984:41; Holmer 1986). Greiser (1984:41) states that dates for Oxbow points cluster between c. 5500-4000 B.P., but that these forms persist in central Alberta and Saskatchewan till c. 3000 B.P. (Buchner 1981; Gibson 1981). Greiser (1984:41) notes that many researchers have found Oxbow points with McKean Lanceolate forms as well as the Elko Eared forms (Aikens 1970), but suggests that these examples are products of depositional mixing. Three Oxbow components, dating c. 5200-3500 B.P. were defined at the Sun River site near Great Falls (Greiser et al. 1983).

McKean Complex

The McKean Complex consists of lanceolate forms with indented bases or the McKean type, shouldered or stemmed lanceolate forms called the Duncan type, and eared or expanding stem triangular forms termed the Hanna type (Mulloy 1954:50).

The McKean points tend to cluster between c. 4500-3500 B.P., and occur throughout the Northern Plains and Central Rockies. Greiser (1984:43) notes that contemporaneous forms on the Columbia Plateau include side-notched and corner-notched forms indicative of the Tucannon Phase (Leonhardy and Rice 1970), labelled Cold Springs Side-notched and Columbia Corner-notched A by Lohse (1985). In the basin, McKean points occur with Pinto series and Elko series variants (Thomas 1981; Holmer 1978, 1986).

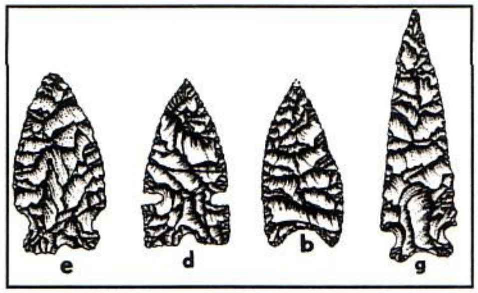

Figure 24. McKean Type Series (Frison 1978: Fig. 5.32).

Duncan and Hanna points occur after McKean points throughout the northwestern Plains. Swanson (1972) suggested that Hanna points are comparable to the Pinto series of the Great Basin.

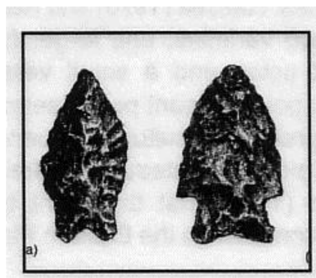

Figure 25. Duncan and Hanna Types: left, Duncan; right, Hanna (Jennings 1989: Fig. 4.13).

<u>Corner-notched point types</u>

Corner-notched points called Pelican Lake are found on the Northwestern Plains by c. 3000 B.P. (Wettlaufer 1955; Forbis 1962; Davis and Stallcop 1965; Reeves 1970; Syms 1980; Foor 1982). Bifacial flaked lanceolate forms with rounded bases, sharp points, and steeply bevelled resharpened edges are commonly found in conjunction with Pelican Lake points (Frison 1978:79). Greiser (1984:44) states that Elko series points from the Great Basin are morphologically similar to Pelican Lake points.

On the Plateau, Columbia Corner-notched series and Quilomene Bar series points are typologically similar forms (Nelson 1969; Leonhardy and Rice 1970; Lohse 1985).

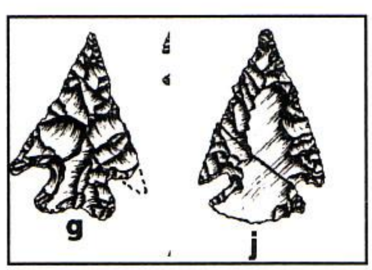

Figure 26. Pelican Lake Type (Frison 1978: Fig. 5.40).

Besant type points occur on the Northwestern Plains c. 2000 B.P. (Wettlaufer 1955:44; cf. Syms 1977). These points are large and broad triangular forms with shallow open corner notches. Reeves (1970) and Kehoe (1974) have proposed two varieties, one larger form postulated to be a dart point, and a small version postulated to be an arrow point. Besant points seem unique in the prehistoric cultural sequences of the Great Basin and Columbia Plateau, and Greiser (1984:44) cites Johnson (1977) that this point type seems to be a form more common on the Eastern Plains (cf. Reeves 1969, 1970).

Figure 27. Besant Type (Frison 1978: Fig. 5.40).

Small Late Prehistoric Point Types

The Late Prehistoric period is marked by the dimunition of projectile point size, including various small side-notched and corner-notched triangular forms. The earliest arrow point type on the Plains is the Avonlea, which a small side-notched triangular form with low side notches and a slightly concave base (Kehoe and McCorquodale 1961). Dates for Avonlea points cluster between c. 1500-800 B.P. (Greiser 1984:45). Johnson (1970:48) suggests that the area of concentration for Avonlea points is in the Plains area bounded by the Missouri, Saskatchewan and Qu'Appelle Rivers. Greiser (1984:45) adds that these points are common throughout the tributaries of the Missoouri River drainage.

Prairie Side-notched points occur between c. 1300-200 B.P. (Greiser 1984:47). These points are more crudely made than the Avonlea, are small side-notched triangular forms with high notches and straight to slightly convex basal margins (Forbis 1962; Reeves 1969, 1970).

The final small point series is the Plains Side-notched Complex (Kehoe 1966), which includes small side-notched triangular forms with symmetrical outlines, generalized flaking patterns, deep notches placed high on the lateral blade margins, and occasional medial basal notches. This series is cited by Greiser (1984:47) as comparable to the Desert Side-notched series defined for the Great Basin (Thomas 1981; Holmer 1978, 1986).

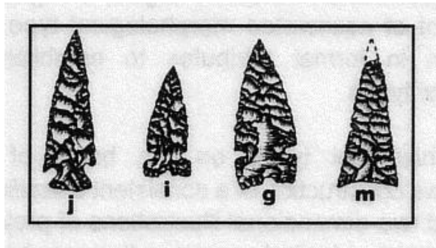

Figure 28. Plains Side-notched Type (Frison 1978: Fig. 5.41).

Lohse (1985) Classification System

Explicit types were defined by Lohse (1985) in an attempt to replicate accepted projectile point typologies on the Columbia Plateau. The analysis had two discrete stages: (1) description and classification, in which morphology was described in a paradigmatic classification; (2) auto-classification, wherein line segments, angles and ratios were computed for the point forms and entered into multivariate statistical routines to judge the success of point assignment to the recognized types.

Paradigmatic Classification

Eighteen morphological types or paradigmatic classes were defined on the basis of line segment definition and paradigmatic classification.

Projectile point outlines can be defined as series of line segments and nodes. Resultant classifications consist of line segment codes as shown.

Figure 29 illustrates paradigmatic morphological or descriptive classifications for projectile points as developed for the Rufus Woods Lake classification (Lohse 1985). Remember that only the two-dimensional outlines are being described, though surface details and cross-section or other variables can be added as needed. The box below shows paradigmatic codes added to the line segment definitions for the classes shown.

Descriptor	Code	Classification
Large triangular	aA	N 1 N 1
Large side-notched triangular	aA123	1 N N 1
Shouldered lanceolate	aA1	2 2 NN

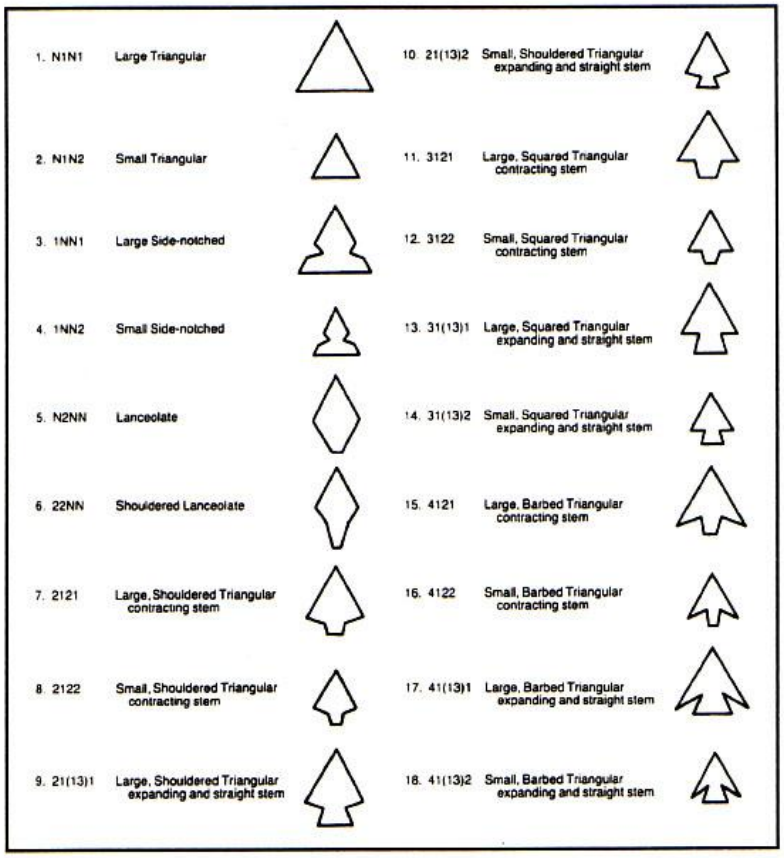

Figure 29. Morphological projectile point classes (Lohse 1985).

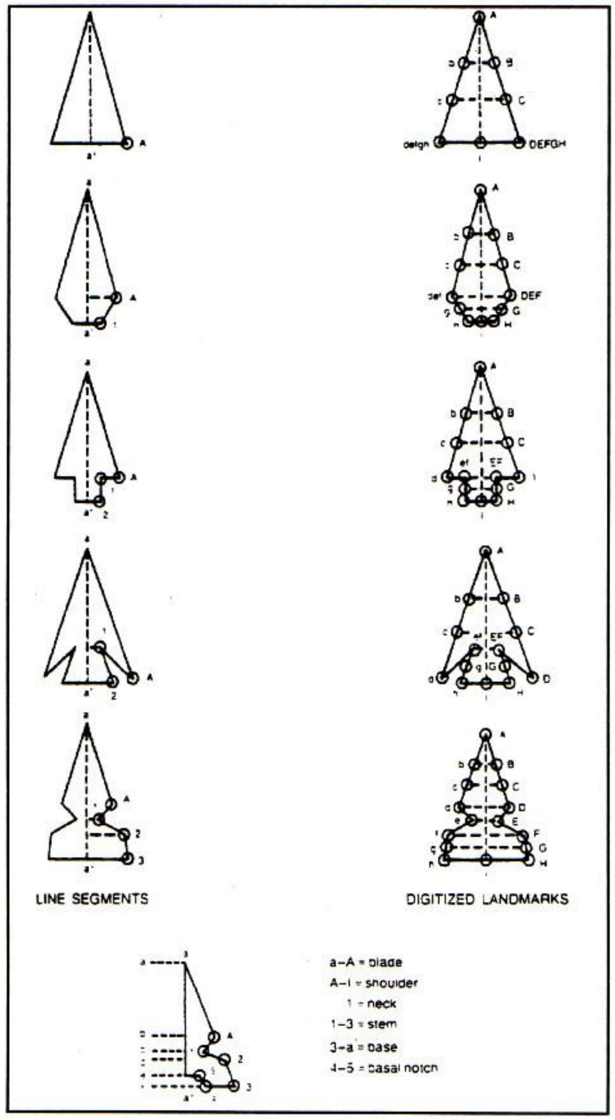

Figure 30. Definition of line segments and nodes to create objective descriptive classes of projectile points (Lohse 1985).

These descriptive or morphological classes can be related to named historical projectile point types simply by correlating postulated divisions of formal attributes with forms idealized as triangles and lanceolates. Historical types then become variants of larger groupings of triangular and lanceolate forms as shown in Figure 3. Lohse (1985) used this model to develop sets of measurements appropriate for discriminant analysis auto-classification routines. A standard system of measurements was then established, images of points were placed on a plotter, and all interval level measurements were placed in a computer database for multivariate statistical analyses.

A number of classification runs were performed and points were manually sorted into assigned groups. Errors were noted and runs were performed againl Experts were asked to assess the accuracy of these auto-classifications, and assessments of accuracy were as high as 80% for lanceolate forms and 96% for triangular forms. In general, it was found that only a few robust variables (discriminant functions) were actually needed for satisfactory classification:

Division	Series	Point Types
Lanceolate	Lanceolate	Large unnamed Lanceolate (Type 11)[1] Windust C (Type 12) Cascade A (Type 13) Cascade B (Type 14) Cascade C (Type 15)
	Shouldered Lanceolate	Windust A (Type 21)[1] Windust B (Type 22)[1] Lind Coulee (Type 23)[1] Mahkin Shouldered (Type 24)[2]
Triangular	Side-notched Triangular	Cold Springs Side-notched (Type 31) Plateau Side-notched (Type 32)
	Corner-removed Triangular	Nespelem Bar (Type 41)[2] Rabbit Island A (Type 42) Rabbit Island B (Type 43)
	Corner-notched Triangular	Columbia Corner-notched A (Type 51) Quilomene Bar Corner-notched (Type 52) Quilomene Bar Corner-notched A Quilomene Bar Corner-notched B Columbia Corner-notched B (Type 53) Wallula Rectangular Stemmed (Type 54)
	Basal-notched Triangular	Quilomene Bar Basal-notched A (Type 61) Quilomene Bar Basal-notched B (Type 62) Columbia Stemmed A (Type 63) Columbia Stemmed B (Type 64) Columbia Stemmed C (Type 65)

1. Dropped out of analysis for final classification runs as no examples were identified in the Rufus Wood Lake project area.

2. Type defined based on distribution within the Rufus Woods Lake cultural sequence.

Figure 30. Correlation of historical types and idealized descriptive classes (Lohse 1985).

Lanceolates: Function 1: haft length; Function 2: neck width, blade width, shoulder angle and shoulder length; 91% of variance

Triangles: Function 1: shoulder angle; Function 2: basal margin angle; Function 3: basal width, neck width/basal width ratio; 94% of variance.

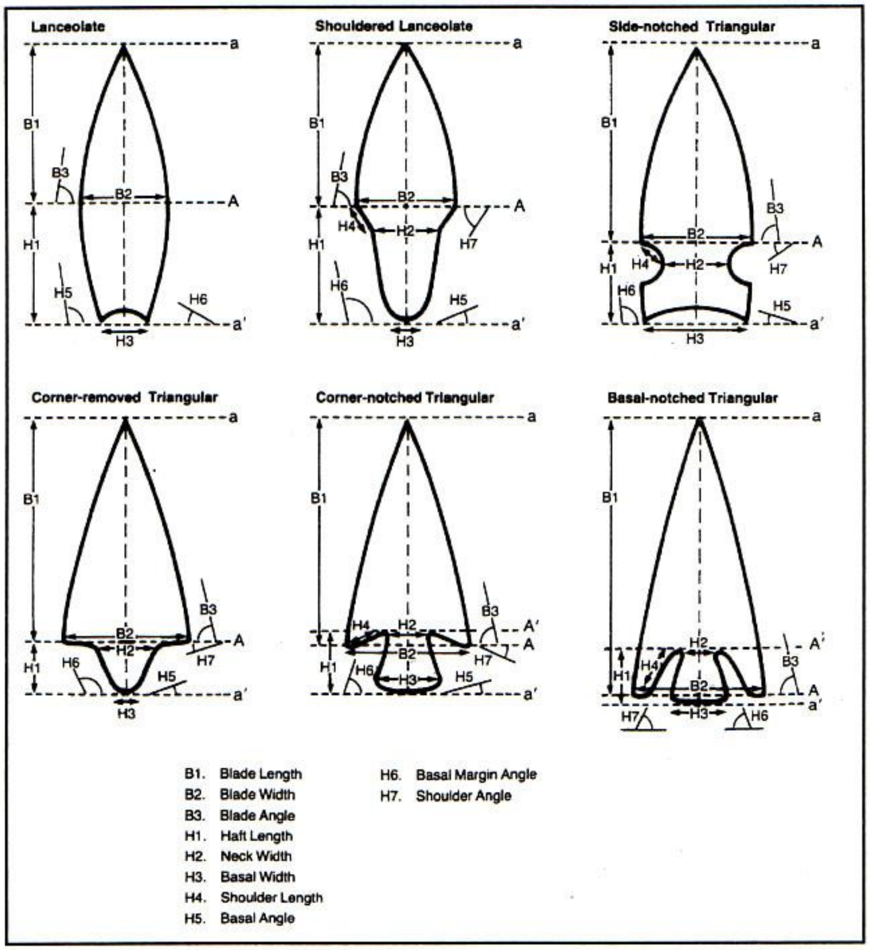

Figure 32. Line and angle measurements taken for classification of Rufus Woods Lake projectile points (Lohse 1985).

MEASUREMENTS		
Blade Measurements		
B1.	Blade Length (.1mm). The distance from the blade-haft juncture (Node A) to the tip of the point, taken on the vertical axis a-a'.	BLL
B2.	Blade Width (.1mm). The distance from the widest point on the right lateral margin of the blade to the widest point on the left lateral margin of the blade.	BLW
B3.	Blade Angle (degrees). The outside angle between the blade-haft juncture and the margin of the blade (axis A and line segment aA). If the blade margin is markedly convex, the blade angle follows the lower section near the blade-haft juncture. Otherwise, it follows the general trend of the blade margin.	BLA
Haft Measurements		
H1.	Haft Length (.1mm). The distance from the lowest point on the basal margin to the blade-haft juncture (axis a' to A on vertical axis a-a').	HAL
H2.	Neck Width (.1mm). The distance from the point defining the blade-haft juncture on the right margin of the haft to the point defining the blade-haft juncture on the left margin of the haft (Node 1).	NEW
H3.	Basal Width (.1mm). The distance from the widest point on the right lateral margin of the base to the widest point on the left lateral margin of the base.	BAW
H4.	Shoulder Length (.1mm). The distance between A and A'. A' is not indicated on each drawing in Figure 11-4 but it is the axis along which the neck width (H2) is measured.	SHL
H5.	Basal Angle (degrees). The angle between the a' axis and the basal margin of the haft.	BAA
H6.	Basal Margin Angle (degrees). The angle between the a' axis and the lateral margin of the haft.	BMA
H7.	Shoulder Angle (degrees). The angle between the shoulder of the blade and axis A.	SHA
Other Measurements		
G1.	Thickness (.1mm). Thickness of the blade-haft juncture, taken on axis A. On lanceolate forms, this measure is taken between the widest lateral points on the blade. On triangular forms, it is taken at the neck.	
G2.	Weight (.1gm). This measure applies to whole specimens. Broken specimens may be included only if a reasonable estimate of the original size can be made.	
G3.	Total Length (.1mm). The distance between axis a and a' along vertical axis a'.	TOL
Ratios Calculated from Above		
R1.	Blade Length/Total Length	BLL/TOL
R2.	Neck Width/Basal Width	NEW/BAW
R3.	Basal Width/Blade Width	BAW/BLW

Figure 33. Measurements taken on projectile points in the Rufus Woods Lake classification system (Lohse 1985).

STYLAN: Paradigmatic Classifications

Eleven classificatory dimensions have been defined for STYLAN: BLADE/STEM JUNCTURE, OUTLINE, STEM EDGE ORIENTATION, SIZE, BASAL EDGE SHAPE, CROSS SECTION, SERRATION, EDGE GRINDING, BASAL EDGE THINNING, and FLAKE SCAR PATTERN. Of these, the first four will define morphological types. The other seven serve to describe these types more fully, and permit the identification of significant variables within the morphological classes.

STYLAN requires definition of the margins of projectile points. This is done by visualizing straight lines drawn from nodes defined where the outline of the projectile two-dimensional form changes direction. For a corner-notched triangular point, the blade is defined as line segment a-A. The shoulder is line segment A-1. The neck is node 1. The stem is line segment 1-2. The base is line segment 2-a'. Terms applied and the number of line segments vary with the two basic subdivisions of form. Lanceolates generally are defined by four or fewer line segments (aA12). Stemmed triangular forms are defined by fiver or fewer line segments (aA123). Side-notched triangular forms are defined by five or more line segments (aA12345).

Cross-tabulation of classificatory dimensions D5-D11 supplies detailed descriptions of the morphological types and allows us to assess the temporal distribution of formal attributes as well as projectile point styles. We may subdivide any or all of these types based on their basal edge shape, serration, or flaking pattern. We may also assess the chronological significance of concave bases, serrated margins, or regular collateral flaking pattern independent of associated morphological type. Further, we can recognize variation in formal attributes to establish subdivisions in recognized historical types.

Definition of historical types on the basis of line and angle measurements allows construction of a consistent classification method that can utilize published two-dimensional illustrations of projectile points. Prior studies have validated typological exercises that emphasize the outline of projectile points (Ahler 1971; Gunn and Prewitt 1975; Holmer 1978, 1986; Lohse 1985).

<u>Dimension I: BLADE-STEM JUNCTURE</u>

This dimension describes the relationship between projectile point blade and stem.

Not Separated: There is no separation between blade and stem.

Side-notched: The separation between blade and stem consists of a notch introduced from the lower lateral margin of the projectile point.

Shouldered: The separation between blade and stem is a gradual sloping shoulder that forms an oblique angle from the proximal boundary of the blade down to the distal margin of the stem. Shoulders tend to be made by removal of the corner of the lateral and basal margins of a triangular form.

Squared: The separation between blade and stem is an abrupt shoulder that forms a roughly perpendicular angle from the proximal boundary of the blade down to the distal margin of the stem. Squared shoulders tend to be made by removal of the corner of the lateral and basal margins of a triangular form.

Barbed: The separation between blade and stem is an abrupt inward curving angle that extends the proximal margin of the blade down past and roughly parallel to the lateral marginf of the stem. Barbs tend to be made from long narrow notches introduced from the basal margin.

Indeterminate: Classification of the BLADE-STEM JUNCTURE cannot be made.

<u>Dimension II: OUTLINE</u>

This dimension broadly characterises the basic two-dimensional form or outline of projectile points. These classes assume significance only when combined with other descriptive dimensions.

Triangular: The greatest width of the projectile point form is in the lwoer one-third of the outline.

Lanceolate: The greatest width of the projectile point form is in the middle one-third of the outline.

Indeterminate: Assessment of the original projectile point outline cannot be made.

Dimension III: STEM EDGE ORIENTATION

This dimension describes the lateral margins of the stem as diverging or converging angles.

Straight: The lateral margins of the stem are roughly perpendicular to the long axis of the projectile point.

Contracting: The lateral margins of the stem converge inward toward the proximal end of the long axis of the projectile point.

Expanding: The lateral margins of the stem expand outward toward a basal line drawn at the proximal end of the long axis of the projectile point.

Indeterminate: Characterisation of the stem edge orientation cannot be made.

Dimension IV: SIZE

This dimension describes the relative size of the projectile point.

Large: The projectile point has a neck width of over 1 cm.

Small: The projectile point has a neck width of 1 cm or less.

Indeterminate: Measurement of the neck width of the projectile point cannot be made.

Dimension V: BASAL EDGE SHAPE

This dimension describes the shape of the basal or proximal margin of the projectile point as a curve.

Straight: The basal edge of the projectile point tends toward a straight margin with few if any irregularities.

Convex: The basal edge of the projectile point bends outward beyond a perpendicular line drawn out from the long axis of the point at the proximal end.

Concave: The basal edge of the projectile point bends inward from a perpendicular line drawn out from the long axis of the point at the proximal end.

Point: The basal edge of the projectile point converges sharply at the proximal end of the long axis of the point.

Straight or concave and notched: The basal edge of the projectile point tends toward a straight margin with few if any irregularities or bends inward from a perpendicular line drawn out from the long axis of the point at the proximal end. The notch extends inward from the basal margin, but must be seen as wholly confined within the basal margin regardless of presence or absence of curvature.

Indeterminate: Characterisation of the basal edge shape cannot be made.

Dimension VI: BLADE EDGE SHAPE

This dimension describes the two-dimensional shape of the blade by characterising the curvature of the lateral blade margins.

Straight: The lateral margins of the blade of the projectile point form an essentially straight line with few irregularities.

Excurvate: The lateral margins of the blade of the projectile point bend inward from a straight line drawn between the point at the distal end of the blade and the point at the proximal end of the blade shoulder.

Incurvate: The lateral margins of the blade of the projectile point bend outward from a straight line drawn between the point at the distal end of the blade and the point at the proximal end of the blade shoulder.

Reworked and straight: The lateral margins have been reworked due to breakage of the original projectile point blade. The present blade margin is straight.

Reworked and excurvate: The lateral margins have been reworked due to breakage of the original projectile point blade. The present blade margin is excurvate.

Reworked and incurvate: The lateral margins have been reworked due to breakage of the original projectile point blade. The present blade margin is incurvate.

Indeterminate: Assessment of the blade edge shape of the projectile point cannot be made.

Dimension VII: CROSS SECTION

This dimension describes the cross section of the projectile point viewed from the proximal end as a geometric shape.

Planoconvex: The cross section has one surface flat and the other convex.

Biconvex: The cross section has two convex surfaces.

Diamond: The cross section forms a lozenge-shaped plane figure.

Trapezoidal: The cross section forms a plane figure with four sides, only two of which are parallel.

Indeterminate: Assessment of the projectile point cross section cannot be made.

Dimension VIII: SERRATION

This dimension notes the presence of absence of a serrated blade margin.

Serrated: Notches occur in a regular pattern along the lateral margins of the blade.

Non-serrated: Lateral margins of the blade may be sinuous, but lack a regular pattern of notching.

Indeterminate: Assessment of the pattern of treatment for blade margins cannot be made.

Dimension IX: STEM-HAFT EDGE GRINDING

This dimension describes intentional modification of the stem or haft of the projectile point to facilitate hafting.

Not ground: There is no evidence of intentional grinding.

Blade edge: Grinding occurs on the lateral margin of the blade of lanceolate projectile points.

Stem edge: Grinding occurs on the lateral margin of the stem of shouldered lanceoalte projectile points.

Indeterminate: Assessment of grinding of the stem or haft margins of lanceolate projectile points cannot be made.

Dimension X: BASAL EDGE THINNING

This dimension classifies intentional manufacture of the basal edge of the projectile point to facilitate hafting by reducing surfaces and thickness of the haft element.

Not thinned: There is no evidence of intentional thinning of the haft element of the projectile point.

Short flake scars: Thinning of the haft element left short abrupt flake scars on the surface.

Long flake scars: Thinning of the haft element left long flake scars on the surface.

Indeterminate: Assessment of intentional basal edge thinning cannot be made.

Dimension XI: FLAKE SCAR PATTERN

This dimension characterises the pattern and symmetry of surface reduction of projectile points.

Variable: Flake scar pattern consists of irregularly sized flakes removed at various angles to the lateral margins of the projectile point.

Uniform: The flake scar pattern consists of fairly regularly sized flakes removed at somewhat consistent angles from the lateral margins of the projectile point.

Mixed: The flake scar pattern consists of sections of variably flakes surface and uniformly flaked surface.

Collateral: The flake scar pattern consists of flakes of uniform size and carry removed roughly perpendicular to the lateral edges of the projectile point and meeting at the dorsal or ventral midline of the surface.

Transverse: The flake scar pattern consists of flakes of uniform size and carry removed at a consistent angle tangential to the alteral edges of the projectile point and carrying completely across the surface.

Other: Flake scar pattern is different from the above characterisations. (Specify difference in D-BASE F9 Memo Field attached to STYLAN file).

Indeterminate: Assessment of flake scar pattern cannot be made.

[All MEASUREMENTS are only taken on <u>complete attributes</u>. Broken specimens may have a number of measureable attributes.]

<u>Dimension XII: LENGTH</u>

Measurement of the long axis of the projectile point is taken in millimeters. Measurement is not taken for incomplete specimens.

<u>Dimension XIII: NECK WIDTH</u>

Measurement is taken across the narrowest distal portion of the edge of the stem or neck in millimeters.

<u>Dimension XIV: BASAL WIDTH</u>

Measurement is taken across the proximal edge of the base or stem in millimeters.

<u>Dimension XV: HAFT THICKNESS</u>

Measurement is taken through the thickest portion of the haft element in millimeters.

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Concepts to Review

- Morphological classes
- Phases and stages
- Type sites
- Cultural areas
- Cultural traditions and horizons
- Paradigmatic classifications
- Line segments and nodes
- Mathematical topologies
- Cultures and “cultures”

STYLAN DIMENSIONS

Dimension I: BLADE-STEM JUNCTURE
1. Side-notched
2. Shouldered
3. Square
4. Barbed
5. Indeterminate
9. Not Applicable

Dimension II: OUTLINE
1. Triangular
2. Lanceolate
3. Indeterminate
9. Not Applicable

Dimension III: STEM EDGE ORIENT
1. Straight
2. Contracting
3. Expanding
4. Indeterminate
9. Not Applicable

Dimension IV: SIZE
1. Large
2. Small
3. Indeterminate
9. Not Applicable

Dimension V: BASAL EDGE SHAPE
1. Straight
2. Convex
3. Concave
4. Point
5. Straight or convex and notched
6. Indeterminate
9. Indeterminate

Dimension VI: BLADE EDGE SHAPE
1. Straight
2. Excurvate
3. Incurvate
4. Reworked
5. Indeterminate
9. Not Applicable

Dimension VII: CROSS SECTION
1. Planoconvex
2. Biconvex
3. Diamond
4. Trapezoidal
5. Indeterminate

Dimension VIII: SERRATION
1. Not Serrated
2. Serrated
3. Indeterminate

Dimension IX: EDGE GRINDING
1. Not Ground
2. Blade Edge
3. Stem Edge
4. Indeterminate

Dimension X: BASAL EDGE THINNING
1. Not Thinned
2. Short Flake Scars
3. Long Flake Scars
4. Indeterminate

Dimension XI: FLAKE SCAR PATTERN
1. Variable
2. Uniform
3. Mixed
4. Collateral
5. Transverse
6. Other
7. Indeterminate

Dimension XII: LENGTH (mm)

Dimension XIII: NECK WIDTH (mm)

Dimension XIV: BASAL WIDTH (mm)

Dimension XV: HAFT THICKNESS (mm)

Database Structure: D\DBASE\STYLAN.DBF

Field	Field Name	Type	Width	Dec	Index
1	Specno	Character	7		Y
2	Quant	Numeric	3		N
3	Bladjct	Character	1		Y
4	Outline	Character	1		Y
5	Stem	Character	1		Y
6	Size	Character	1		Y
7	Base	Character	1		Y
8	Bladshp	Character	1		Y
9	Cross	Character	1		Y
10	Serrat	Character	1		Y
11	Grind	Character	1		Y
12	Thin	Character	1		Y
13	Scars	Character	1		Y
14	Length	Numeric	5	1	N
15	Neck	Numeric	5	1	N
16	Basal	Numeric	5	1	N
17	Haft	Numeric	5	1	N
18	Memo	Memo	10		N

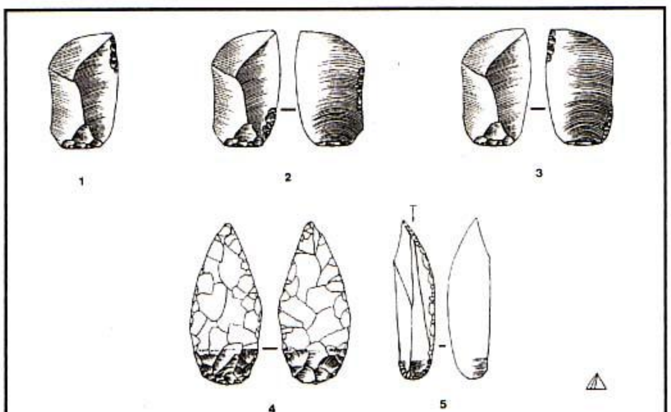

Fig. 40 — Localization of removals, some examples. 1 : distal right. 2 : proximal right and central inverse left. 3 : distal inverse right and proximal inverse left. 4,5 : basal.

Figure 10. Removal locations (Inizan, Roche and Rixier 1992).