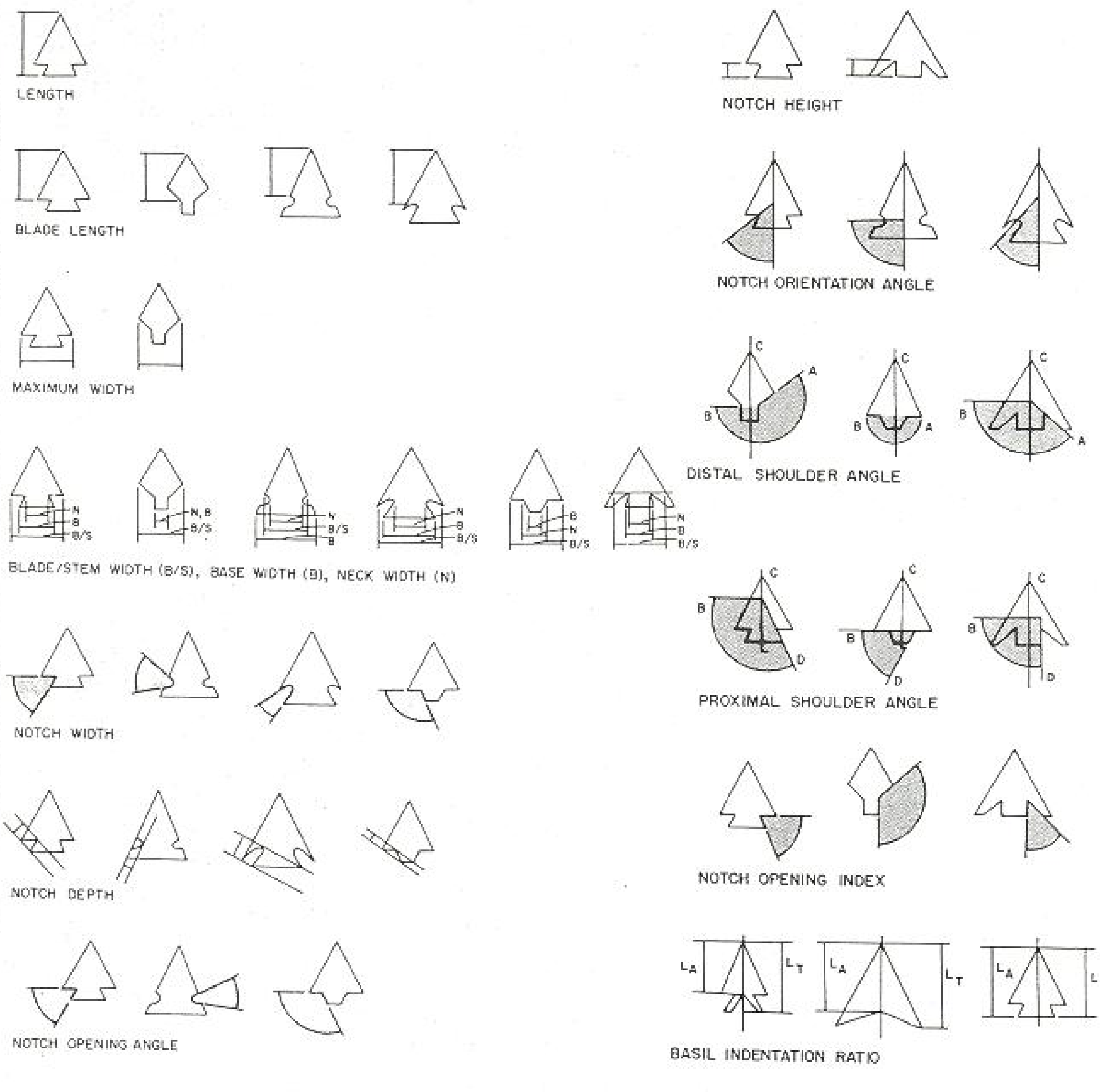
# IDAHO ARCHAEOLOGIST




VOL. VII, NO. 1 SUMMER, 1984

# IDAHO ARCHAEOLOGIST

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Cover: Quantitative Attributes



NOTICE TO AUTHORS

All manuscripts should conform as nearly as possible with the style established by the Society for American Archaeology. (See page 13, Vol. III, No. 1 and page 1, Vol. II, No. 2, *Idaho Archaeologist).* Manuscripts should be typed double-spaced with 1½-inch margins and submitted in the original and two copies. The *Idaho Archaeologist* will publish articles concerning archaeology in Idaho and those parts of abutting states and provinces included in the Columbia drainage and the Great Basin.

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This issue of the *Idaho Archaeologist* reflects several changes in the magazine. The first and most important of these changes is the departure of Bill Norquist as Editor. Bill, with the help of the Great Basin Chapter of the Idaho Archaeological Society, started the *Idaho Archaeologist* and kept it going until this issue. Under his editorship, the journal has grown from a few xeroxed pages to the magazine you are reading. The *Idaho Archaeologist* would not exist but for Bill and his persistence. Therefore, this issue is dedicated to Bill as a feeble effort at thanking him. He is continuing to help us produce the magazine as unofficial editor emeritus.

The *Idaho Archaeologist* will now be published semi-annually but with the same number of pages per year as before, when it was published quarterly. This change makes it possible for the editorial staff to maintain a production schedule. The *Idaho Archaeologist* should be issued every January and July.

It is the intent of the new editors to expand the pool of reviewers to include out-of-state archaeologists. We also encourage papers from avocational archaeologists and archaeologists from states bordering on Idaho. We wish to continue the series of special regional issues which began with the Southwest Idaho issue, and have issues on Northern Idaho, Central Idaho and Eastern Idaho.

This is Kenneth Ames's last issue as an editor. Papers should be submitted to:


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Boise State University
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until a new editor is appointed.

One critical thing is unchanged, however. The *Idaho Archaeologist* remains committed to publishing papers by non-professional archaeologists as well as by professionals and students. We cannot over-emphasize that point. This magazine is a forum for everyone with an interest in advancing our understanding of Idaho's prehistory.

*The Editors*

# ARCHAEOLOGICAL TEST EXCAVATIONS AT THE HEMMERT SITE (10-BL-14) SOUTHEASTERN IDAHO

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## INTRODUCTION

The Hemmert Site (10-BL-14) named after the land owner, Mr. Lonzo Hemmert, St. Charles, Idaho, is located on the northeast corner of Bear Lake at Hemmert Hot Springs, Bear Lake County, Idaho. The site covers an area of approximately 100 x 100 meters and is situated on both sides of the existing road along the north shore of Bear Lake extending south to the area of the Hot Springs (see Figure 1). The site was visited in 1980 during a survey of state lands in southeastern Idaho (Plew, n.d.), for the Idaho State Historical Society. Plowing and other land modifications have altered and disturbed parts of the site. In addition, extensive collection has obliterated much surface evidence of aboriginal activities. Bear Lake is a known historic trading locality (see Liljeblad 1957:111-112). The Hemmert site is the first site tested in the vicinity of Bear Lake.

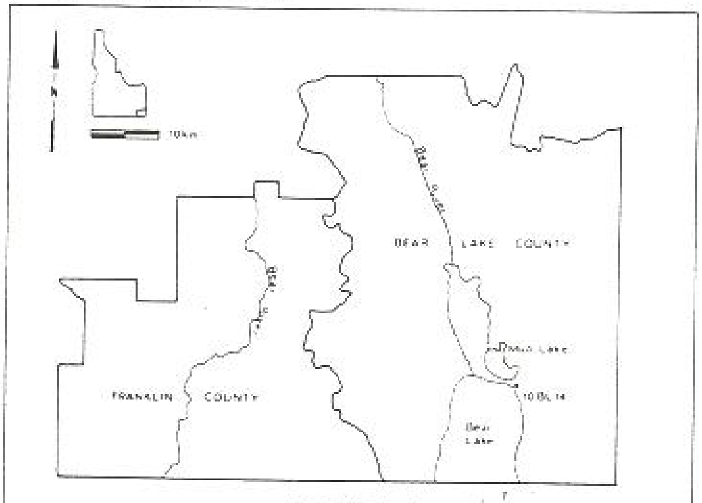



FIGURE 1

Map Showing General Location of the Hemmert Site

## CULTURAL DEPOSITS AND STRATIGRAPHY

A total of five 1 x 2 meter test pits were excavated to sterile sediment. Excavation was conducted using arbitrary 10 cm. levels. The test pits were located north-south along an east-west base line. The units were placed in an area of a surface concentration of approximately 30 meters from the lake shore (see Figure 2). The following are brief unit descriptions:

*Test Pit 1*

Test Pit 1 produced the greatest amount of cultural material including projectile points. Levels 1-4 (0-40 cm. below surface) were a dark grey-brown sandy silt containing relatively small rocks. An area of hard packed and light tan colored silt containing bits of mussel and burned bone was encountered at ca. 40 cm. below surface. The feature extended to ca. 55-60 cm. and may be a hearth remnant or possibly a storage pit. A charcoal lense ca. 6 cm. in diameter underlies the feature. The unit was very sandy at about 70 cm. The remainder of the unit which was excavated to 1 meter below surface was sterile (see Figure 3).

*Test Pit 2*

Level 1 (0-10 cm.) was a medium grey-brown sediment. It was loosely compacted and comprised of large amounts of small angular fire cracked rock. Three artifacts were recovered. Level 2 (10-20 cm.) contained numerous small smooth lake pebbles, with some fire cracked rock and lithic debris. Two bifaces and a projectile point fragment were recovered. A few lithic flakes were recovered from the upper levels. The remainder of the unit was sterile.

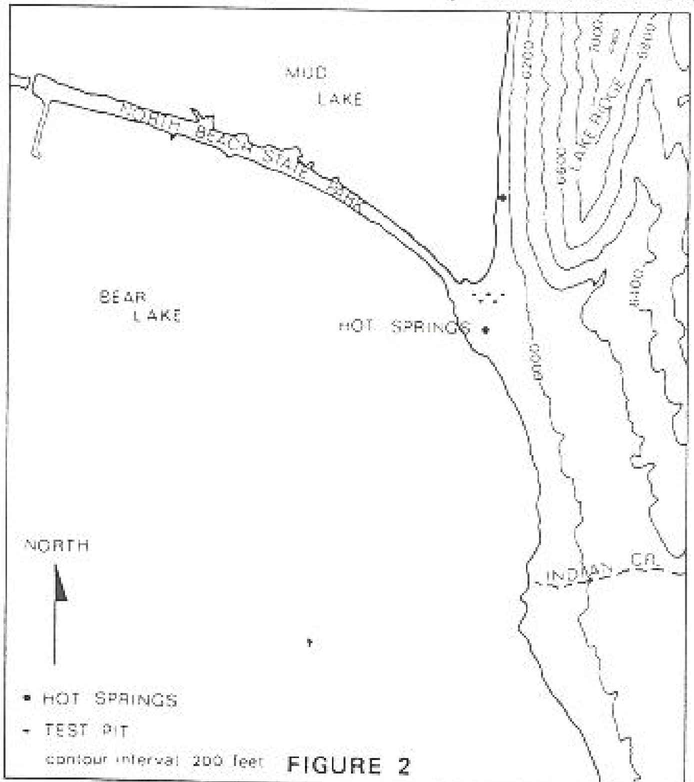



FIGURE 2

Map Showing Location of Test Pits at 10-BL-14

*Test Pit 3*

Test Pit 3 contained cultural bearing deposits to a depth of 30 cm. Sediments were a loosely cemented grey-brown sand underlain by sandy silt. Small rocks were scattered throughout. A small rock feature, 10 cm. in diameter, was recorded in the southwestern corner of the unit surface at 20 cm. below the surface. A biface was recovered from levels 1 and 2. Small amounts of lithic debris were found in all levels.

*Test Pit 4*

The unit is characterized by dark brown sandy silt which is moist, loosely cemented and contains small angular rocks and

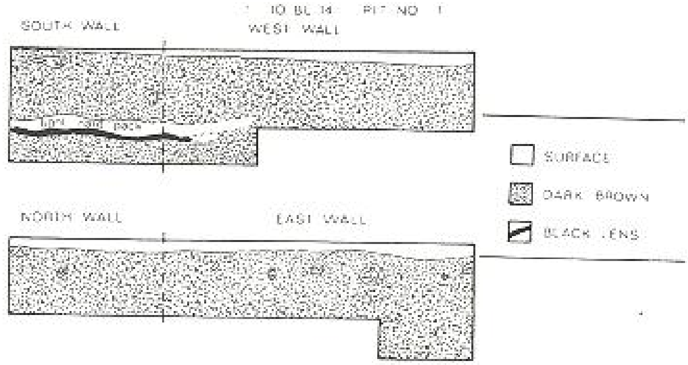



FIGURE 3

Wall Profiles of Test Pit 1

smooth cobbles. No artifacts were recovered though a few lithic flakes were found in the upper levels. Several small circular features measuring ca. 2 cm. in diameter were observed in a semi-circular fashion across the north half of the unit at 30-40 cm. below surface. The holes contained a light grey fill and in cross-section appeared to be animal or insect burrows (see Figure 4).

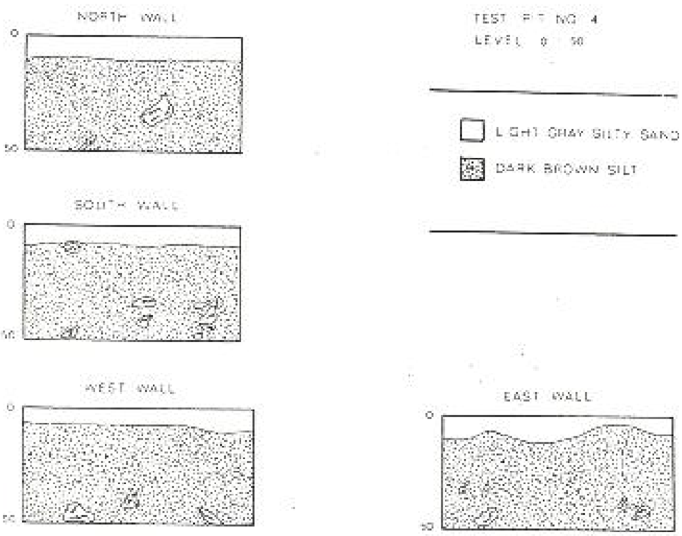


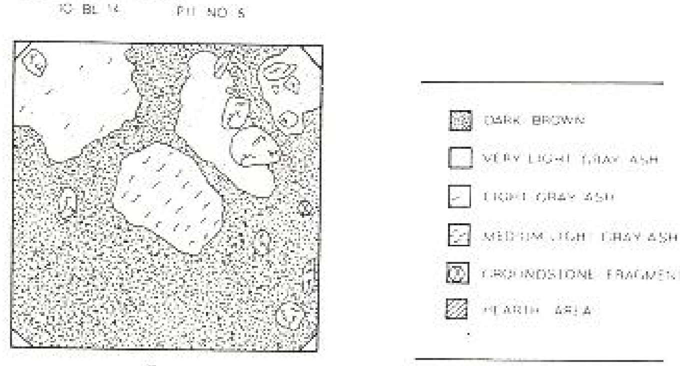

FIGURE 4

Wall Profiles of Test Pit 4

*Test Pit 5*

Test Pit 5 consisted of a dark grey-brown sandy silt to a depth of about 40 cm. below surface where sediments became sandy and were culturally sterile. A hearth area of possible rubbish/storage pit was located between 20-35 cm. below surface. This feature was a dish shaped configuration approximately 40 cm. in diameter of light grey ash with concentrations of light beige-orange ash (see Figure 5b). The matrix contains fire-cracked cobbles, charcoal and bits of mussel and burned bone. A groundstone fragment was associated with the feature which is similar in form to the rubbish-storage pit features from the Bear River No. 2 site (Aikens, 1967: 40-43). 1250 fish remains were recovered from the fill. The unit was sterile below 60 cm.

The following observations may be made concerning the sediments and cultural features: (1) the upper 10-20 cm. of portions of the site appear to have been disturbed by plowing and surface modifications; (2) the density of cultural materials varies over the area, though most appear contained in the upper 40-50 cm.



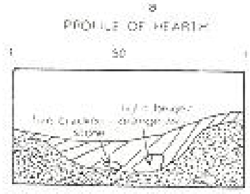




FIGURE 5

a. Plan View of Level 20-30cm, Unit 5

b. Profile of Hearth, Unit 5

MATERIAL CULTURE

The material remains from the Hemmert Site (10-BI-14) were limited to a few generally undiagnostic artifacts. Though seven projectile points were recovered, none are characteristic of the types commonly found throughout southern Idaho. Similar miscellaneous types do occur in Idaho sites but have not been given specific type names (e.g., Pavesic and Meatte, 1980; Plew 1979a). Provenience data are provided in Table 1.

*Projectile Points*

1. Triangular Stemmed Points. Number of Specimens: 3. Form: Points having triangular shaped blades which slope abruptly into a stem which is approximately 3/4 of the width of the greatest blade within. Bases are concave. Points range in size from 3.1-4.7 x 1.9-2.7 x 0.5-1.1 cm. 1 Cryptocrystalline, 1 obsidian, and 1 ignimbrite.
2. Stemmed Point—small (3.1 x 2.4 x 0.4 cm.) point of grey

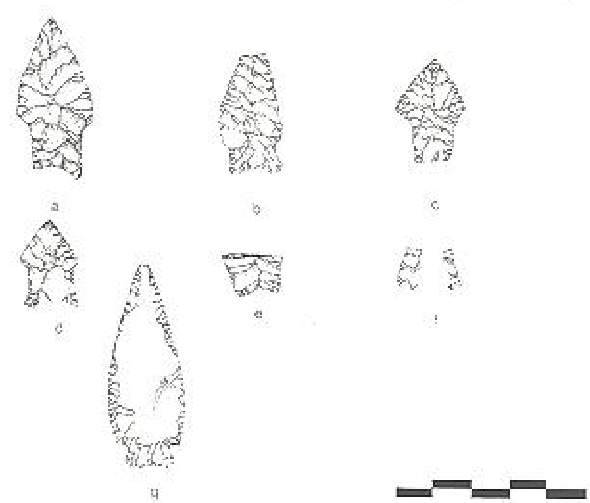


FIGURE 6

| | |
|---|---|
| a - d | Triangular Stemmed Points |
| e - f | Small Lanceolate Forms |
| g | Large Side Notched |

TABLE 1

ARTIFACT PROVENIENCE, 10-BL-14

| Artifact / Depth in CM. | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 |
|---|---|---|---|---|---|---|---|---|
| Triangular Stemmed Point | 1 | | 2 | | | | | |
| Small Stemmed Point | | | | 1 | | | | |
| Large Side Notch | | | 1 | | | | | |
| Lanceolate Point Tips and Bases | 1 | 1 | 1 | | 2 | 1 | | 1 |
| Bifaces | 2 | 6 | 1 | | 1 | 1 | | |
| Retouched Flakes | 1 | 2 | | | | | | |
| Mano | | | 1 | | | | | |
| Pipe Fragment | | | 1 | | | | | |
| Stone Balls | | | 3 | | | | | |
| Incised Stones | | | 2 | | | | | |
| **TOTALS** | 5 | 9 | 12 | 1 | 3 | 2 | | 1 |

ignimbrite. Triangular blade slopes into stem 3/4 width of blade. Specimen is plano-convex and has a straightened base.

3. Large side-notched point (5.8 x 2.4 x 0.2 cm.) made on extremely thin blade. Leaf-shaped blade with slightly excurvate sides. Edge retouch only. Specimen is side notched and has straight base.
4. Two lanceolate forms having slightly concave bases of cryptocrystalline and ignimbrite materials. Large primary flake scars dominate each specimen.

*Projectile Point Tips and Bases*

Two triangular projectile point tips and three concave projectile bases of obsidian were recovered.

*Bifaces*

Eleven biface fragments were recovered. These include two morphologically distinct categories. The first category includes relatively thin broad bifaces which are lenticular to slightly convex in cross-section. The second category includes specimens which are relatively narrow, steeply keeled and biconvex in cross-section.

FIGURE 7

a Scraper b Biface

*Retouched Flakes*

Three retouch flakes are retouched on lateral margins only. Two obsidian and one cryptocrystalline specimen were recovered.

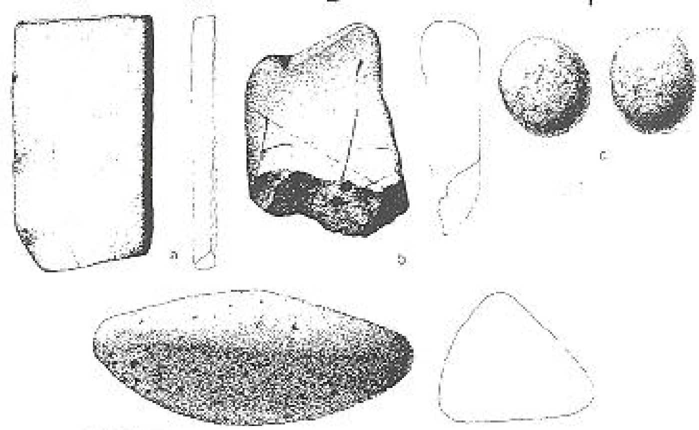


FIGURE 8

a - b Incised Stones
c Stone Balls
d Mano

*Groundstone*

1. Mano. Tabular quartzite stone rounded and smoothed on a lateral margin. Specimen measures 5.0 x 4.5 x 2.0 cm.
2. An unfinished possible pipe fragment measuring 5.2 x 3.5 x 3.1 cm. Specimen is rounded and smoothed on one lateral surface. Opposite margin is broken. One end has been cut at a right angle to the long axis of the specimen. The opposite end has been cut diagonally and drilled to an approximate depth of 2 cm. Striations and cut marks appear over the entirety of the specimen. An elbow pipe has been reported from the east side of Bear Lake (Lindsay 1976).

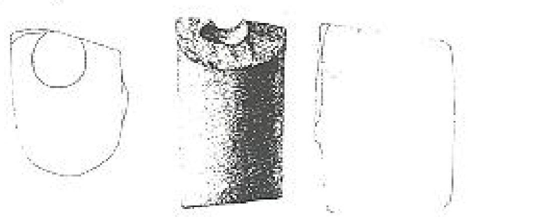


FIGURE 9

Pipe Fragment

TABLE 2
DISTRIBUTION OF FIRE CRACKED ROCK, LITHIC DEBRIS, BONE AND SHELL
FOR ALL TEST UNITS 10-BL-14

| Level | Fire Cracked Rock | Basalt | Cryptocrystalline | Obsidian | Bone | Shell |
|---|---|---|---|---|---|---|
| 0-10 | 84 | | 115 | 70 | 10 | 6 |
| 10-20 | 18 | | 41 | 23 | 12 | |
| 20-30 | 1 | 1 | 10 | 22 | 32 | |
| 30-40 | 28 | 1 | 4 | 9 | 12 | 1 |
| 40-50 | | | 33 | 14 | 6 | |
| 50-60 | | | | 2 | 47 | 1 |
| TOTALS | 131 | 2 | 173 | 140 | 119 | 8 |

*Total Items: 573*

*Miscellaneous*

Stone Balls—three smoothed stone balls were recovered from the excavation. These specimens measure 5.5 - 6.5 cm. in diameter.

Incised Stones—two relatively rectangular shaped specimens exhibit evidence of incising. One specimen may be the result of plowing activity.

Cultural remains from the Hemmert site (10-Bl-14) were limited to a total of seven projectile points and twenty-seven additional artifacts consisting of retouched flakes, bifaces, stone balls, incised stones and a pipe fragment.

*Faunal Remains*

Test excavations recovered a total of 119 bone fragments. Specimens are small, charred and highly splintered, making identification nearly impossible. On the basis of size, it appears that most of the remains probably belong to small mammals. Of greatest interest are 1,250 fish remains recovered from a flotation sample taken from the hearth area in Test Pit 5. The majority of the sample consists of small caudal vertebrae, presently unidentified.

## DISCUSSION

Test excavations at the Hemmert site (10-BL-14) produced a limited cultural assemblage and few cultural features. The deposit which averages 50 - 70 cm. in thickness consists of extensive alluvium and has been variously disturbed. Though the cultural affiliation of the site cannot be adequately evaluated on the basis of the meager cultural assemblage, the Hemmert site does contain material remains associated with Fremont. Projectile points, stone balls and incised stones found at 10-BL-14 are similar to materials recovered from Fremont sites in Northern Utah (see e.g. Aikens 1966; Dalley 1976). Unfortunately, no pottery was recovered. The absence of pottery is significant since Plew (1979) and Butler (1979) have recently discussed Fremont-like pottery in southern Idaho as an indicator of a Fremont influence. In this instance, the absence of pottery and the presence of stone balls and possible incised stones neither confirms nor refutes the Fremont affiliation of 10-BL-14. Several sites located on the periphery of the Great Salt Lake area (cf. Dalley 1976), contain Fremont-like materials, but do not fall within the mainstream of the Great Salt Lake pattern. This may be the case with the Hemmert site and other sites in southern Idaho such as the pottery bearing levels at Wilson Butte Cave where Fremont pottery has been identified (see Plew 1979:331, also Butler 1980). Butler (1979a) has correctly observed that broad similarities exist between the subsistence bases of the Upper Snake and Salmon River country (eastern Idaho) and the Fremont variants of Northern Utah. In this regard, the Hemmert site (10-BL-14) probably shares a generalized subsistence pattern characteristic of Northern Utah, i. e., a pattern of hunting and gathering with an emphasis on locally available resources (cf. Madsen and Lindsay 1977).

Recent discussions of the genetic origins of Fremont (see Madsen and Lindsay 1977; Madsen 1979 and 1980; Hogan and Sebastian 1980) have emphasized the need to reexamine traditional definitions of Fremont. Madsen and Lindsay (1977) and Madsen (1979) believe Fremont to be restricted to the area Colorado Plateau east of the Wasatch range. They use the designation Sevier to refer to the semi-sedentary, pottery making, non-agricultural peoples of the eastern Great Basin. The Madsen and Lindsay (1977) scheme focuses upon subsistence and ecological adaption to local environmental settings. The variation discussed by Madsen and Lindsay (1977) reemphasizes the variation known to exist in Archaic contexts elsewhere in the Great Basin (cf. Heizer and Napton 1970). The significance of a Sevier pattern based largely upon hunting and gathering lies in its clear challenge to the Formative status of Fremont. If Fremont manifestations are not Formative, then geographically peripheral cultures or occupations may be viewed as part of a broad pattern sharing, with regional specialization, a common subsistence strategy and material traits. Throughout the eastern and northern periphery of the Great Basin which culturally extends to southern Idaho, there is during the Late Archaic, a broadly similar pattern of subsistence. The subsistence pattern is an extension of the traditional Archaic concept of the use of unspecialized and multiple resources. Madsen and Lindsay's (1977) work at Backhoe Village emphasizes ecological adaptation to varied environmental settings and characterizes a general Northern Great Basin subsistence strategy. This strategy may be defined as a generalized hunting and gathering pattern varying by the utilization of locally significant resources (see e.g. Dalley 1976; Aikens 1976; Swanson and Dayley 1969; Miller 1972; Pavesic and Meatte 1980; Plew 1980, 1981). This allows the dissemination and synthesis of Idaho data into a broader cultural context, devoid of trait lists and arbitrarily defined cultural boundaries. Though Aikens (1980) has correctly observed the importance of trait list and diffusionist/migrationist approaches, Hogan and Sebastian (1980) have properly noted the abuse of typological comparisons based upon a few diagnostic artifacts. In this regard, discussion of a Fremont occupation or presence in southern Idaho, based upon the presence and absence of "Fremont traits," e.g. pottery or basketry (see Butler 1979b) does little more than confuse the already debated nature of Fremont (cf. Marwitt 1980). Madsen (1977) has written: "Attempts to define the Fremont in terms of trait lists fail completely since lists specific enough to distinguish the "Fremont" from other Southwestern agricultural groups necessarily exclude one or more of the "Fremont" variants, and lists general enough to include all the variants do not distinguish the "Fremont" from other similarly defined cultures. Actually, in over 40 years of papers and monographs, only one attempt has been made to define the "Fremont" (as presently recognized) even in so minimal manner as through traits lists. The overwhelming majority of trait lists are restricted to defining portions of the Fremont area. There are lists of traits for the Colorado Plateau; there are lists of traits for the eastern Great Basin; but nowhere is there a list of traits for the Fremont as a whole." Madsen's reference is to Ambler's (1966) discussion of the distribution of 115 traits in the Fremont area. The results of his investigations indicate little continuity of specific traits over the entirety of the Fremont region.

These assessments are particularly important since discussions of the Idaho Fremont materials (Butler 1979, 1980; Plew 1979b) are based upon comparisons with Great Salt Lake (Butler 1980; Plew 1979b) and Sevier variants (Plew 1979a), much less a well defined "Fremont" entity. Owing to the restricted level of comparison and considering the broad similarities of the subsistence bases of the Great Salt Lake variant, Sevier variant and southern Idaho as subsumed under a generalized subsistence strategy, present attempts to define cultural boundaries (Butler 1980, 1981) are based at best on the minimal occurrence of pottery and basketry. The use of undecorated grey ware as an indicator of Fremont influence is problematic since such wares are wide spread and subject to variation attributable to locally available resource material. Regarding basketry, Adovasio (1970) has identified eighteen basketry fragments from southern Idaho as belonging to the common Fremont type. He notes, however (1970:11) the wide spread occurrence of these types over the entirety of the eastern Great Basin for ca. 7,000 years. Further, the distribution and variation in form of some artifact categories is too generalized to be of use as diagnostics of a Fremont occupation in a peripheral and poorly known area.

Projectile points exemplify this problem. The point types most commonly associated with the Fremont occupation in Utah are the Desert Side-Notched, Cottonwood Triangular, and Rose Spring-Eastgate series. These generalized point types are widely distributed over much of California and the Great Basin and cannot be specifically diagnostic of the Fremont. In a paper entitled "Common Post-Archaic Projectile Points of the Fremont Area" Holmer and Weder (1980) describe eight spatially and/or temporally diagnostic types for the Fremont area. While these points may be considered post-Archaic in Utah, they are not post-Archaic in southern Idaho (see e.g. Butler 1978). This is significant since Classic Fremont may be considered a Formative culture.

An example of the inherent difficulties in broad area comparisons is the Parawan Basal Notched type considered characteristic of the Parawan Fremont (see Marwitt 1970; Holmer and Weder 1980). Aikens (1980:76) correctly observes that the Parawan type is a typological refinement of the general Eastgate series. It is therefore not surprising that similar variations have been noted in the Owyhee Upland area of southwestern Idaho (Plew 1979:100-101). An additional example clearly reflecting the problematic nature of broad area comparisons based upon general morphology is the Rattlesnake Cremation site in southwestern Idaho (Bonnichsen 1964). The description of projectile points from this site using Plateau type names Wallula Rectangular Stemmed and Columbia Basal Notched provide the partial basis for Swanson's (1965) suggested Plateau incursions on the western Snake River Plain. Pavesic's (1971) criticisms of the Swanson (1965) model based on general morphology of types, led to the recent description of these types as Great Basin Rose Spring and Eastgate points (see e.g., Webster 1978). These types which bear resemblance to the Parawan sub-type and occur on the Plateau attest to the potential problems of describing a Fremont occupation in Idaho.

The definition of archaeological cultures must be based upon more than the geographic distribution of material traits, and address the multiplicity of adaptations possible to varied environments. The definition of an Idaho Fremont entity (see Butler 1981) seems at best, problematic in view of the inability of Fremont scholars to agree upon the nature of Fremont culture in the area in which it is best known (Aikens, 1979, 1980; Berry 1980; Hogan and Sebastian 1980; Madsen 1979, 1980; Marwitt 1979, 1980). My initial comments on the relationships of southern Idaho materials to those of the Fremont area (Plew 1979a, 1979b) were meant to serve as means of viewing possible relationships between the areas with respect to existing interpretive models. These models do reflect typological and diffusionist/migrationist approaches. However, the study of the distribution of material objects need not result in the extension of the boundaries of archaeological cultures. The Late Archaic cultures of southern Idaho may share a subsistence pattern similar to portions of northern and western Utah characterized as Great Salt Lake and Sevier variants (Marwitt 1970) or Sevier culture (Madsen and Lindsay 1977) but should not be defined as Fremont. This is particularly true when, as noted, there is lack of agreement on the definition of Fremont (Marwitt 1980). This discussion does not suggest abandonment of these questions, but a note of caution with respect to the inherent difficulties of comparative typological-historical explanations of peripheral archaeological cultures. Early confusions over the genetic or historical origins of Fremont (cf. Judd 1926; Morss 1931; Steward 1936) are witness to the oversimplification of this typological approach. Though trait list comparisons are important (cf. Aikens 1980), they cannot, without extensive investigations, be used to extend the boundaries of major archaeological cultures to peripheral areas. The latter does not characterize the status of "Fremont archaeology" in southern Idaho. The description of a Fremont entity or occupation in southern Idaho based upon the minimal occurrence of Fremont-like traits (Butler 1979b; Plew 1979a, 1979b, 1981; Bowers and Savage 1964), from in some instances, disturbed and undocumented excavations (see Plew 1981 for discussion) is premature and potentionally polarizing. In sum, a handful of potsherds, distributed over an area half the size of the entire Utah Fremont area cannot form the basis for a Fremont variant (cf. Butler 1981).

Research efforts must concentrate on investigations which will increase the data base and thereby permit a reasonable consideration of these questions. Specifically, there is a need to develop a research design with which to approach the question of Fremont in Idaho. This should minimally include: (1) a theoretical design sensitive to the definitional problems inherent in comparative typological explanations and the historical development of Fremont studies in the core area; and (2) a research strategy designed to recover data which will elucidate the nature or extent of Fremont influence in Idaho. This must include survey of high potential areas, test excavations and ultimate full scale excavation of selected sites. Only upon the accumulation of sufficient data can we adequately and fully address the issue of "Fremont" in Idaho.

In summary, Hemmert site (10-BL-14) is a probable temporary camp. Though the specific function of the site and season of use are not known, a small faunal assemblage suggests the site is not comparable to Malad Hill (Swanson and Dayley 1968) and Weston Canyon (Miller 1972) which are documented hunting camps. Though diagnostic projectiles were not recovered, it may be inferred on the basis of general morphology and size that the points and thereby the site date to the Late Archaic. Though the material assemblage contains artifacts similar to those found in Fremont sites in northern Utah, designation of Hemmert site as a Fremont site seems problematic considering the absense of chronological control and the generalized and widespread distribution of the artifacts in question. However, the presence of materials occurring in Fremont sites and a feature resembling the rubbish-storage pits unearthed at Bear River No. 2 site in northern Utah (Aikens 1967) reiterate the need to synthesize Idaho data within the context of regional cultural manifestations.

## ACKNOWLEDGEMENTS

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## REFERENCES CITED

Adavasio, James M.
1970 The Origin, Developments and Distribution of Western Archaic Textiles. *Tebiwa* 13(2):1-40. Pocatello.

Aikens, C. Melvin
1966 Fremont-Promontory-Plains Relationships. *University of Utah Anthropological Papers* No. 82. Salt Lake City.

1967 Excavations at Snake Rock Village and the Bear River No. 2 Site. *University of Utah Anthropological Papers* No. 87. Salt Lake City.

1979 Comment by Aikens. *American Antiquity* 44(4):731-732.

1980 Comments. *Antiquities Section Selected Papers.* Division of Utah State History, 16:74-76. Salt Lake City.

Ambler, Richard J.
1967 Caldwell Village and Fremont Prehistory. Doctoral Dissertation, University of Colorado. Boulder.

Berry, Michael S.
1980 Fremont Origins: A Critique. *Antiquities Section Selected Papers,* Division of Utah State History 16:17-24. Salt Lake City.

Bonnichsen, Robson
1964 The Rattlesnake Canyon Cremation Site, South-western Idaho. *Tebiwa* 7(1):28-38. Pocatello.

Bowers, Alfred W. and C. N. Savage
1962 Primitive Man on Brown's Bench. Idaho Bureau of Mines and Geology, *Information Circular,* No. 14. Moscow.

Butler, B. Robert
1979a The Native Pottery of the Upper Snake and Salmon River Country. *Idaho Archaeologist* 3(1):1-10. Caldwell.

1979b A Fremont Culture Frontier in the Upper Snake and Salmon River Country? *Tebiwa,* Miscellaneous Papers of the Idaho State University Museum of Natural History, No. 18. Pocatello.

1981 When Did the Shoshoni Begin to Occupy Southern Idaho? Essays on Late Prehistoric Cultural Remains from the Upper Snake and Salmon River Country. *Idaho Museum of Natural History Occasional Papers* No. 32. Pocatello.

Dalley, Gardiner F.
1976 Swallow Shelter and Associated Sites. *University of Utah Anthropological Papers* No. 96. Salt Lake City.

Heizer, Robert F. and Lewis K. Napton
1970 Archaeology and Prehistoric Great Basin Lacustrine Subsistence Regime as Seen From Lovelock Cave, Nevada. *Contributions of the University of California Archaeological Research Facility* No. 10.

Hogan, Patrick and Lynne Sebastian
1980 The Variants of the Fremont: A Methodological Evaluation. *Antiquities Section Selected Papers,* Division of History 16:13-16. Salt Lake City.

Holmer, Richard N. and Dennis G. Weder
1980 Common Post-Archaic Projectile Points of the Fremont Area. *Antiquities Section Selected Papers,* Division of Utah State History 16:55-68. Salt Lake City.

Judd, Neil M.
1926 Archaeological Observations North of the Rio Colorado. *Bureau of American Ethnology* No. 82. Washington D.C.

Lindsay, LaMar W.
1976 Unusual or Enigmatic Stone Artifacts: Pots, Pipes, Points, and Pendants from Utah. *Antiquities Section Selected Papers,* Division of Utah State History 8:107-117. Salt Lake City.

Liljeblad, Sven
1957 Indian Peoples of Idaho. Mimeographed Paper, Idaho State College Museum. Pocatello.

Madsen, David B.
1979 The Fremont and the Sevier: Defining Prehistoric Agriculturists North of the Anasazi. *American Antiquity* 44(4):711-722.

1980 Fremont/Sevier Subsistence. *Antiquities Section Selected Papers,* Division of Utah State History 16:25-33. Salt Lake City.

Madsen, David B. and LaMar W. Lindsay
1977 Backhoe Village. *Antiquities Section Selected Papers,* Division of Utah History Salt Lake City.

Marwitt, John P.
1970 Median Village and Fremont Culture Regional Variation. *University of Utah Anthropological Papers* No. 95.

1979 Comment by Marwitt. *American Antiquity* 44(4):732-736.

1980 A Fremont Perspective. *Antiquities Section Selected Papers*, Division of Utah State History 16:9-12. Salt Lake City.

Miller, Susanne J.
1972 Weston Canyon Rockshelter: Big Game Hunting in Southeastern Idaho. M. A. Thesis, Idaho State University. Pocatello.

Morss, Noel
1931 The Ancient Culture of the Fremont River in Utah. *Papers of the Peabody Museum of American Archaeology and Ethnology*. 12(3).

Pavesic, Max G.
1971 The Archaeology of Hells Canyon Creek Rockshelter, Wallowa County, Oregon. Doctoral Dissertation, University of Colorado. Boulder.

Pavesic, Max G. and Daniel S. Meatte
1980 Archaeological Test Excavations at the National Fish Hatchery Locality, Hagerman Valley, Idaho. *Archaeological Reports* No. 8, Boise State University. Boise.

Plew, Mark G.
1979a Archaeological Excavations at Camas and Pole Creeks, South-central Owyhee County, Idaho. *Archaeological Reports* No. 5, Boise State University. Boise.

1979b Southern Idaho Plain: Implications for Fremont Shoshoni Relationships in Southwestern Idaho. *Plains Anthropologist* 24(86):329-335. Lincoln.

1980a Archaeological Investigations in the South-central Owyhee Uplands. *Archaeological Reports* No. 7, Boise State University. Boise.

1980b Comments on Butler's "Native Pottery of the Upper Snake and Salmon River Country." *Idaho Archaeologist* 3(3):4-6. Caldwell.

1981a "Southern Idaho Plain: What Are the Facts": A Reply to Butler. *Plains Anthropologist* 26:161-164.

1981b Archaeological Test Excavations at Four Prehistoric Sites in the Western Snake River Canyon Near Bliss, Idaho. *Project Reports* No. 5, Idaho Archaeological Consultants. Boise.

Steward, Julian H.
1936 Pueblo Material Culture in Western Utah. *University of New Mexico Bulletin* 287, Anthropological Series Vol. 1, No. 3 Albuquerque.

Swanson, Earl H., Jr.
1965 Archaeological Explorations in Southwestern Idaho. *American Antiquity* 31:24-37.

Swanson, Earl H., Jr., and John Dayley
1968 Hunting at Malad Hill in Southeastern Idaho. *Tebiwa* 11(2):59-69. Pocatello.

# EXPERIMENTAL STUDIES IN CERAMIC VESSEL WALL STRENGTH

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ABSTRACT

The cone and anvil method of measuring wall strength has been tested on a sample of contemporary pottery fired under aboriginal conditions. A good correlation between wall strength and wall thickness was revealed and found to be an inverse relationship indicating that for a given set of conditions, including constant firing temperature, the thinner sections of a ceramic vessel will be stronger than thicker sections presumably because of more effective clay particle fusion in the former. Some other aspects of wall strength are discussed and recommendations for future research are presented.

## INTRODUCTION

In April of 1983, Ms. Genie Sue Weppner conducted a demonstration of prehistoric pottery manufacture at Washington Grade School in Pocatello, Idaho. For her demonstration a variety of pots, some of which the students had made under her supervision, were fired in an outdoor pit-kiln, presumably closely replicating aboriginal technology. Because the author was able to observe and record the firing process, this was an excellent opportunity to obtain a contemporary ceramic vessel to test earlier hypotheses regarding wall strength and firing temperature (Cluer 1984). From these pots a small (10 cm diameter), semi-spherical container was chosen for use in an experimental evaluation of the cone and anvil method of determining ceramic vessel wall strength.

## EXPERIMENTAL CONDITIONS

### Firing Technique

Weppner's technique of firing utilizes a hemispherical-shaped hole in the ground about 50 cm in diameter and 20 cm deep. A small flue through which fire tending and ventilation will take place is dug into one side of the depression. Small sticks of wood and scraps of paper are placed in the bottom of the pit to start the fire. Over this and resting on the ground surface is a metal grill upon which the pots are placed. Relatively large slabs of prefired ceramic material are placed over and around the fragile unfired pottery to protect it from direct exposure to the fire and from falling debris. Finally, dung is piled in a mound around the protective slabs but not over the flue, and a small fire is started (Figure 1).

Weppner's particular firing methods involve about 15 minutes of "preheat" treatment in which the initial fire remains small and the temperature low. This, she says, is to insure that the vessels are as dry as possible before they are subjected to the higher temperatures of actual firing which would burst any significant amount of trapped water and ruin the vessel.

FIGURE 1
Photograph of firing pit being covered with dung fuel. Pyrometer for monitoring temperature is in lower left. Width of pit is about 50 cm.

After initial preheating, the fire is built up and the dung allowed to ignite. As firing progressed the temperature was monitored with a thermo-electric pyrometer (lower left in Figure 1). The resulting plot of firing temperature and duration is shown in Figure 2. Some points are worth noting: (1) there is much variation in temperature, even after it reaches an *initial peak; (2) firing temperature is low*—a maximum of 620°C sustained for only a few minutes; (3) duration of actual firing, following the preheat period, is short—only about 50 minutes; and (4) the vessels were drawn (removed from the fire) at nearly a maximum temperature so they were subjected to the cool morning air without any cool-down period. This last point did not seem to have any adverse effect on the finished product.

The firing atmosphere is difficult to determine without the use of elaborate gas monitoring apparatus, but some general comments can be made. When the wood and paper first start to burn, volatiles are released and reducing gases are present; however, the temperature will usually be low (as

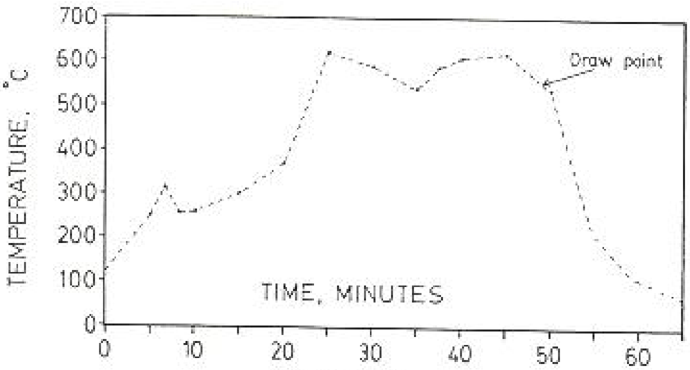


FIGURE 2

Time vs. temperature plot for the firing process. Draw point is when fuel was removed and the pottery withdrawn from the fire.

was indeed the case in this firing) and the gases will have little effect (Shepard 1956:217). Variation of draft and temperature and introduction of new fuel make it nearly impossible to account for and evaluate the many changes in firing atmosphere. Fortunately, the final character of the fired vessel may reveal enough information to determine whether the *average* conditions were oxidizing, reducing, or neither (Shepard 1956:217-222). Weppner (1983: personal communication) considers this batch of pottery to have been slightly oxidized because of the clear and brilliant colors displayed on the vessel exteriors. However, upon examination of the fractured pieces, the interior showed a gray coloration indicative of at least partial reduction. The successful potter, however, does not usually have the opportunity to view the wall interiors of her pots and, therefore, does not have the benefit of this aspect when judging the atmospheric conditions of firing.

**Sherd Characteristics**

Forty-six sherds were randomly broken out of the test vessel. (The significance of the sample size *N* is discussed in the next section.) They averaged about 15 $cm^2$ in area and 6.5 mm in thickness although there was considerable variation. The sherds consisted of a small amount (5 to 10%) of fine to very fine, mostly subround, quartz grains (temper) set in an otherwise homogeneous clay paste matrix. Detailed compositional information was not determined.

Five sherds were selected at random for porosity analysis. The following values were obtained: 30.47%, 24.47%, 22.33%,

TABLE 1

Wall Thickness, Fracture Length, and Wall Strength Data

| Sherd # | Wall Thick (mm) | Frac Length (mm) | Wall Strength ($kg/cm^2$) | Sherd # | Wall Thick (mm) | Frac Length (mm) | Wall Strength ($kg/cm^2$) |
|---|---|---|---|---|---|---|---|
| 1 | 7.60 | 15.0 | 1321.0 | 24 | 7.20 | 30.0 | 1396.0 |
| 2 | 7.70 | 17.5 | 1197.0 | 25 | 5.20 | 43.5 | 1291.0 |
| 3 | 7.35 | 34.5 | 787.0 | 26 | 5.00 | 18.0 | 1876.0 |
| 4 | 6.90 | 22.0 | 1103.0 | 27 | 7.20 | 28.0 | 1599.0 |
| 5 | 8.55 | 41.0 | 1234.0 | 28 | 6.25 | 22.5 | 2830.0 |
| 6 | 6.05 | 24.0 | 1065.0 | 29 | 7.00 | 28.0 | 1722.0 |
| 7 | 7.05 | 31.5 | 1289.0 | 30 | 7.10 | 45.5 | 1068.0 |
| 8 | 6.85 | 26.0 | 1202.0 | 31 | 8.10 | 31.5 | 1313.0 |
| 9 | 6.15 | 22.5 | 1478.0 | 32 | 7.10 | 36.0 | 1348.0 |
| 10 | 5.95 | 32.0 | 1295.0 | 33 | 7.10 | 20.0 | 1442.0 |
| 11 | 7.10 | 29.5 | 1504.0 | 34 | 7.45 | 28.0 | 1159.0 |
| 12 | 5.55 | 25.5 | 1794.0 | 35 | 6.75 | 30.0 | 1349.0 |
| 13 | 5.00 | 18.0 | 1952.0 | 36 | 5.40 | 22.0 | 2538.0 |
| 14 | 6.75 | 24.0 | 1434.0 | 37 | 4.30 | 26.0 | 1940.0 |
| 15 | 6.60 | 32.0 | 1178.0 | 38 | 8.30 | 15.0 | 1545.0 |
| 16 | 7.85 | 31.0 | 1192.0 | 39 | 7.25 | 21.5 | 1594.0 |
| 17 | 8.10 | 38.0 | 1213.0 | 40 | 7.00 | 43.0 | 1435.0 |
| 18 | 3.80 | 28.0 | 3453.0 | 41 | 8.00 | 25.5 | 1603.0 |
| 19 | 5.30 | 17.0 | 2464.0 | 42 | 4.80 | 20.0 | 2252.0 |
| 20 | 5.85 | 23.0 | 1778.0 | 43 | 5.40 | 24.0 | 2984.0 |
| 21 | 4.10 | 23.0 | 2373.0 | 44 | 6.65 | 35.0 | 1353.0 |
| 22 | 7.60 | 20.0 | 1428.0 | 45 | 5.40 | 17.5 | 5766.0 |
| 23 | 5.00 | 17.5 | 1857.0 | 46 | 4.60 | 22.5 | 2017.0 |

30.00%, and 33.33% apparent porosity from which an average of 28.12% and standard deviation of 4.56% were derived for the entire sample. Standard procedures, as outlined in Shepard (1956:127), were followed except that instead of boiling the sherds in only plain water, they were boiled in a mixture of distilled water and a wetting adjuvant. This procedure will generally result in a higher but more accurate value. From the wide variation in apparent porosity, it is evident that in subsequent tests every sherd should be measured for porosity, and this parameter should be incorporated into the wall strength analyses.

Because of the relatively low firing temperature (ca. 620°C) already mentioned and the general friability of the finished product, this can be considered an example of low fire ceramic ware. The wide range in porosity is probably due to incomplete fusion of the clay particles, also a result of the low temperature, short duration mode of firing.

**Statistical Analysis**

Statistical analyses were performed using the SPSS Scattergrams computer program designed to simultaneously compare the relationships between two variables (Nie et al. 1975). Three variables were considered in this experiment: (1) wall strength, (2) wall thickness, and (3) fracture length. Thus, three *sets* of data were obtained: (1) wall strength vs. wall thickness, (2) wall strength vs. fracture length, and (3) wall thickness vs. fracture length. The three measured variables for the 46 sherds are listed in Table 1. And statistical analyses are summarized in Table 2. The following review of statistical methods should provide a common frame of reference from which to interpret the results. Here the reader is referred to Zuwaylif (1979) for further explanation or clarification.

In Table 2 is a presentation of the computer derived statistics for the three data sets. From this table, the parameters that concern us are coefficient of correlation *(r)*, coefficient of determination *($r^2$)*, and the standard error of estimation *(Sy)*. The Y intercept (a) and the slope (b) are simply factors in the equation of the lines of regression shown in Figure 3. The level of significance is used to determine if the correlation and other statistics derived from a particular data set could arise randomly and what the chances of that happening are. For example, a level of significance of 0.05 would indicate there is a 5% chance that any correlation in the data may occur out of a random sample and thus may not really exist. Generally, the level of significance is first decided upon and then the sample size is adjusted to give the proper level as described in Zuwaylif (1979:282-283). In these tests, however, the sample size was controlled by the size of the vessel which was broken into pieces large enough to be tested for wall strength. The resulting sample size *N* though is certainly an adquate size as all the significance levels are less than 0.05 and the wall strength vs. wall thickness and wall strength vs. fracture length are below the 0.01 level (Table 2).

The standard error of estimation *Sy* is very similar to the more familiar standard deviation *S* except that it is computed from the regression line and the deviations are taken from the *bivariate* distribution. The interpretation of *Sy* is also analagous to that of the standard deviation: if we assume a normal (Gaussian) distribution of data points, then we can say that approximately 68% of those points will lie within an area of plus and minus one standard error from the regression line. A range, then, may be constructed for each scattergram by drawing two lines, one *Sy* above and one *Sy* below, parallel to the regression line and approximately 31 points (68% of 46) would fall in that range of the graph. *Sy* is usually given in units of the Y axis.

**TABLE 2**

Statistical Analysis of Scattergram Data

| N = 46 for all data sets | Wall Strength vs Wall Thickness | Wall Strength vs Fracture Length | Fracture Length vs. Wall Thickness |
|---|---|---|---|
| Correlation (r) | −.54953 | −.38260 | .27999 |
| Determination ($r^2$) | .30198 | .14638 | .07839 |
| Significance | .00004 | .00434 | .02974 |
| Standard error of estimation (Sy) | 693.38215 | 766.77918 | 7.50880* |
| Intercept (A) | 4120.82196 | 2799.16448 | −8.45848 |
| Slope (b) | −371.82196 | −40.59638 | .56009 |

**This standard error of estimation is computed from the X (mm) rather than Y axis.*

Both the coefficients of correlation *r* and determination $r^2$ measure the *strength* of a linear relationship between two variables. Both measures assume the value of 1 when there is perfect correlation and 0 when there is no correlation. Furthermore, *r* may also range from 0 to -1, simply assuming the sign of the slope of the regression line; it is only useful, however, when it takes on an extreme value, i.e. close to -1, 0, or 1. Since all values of *r* in our case are intermediate, we will be more concerned with $r^2$, the coefficient of determination.

The coefficient of determination is simply a measure of the percentage of variation observed in Y that can be *explained* by variations in X. And that is, in fact, what we would like to know. For example, we want to know how much of the variation in wall strength can be attributed to different wall thicknesses.

**Measurement of Wall Strength**

The technique of measuring wall strength used in this experiment has been outlined in a previous paper (Cluer 1984) and will not be described here. Some minor changes of pro-

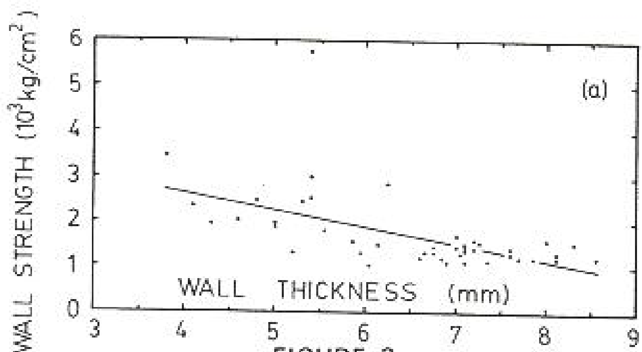


FIGURE 3a

Scattergrams with regression lines: Wall Strength vs. Wall Thickness. (Regression line equations may be found in Table 2 [slope (b) intercept (A) form]. Sample size N = 46.)

cedure are, however, worth noting: A puncturing cone with a 38° surface angle was used instead of 45°; a thin aluminum plate was placed between the sherd and the steel anvil to avoid the possibility of the cone being deformed if it hit the hard anvil; and all data was measured in metric units.

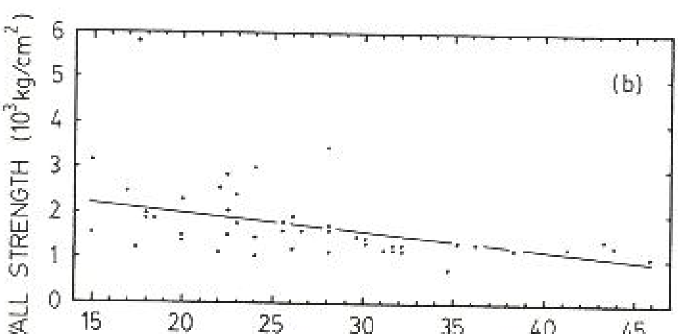


FIGURE 3b

Scattergrams with regression lines: Wall Strength vs. Fracture Length. (Regression line equations may be found in Table 2 [slope (b) intercept (A) form]. Sample size N = 46.)

RESULTS AND CONCLUSIONS

**Wall Strength vs. Wall Thickness**

It can be seen from Figure 3a that there is an inverse relationship between wall strength and wall thickness. That is, the thinner the wall, the stronger the sherd. This relationship was previously suspected (see **Cluer** 1984: Table 1) but could not be statistically supported. Now, there is good

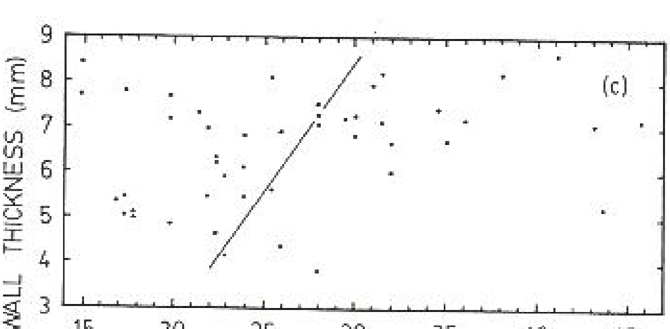


FIGURE 3c

Scattergrams with regression lines: Wall Thickness vs. Fracture Length. (Regression line equations may be found in Table 2 [slope (b) intercept (A) form]. Sample size N = 46.)

correlation ($r = -.55$) and slightly more than 30% of the variation may be directly attributable to either of the two variables ($r^2 = .30198$). (The reader is referred to Table 2.)

I would offer the admittedly oversimplified explanation of the inverse relationship: for a given firing temperature, a thinner wall will present less mass and will thus be less of a heat sink. So, the heat surrounding the thin wall will not be as effectively dissipated, will become *concentrated*, and have a much greater effect toward fusing the clay particles. The thicker areas will dissipate or consume much more heat per unit area and will thus require either higher temperatures, longer firing time, or a combination of both to become as well fused as the thinner sections.

Although 30% of the variation is internally explained, there is still 70% variation of wall strength with respect to thickness that must be due to other factors. Those factors are listed in Cluer (1984) and include such things as porosity differences, micro-variation in temper, etc. For instance, the wide variation in observed porosity may have a significant influence on the strength values obtained. However, as a comparison, Shepard (1956) lists porosity data (p. 128) and "modulus of rupture" (p. 135) values for 16 types of pottery comprising 155 sherds and there is no apparent correlation between types showing a wide spread in porosity and those showing a wide range of strength values. To put another way, types with a large variation in porosity may show the tightest grouping of strength values and vice versa. Obviously, a complex of variables is functioning to determine strength in these types of ceramic ware.

**Wall Strength vs. Fracture Length**

While designing this experiment it was reasoned that fracture length may influence the determined wall strength values; it seemed that a long fracture length would be accompanied by an artificially high strength. This situation would result (it was thought) because of the method of measuring strength: applying *tension* to a sherd until fracture ensued. The underlying assumption was that a longer span, or fracture, would sustain more tension before breaking than would a shorter one, resulting in an unusually high calculated strength. This was borne out because most sherds broke along the shorter

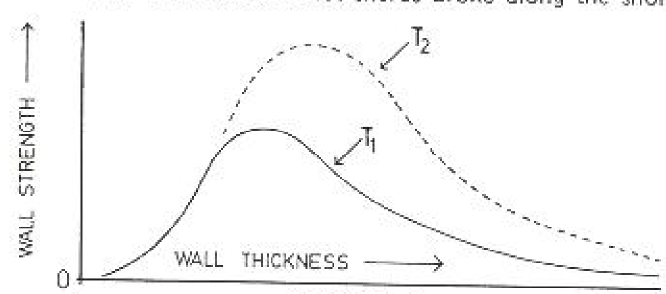


FIGURE 4

Graphical model showing wall strength behavior with respect to wall thickness at two different temperatures, $T_1$ and $T_2$. No scale is implied but both axes originate at zero. It is assumed that both curves will begin to level off at a residual strength around 10.0 mm thickness when fired at temperatures ranging from approximately 600 to 900°C. It should be noted that very thin or very thick sherds may exhibit nearly identical wall strength values regardless of significant differences in firing temperature; therefore, sherds of intermediate thickness will be more useful in delineating different fire-temp groups. See text for further explanation.

dimension if one existed; certainly a reasonable consequence since that dimension would present the path of least resistance.

These observations were made because it would be desirable to equate values obtained from large and small sherds to derive the strength curve for an entire series of sherds or single vessel. From Table 2, however, it is evident that fracture length does not necessarily correlate very well with strength. Only about 15% ($r^2$ = .14638) of the covariation may be internally explained. Although the standard error of strength vs. wall thickness, this statistic is probably more a reflection of the absolute range in strength values and, thus, may not necessarily mean that the estimation here is nearly as precise as for strength vs. thickness which actually showed much better correlation.

**Fracture Length vs. Wall Thickness**

The scattergram shown in Figure 3c for wall thickness plotted against fracture length is, in this case, very aptly named. The points are so randomly distributed that even the regression line appears meaningless. From Table 2 we see that only about 8% of the variation can be explained by internal variation in one or the other of these two variables. I would guess that in a statistical analysis of this type there are many extraneous variables that could account for 8% of the observed variation which points up an interesting question: is fracture length a meaningful paramenter in these analyses? While certainly wall thickness may contribute to fracture length *if* one assumes a relation between wall thickness and absolute sherd size, it now seems obvious that fracture length can have no physical effect on the thickness of a potsherd. Thus, we are working with one variable, wall thickness, which is primarily dependent on the skill of the potter and the workability of his clays (Shepard 1956:2, 57-59; Tony Martin 1982: personal communication) and another, fracture length, which seems to largely depend on sherd size which is in turn a function of strength and wall thickness. I would suggest that it is very difficult and, at best, very confusing to consider a functional relationship between these two types of variables.

Likewise, the attempt to draw a relationship between wall strength and fracture length (Figure 3b) is prone to suspicion and it becomes clear that fracture length is fundamentally a measure of sherd size; but only one dimension of a sherd, for fracture usually occurs along *one* fairly straight line.

**Conclusions and Recommendations**

The inverse relationship between sherd thickness and strength is certainly the most interesting and useful observation to come out of this study. The analyses did not clarify the nature of a relationship between fracture length and thickness or strength of a sherd. However, it is now apparent that fracture length is not significant to the basic relation between thickness and wall strength.

It is, therefore, appropriate that only wall thickness and its relation to strength be further discussed. That the relationship between these two variables is inverse can be somewhat misleading. For example, it is obvious that wall strength cannot continue to increase as thickness decreases as shown in Figure 3a. That regression line merely reflects the incomplete range of thicknesses in this sample and the computer's attempt to draw a linear relationship through that data. Here we have identified the first concern of future research: the test sample must be comprised of a complete range of thicknesses, ideally spanning from around 1.0 mm to 9.0 mm with significant overlap. Also, it may be desirable to trim the sherds to a standard dimension so fracture length can be disregarded.

A second important consideration could be porosity. As mentioned above, just between the five sherds sampled here, there was considerable variability in apparent porosity. Since it is a relatively simple process to determine porosity, it may be useful to determine it for each sherd. These values coupled with thickness measurements may well explain much of the variability in determined strength.

With the above considerations in mind, Figure 4 is presented as a model of the behavior of wall strength and thickness at two different temperatures, $T_1$ and $T_2$, with all other factors held constant. It would prove useful in future research, especially if potter fired at various temperatures is considered. It basically assumes or predicts the following phenomena:

1. The relationship may be approximated by a positively skewed platykurtic ($X^2$ type) curve.
2. As temperature is increased, say, from $T_1$ to $T_2$, the curve will migrate vertically and expand to the right because thicker sections may be more effectively fused.
3. There will be a range of thicknesses, defined by the peak of the curve, where strength will be greatest.
4. As the curve begins to flatten with increasing thickness, strength will not really depend on thickness and may be considered residual.

In conclusion, wall strength (WS) may be expressed as a function of a complex of variables as follows

$$WS = f(m,n,o,p,q,\ldots,x)$$

where the variables include, but are not limited to: thickness, porosity, firing temperature, paste composition, skill of manufacture, etc.

The cone and anvil method has proven to be sensitive to strength variations with respect to thickness, and clearly, it would be a simple matter to distinguish between two groups of ceramics, one falling out at, say, 4000 kg/cm$^2$ and the other at 2000 kg/cm$^2$, with a good degree of confidence. The nondescript pottery commonly found in the northern Great Basin could be differentiated on the basis of wall strength. In addition, some insight may be gained regarding past firing technology with respect to different people and regional variations.

ACKNOWLEDGEMENTS

This study could not have been conveniently undertaken without the generous cooperation of Ms. Genie Sue Weppner. She not only provided the test vessel upon which this work is based but also offered many suggestions and gave the author many insights regarding primitive pottery manufacture.

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Christy Morris, University of Arizona, and Mark Druss critically read previous drafts of this paper. Their comments and suggestions have greatly improved the current draft but all remaining errors are my responsibility alone.

This paper is the second in a series on experimental ceramic studies undertaken at Idaho State University.

## REFERENCES CITED


Cluer, J. K.
1983 The cone and anvil method: A new technique for quantifying ceramic vessel wall strength. *Idaho Archaeologist*. 6(3):9-14. Caldwell.

Nie, N. H., C. H. Hull, J. G. Jenkins, K. Steinbrenner, and D. H. Brent
1975 *Statistical package for the social sciences* (second edition). McGraw-Hill, New York.

Shepard, A. O.
1956 *Ceramics for the archaeologist*. Publication 609, The Carnegie Institute of Washington, D.C.

Zuwaylif, F. H.
1979 *General applied statistics* (third edition). Addison-Wesley, Reading, Massachusetts.

# TOWARDS A TIME SENSITIVE PROJECTILE POINT TYPOLOGY FOR SOUTHWEST IDAHO

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ABSTRACT

Over 1000 projectile points from Mud Springs (10-OE-2614) and Givens Hots Springs (10-OE-1689 and 10-OE-60) in southwest Idaho were measured and sorted into types using the Monitor Valley Projectile Point Key (Thomas 1981). Except for problems in the classification of the Humboldt Series points and Large Side-notched type points the Monitor Valley Key successfully defines morphological types of projectile points. These morphological types have a consistent association with radiocarbon dated features from Givens Hot Springs (Green 1982). This study is intended to be a beginning step in the development of a time sensitive projectile point typology developed specifically for southwest Idaho.

## INTRODUCTION

The purpose of the paper is to make a step toward the development of a metrically defined, temporal projectile point typology for southwest Idaho. Steward (1954:54) defines a Historical Index type, which is now called a temporal type, by stating that it ". . . is defined by form, but, whereas the morphological type is considered as a characteristic of the culture, this second type has chronological, not cultural significance. It is a time marker." The Monitor Valley Key (Thomas 1981) is used in this study to define morphological types of projectile points. These morphological types are then compared to radiocarbon dated features from Givens Hot Springs (Green 1982) to determine if the morphological types defined by the Monitor Valley Key have chronological significance in southwest Idaho. The use of the Monitor Valley Key is not meant to imply that the Monitor Valley sequence is necessarily relevant in southwest Idaho, only that the Monitor Valley Key is a heuristic device that defines morphological types that can be used to develop temporal types in southwest Idaho. In addition, the types in the Monitor Valley Key are metrically defined. A metrically defined projectile point typology developed specifically for southwest Idaho will allow archaeologists in the area to clarify their concepts of exactly what is implied by each type name in terms of morphology and temporal and spatial ranges.

There are two traditional schools of thought concerning the nature of archaeological typology. These two schools are probably best represented by Spaulding (1953) and Ford (1954). Spaulding felt that ". . . classification into types is a discovery of combinations of attributes favored by the makers of the artifacts, not an arbitrary procedure of the classifier (Spaulding 1953:305)." Ford on the other hand, felt that types are created by archaeologists to serve as comparative tools. The difference between these two different concepts of types is based upon the question of the presence or absence of an underlying structure that can provide meaningful information about the makers of the artifacts. With the recent advances in computer technology, and the development of statistical packages such as S.P.S.S. and S.A.S., sophisticated statistical techniques have emphasized the search for underlying structure in attributes and types (Brown 1982:176).

The understanding and indentification of the underlying dimensions in and among artifacts is undeniably a very important aspect of archaeology. But, it is equally important that the typologies used by archaeologists to name and describe artifacts allow different archaeologists to be reasonably confident that they each have a similar artifact in mind for each type name. What can happen when archaeologists have different concepts of the same type is illustrated by Plog (1983: 136). Twenty archaeologists from the Southwest were selected on the basis of their familiarity with Cibola ceramics from east-central Arizona and west-central New Mexico. These archaeologists each identified 27 whole Cibola vessels as to type. The results of this experiment were: ". . . the average agreement on type identification was below 50 percent and in one case 13 different type names were suggested for one vessel (Plog 1983:136)."

The projectile points in this study are from Mud Springs, 10-OE-2614, and Givens Hots Springs, 10-OE-1689 and 10-OE-60 (Figure 1). The points from Mud Springs were donated for study from the private collection of Mr. Everett Clark. The points from Mud Springs were collected by Mr. Clark and have no association with dated features or provenience, other than that they are from the Mud Springs site. The points from Givens Hot Springs were recovered during excavations in 1979, 1980 and 1982 by Thomas J. Green of the Idaho State Historical Society (Green 1982). Both Mud Springs and Givens Hot Springs are sites with substantial occupations dating from the last 5,000 years. While there are no Paleo-Indian or Early Archaic projectile points from these sites, such points have been reported in the area (Huntley 1979; Moe 1982). Such projectile points appear to be more

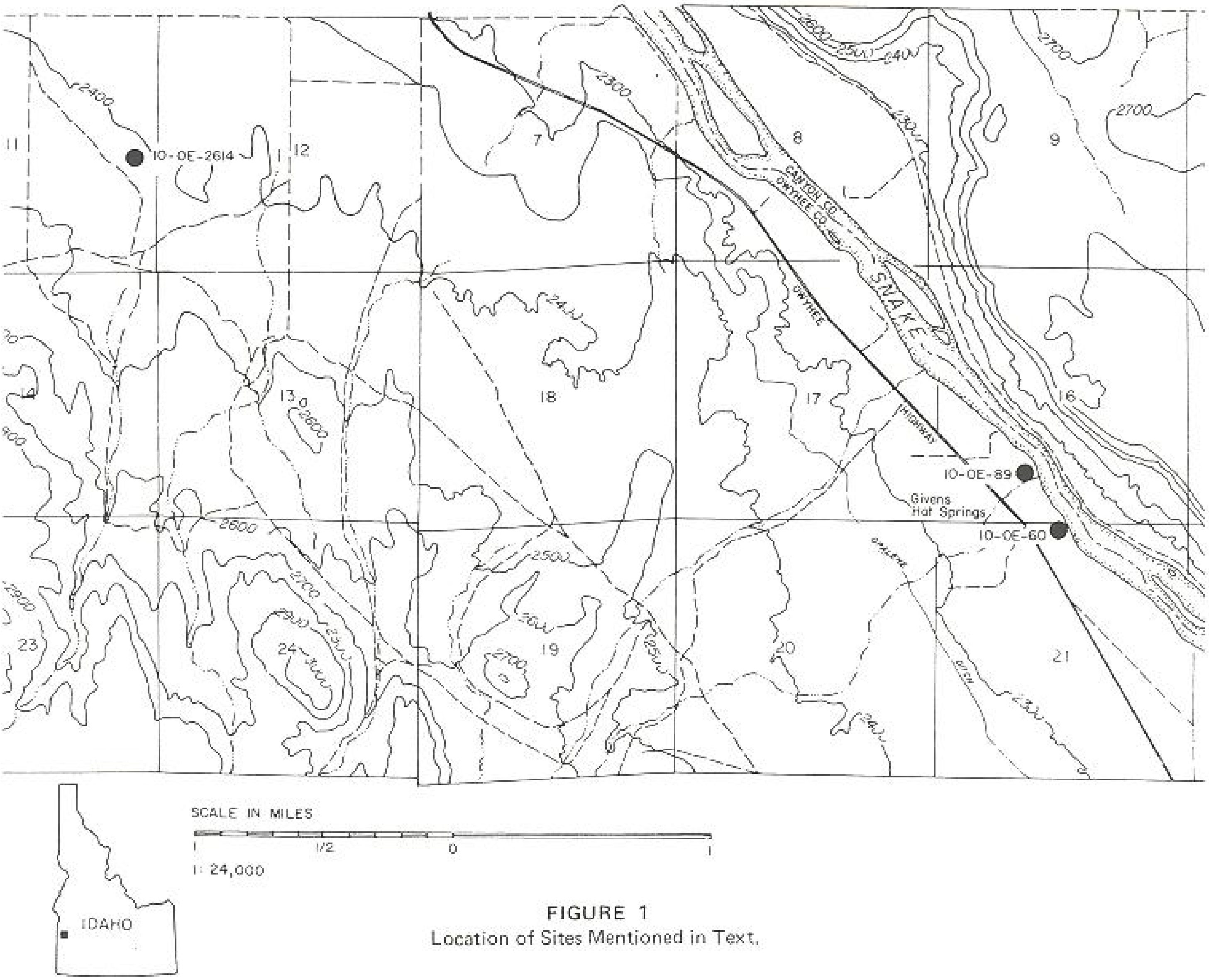


**FIGURE 1**
Location of Sites Mentioned in Text.

common in southeast Idaho than southwest Idaho (c.f. Butler 1965).

## GREAT BASIN PROJECTILE POINT TYPOLOGIES

Before presenting the results of this study, a discussion of the development of the systems previously used to classify projectile points in southwest Idaho seems necessary. Projectile points in southwest Idaho are usually typed and dated by comparisons with radiocarbon dated sequences in the Great Basin (c.f. Webster 1978; Moe, Eckerle and Knudson 1980; Sappington 1981; Plew 1982). The prevalent typological system in southwest Idaho is what Thomas (1981:9) has called "The Berkeley Typological System" (Clewlow, 1967, 1968; O'Connell 1967; Heizer, Baumhoff and Clewlow 1968; Heizer and Clewlow 1968; Roust and Clewlow 1968). While the names and numbers of types and their temporal and spatial ranges vary with the different authors, there is general agreement on these matters. One major feature of the Berkeley System is that morphologically similar projectile point types are combined into a series, such as the Elko Series and the Pinto Series, each of which contains several different types. Hester and Heizer (1973) present the major synthesis of the Berkeley system and is one of the most widely used sources in southwest Idaho. This paper defines the standard Great Basin projectile point types and their temporal ranges. Included in the paper are line drawings of several "representative specimens" (Hester and Heizer 1973:2) of points in each type to clarify some of the confusion that had arisen over exactly what was implied by each type name in terms of morphology and temporal range. The Berkeley system types are intuitively defined rather than metrically defined. The validity of these types has been shown through their years of use, but as noted by Tucker (1980:1), intuitive methods can fail due to the difficulty involved in transmitting intuitive criteria from researcher to researcher.

Other recent typological efforts in the Great Basin are far less intuitive and are quantitatively replicable. The two major authors of these typologies are Holmer (1978, 1980a, 1980b) and Thomas (1970, 1981).

The typological system developed by Holmer (1978) relies upon digitizing key locations on the projectile point. An analytical computer program then uses the values provided by these digitized locations to calculate the angles and mea-

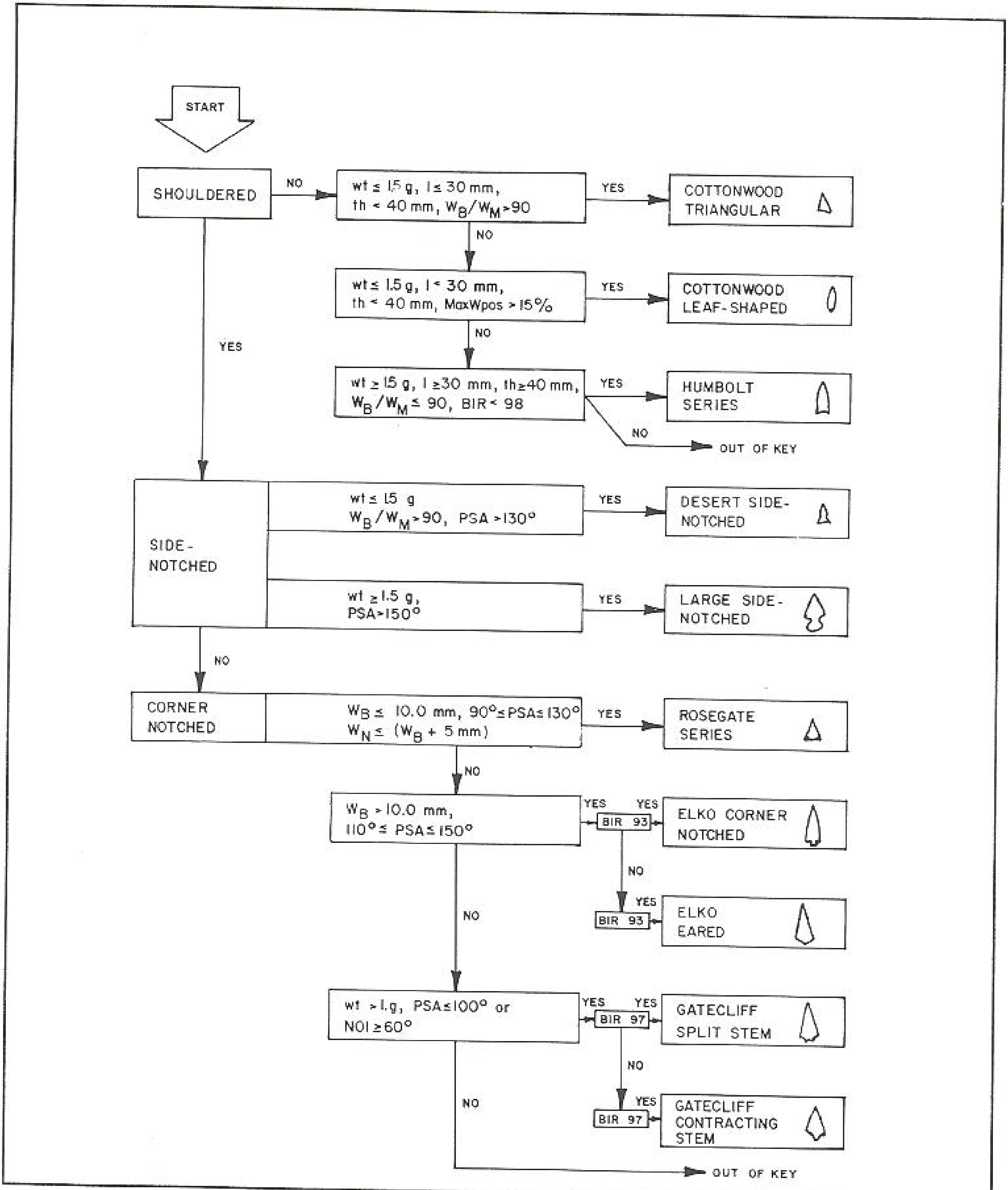


FIGURE 2

Monitor Valley Projectile Point Key.
After Thomas, 1981, Fig. 11.

surements used to define the types. The requirements for each type are defined by isolating statistically significant groups by the use of a discriminant function computer program (Holmer 1978:6). The types of points used are the standard Great Basin types with an expansion in the number of Side-notched types. This system has a validity rate of 95% in terms of classifying the points correctly (Homer 1978:20). An advantage to this system is that inconsistencies that are unavoidable whenever humans are involved, are eliminated by the use of the computer. The major drawback to this system is that it does require a fairly high degree of computer skill and access to computer equipment.

In 1970 Thomas developed the Reese River Key ". . . to mimic the original, intuitive typology (Thomas 1970:46)." This key contains twenty types and it is a closed key, that is any point that is entered into the key will eventually be classified into one of the types. This key is 76.7% accurate in the classification of points into types and 91.4% accurate in classification of points into a series (Thomas 1970:46). A problem with this key is that it does not distinguish well between the Rose Spring Corner-notched and the Surprise Valley Split Stem types. A similar problem also occurs with the Pinto Barbed type (Thomas 1970:46).

In 1981 Thomas developed the Monitor Valley Key (Figure 2) to improve the Reese River Key. The key contains ten types and is an open key. Any point which does not meet the criteria of a type is considered to be out of the key. The criteria in this key ". . . adequately discriminate over 95% of the points recovered from Monitor Valley . . . (Thomas 1981: 24)." The objective of the Monitor Valley key is the development of temporal types for the Monitor Valley. How this key sorts points into types will be discussed later in the paper, but compared to the Reese River Key it is less complicated and easier to use.

In summary, the earlier projectile point typologies of the Great Basin were intuitive and primarily interested in the definition of temporal and spatial ranges, while the later projectile point typologies have been more objective and concerned with a clearer definition of each type. The goals of both of these typological systems are the same, the difference between the two lies in the methods. The typologies of Holmer and Thomas are an attempt to place the older typologies on a firm basis, not to replace them. It is not meant to be implied that intuitive, undefined types are inaccurate or not as useful as the more objective typologies, only that intuitive typologies are difficult to replicate. When points from different areas are compared for temporal or stylistic purposes it is necessary to have a clear metric definition of each type, an understanding of how the types are defined and the range of variation within each type to help ensure the accuracy of the comparisons.

## METHODS

Over 1,000 projectile points were measured quantitatively and qualitatively using a described format (Figure 3) developed by Kenneth M. Ames. This format was used to provide descriptions of each individual point and to provide the data that is summarized in the Appendix. The points were then sorted into types according to the Monitor Valley Key. Out of the 1,006 points, 705 went through the key and were typed, 42 were considered to be out of the key and 259 were too fragmentary to key.

## THE MONITOR VALLEY KEY

Before beginning the discussion of how the Monitor Valley

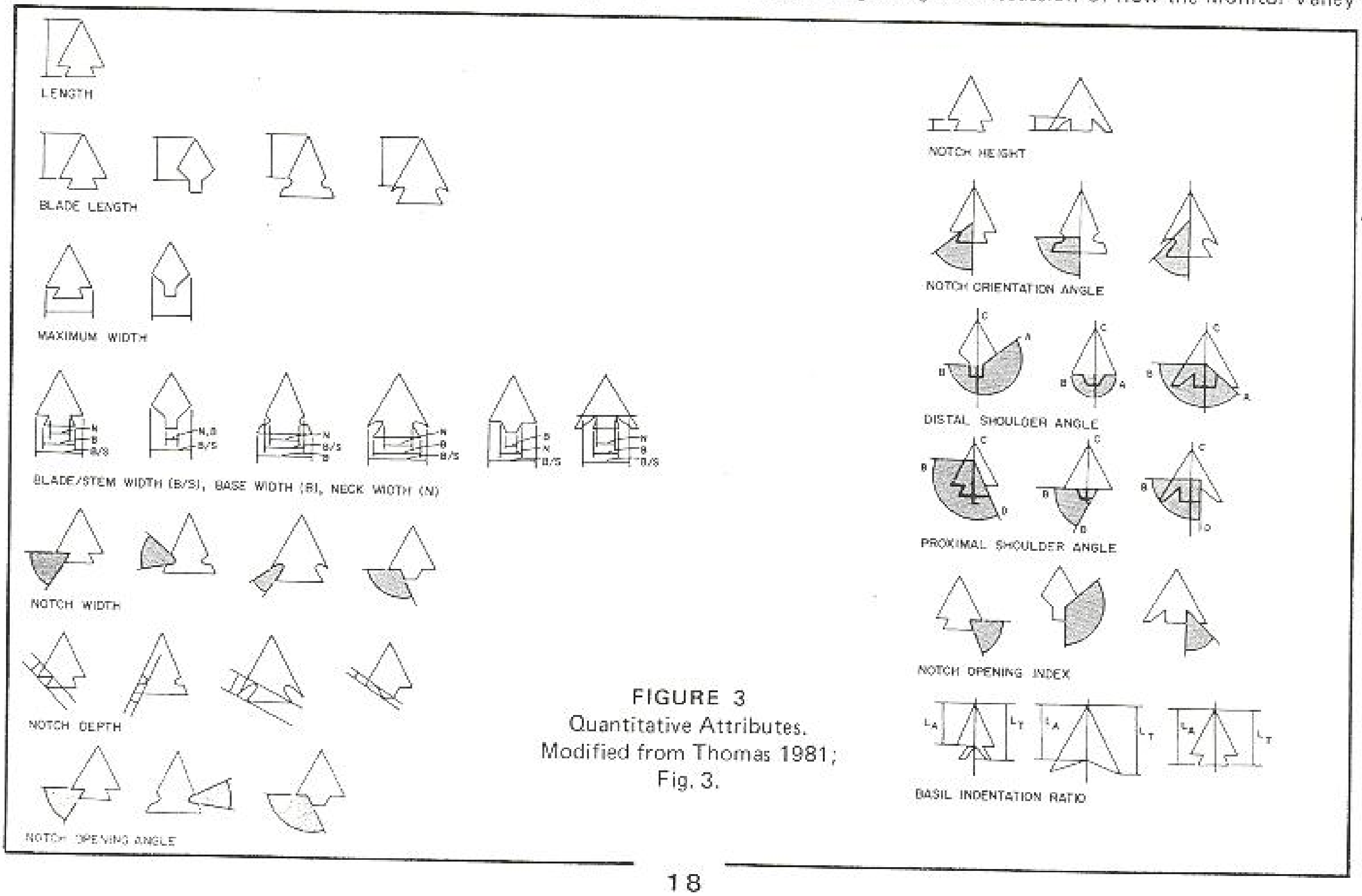


FIGURE 3
Quantitative Attributes.
Modified from Thomas 1981;
Fig. 3.

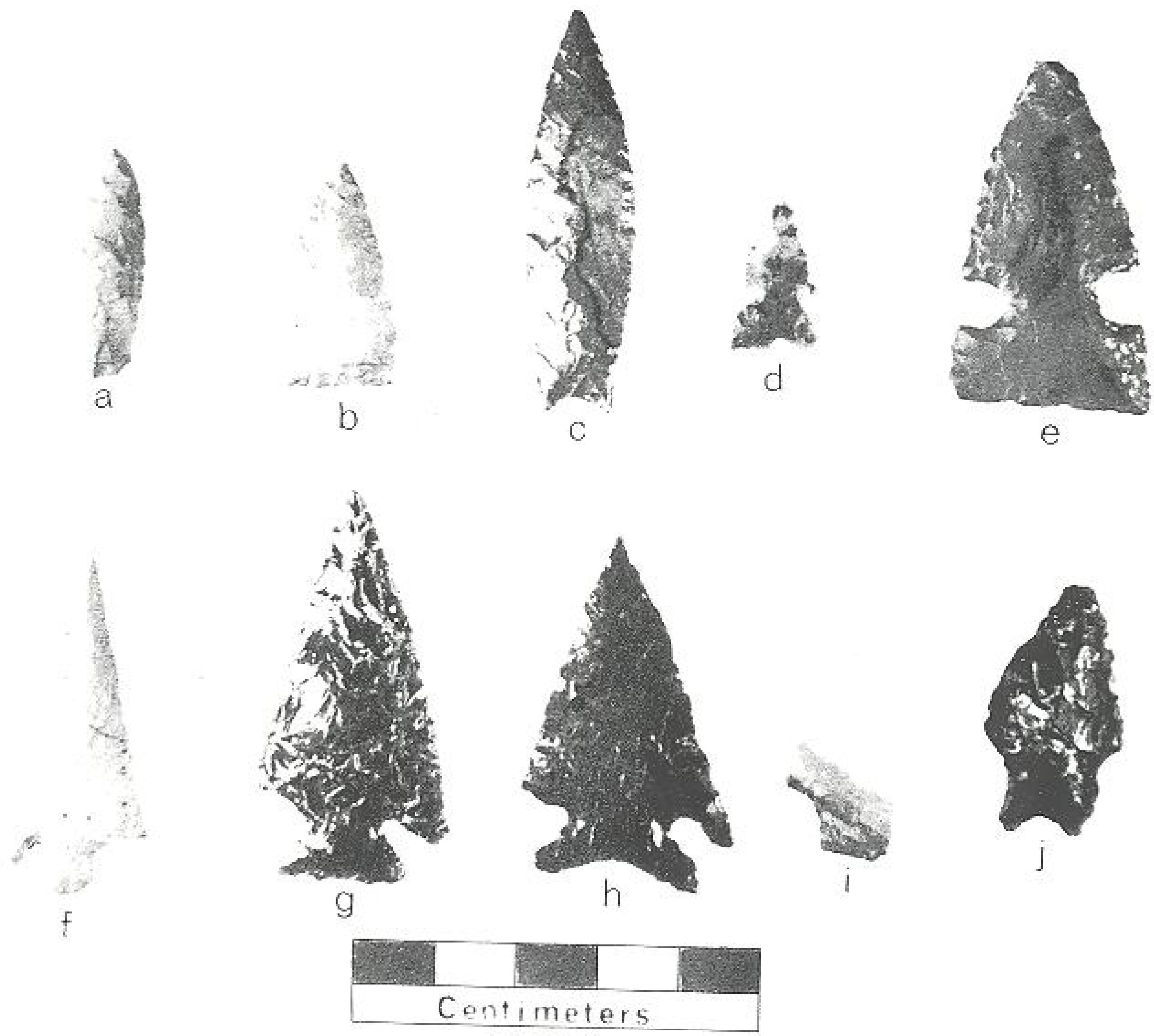


**FIGURE 4**

Projectile Points. a-b, Cottonwood Series; c, Humboldt Series; d, Desert Side Notch; e, Large Side Notch; f, Rose-gate Series; g, Elko Series.

Key classifies projectile points, there are five measurements used in the key that require explanation.

The Basal width/maximum width ratio, WB/WM (Figure 3), measures the size of the base in relation to the maximum width of the point. This measurement is calculated by the division of the width of the base by the maximum width of the point (Thomas 1981:13).

The Maximum Width Position, MaxWPos (Figure 3) is a calculation that quantifies the distance from the widest part of the point in relation to the base of the point. This measurement is defined as ". . . the percentage of the length between the proximal end and the position of maximal width (100 LM/LT). Range is generally between 0 and 90% (Thomas 1981:13)."

The Basal Indentation Ratio, B.I.R. (Figure 3), is a marker of the degree of basal concavity. The Basal Indentation Ratio is calculated by the division of the length of the longitudinal axis by the total length of the point. If the point has a concave base the length of the longitudinal axis will be less than the total length. Scores for this ratio range between .0 and about 0.90 (Thomas 1981:11).

The Proximal Shoulder Angle, P.S.A. (Figure 3), is defined as the angle of the line of the proximal shoulder to a line drawn perpendicular to the longitudinal axis of the point. This value ranges from 0 to 270 degrees (Thomas 1981:11).

The Notch Opening Index, N.O.I. (Figure 3), is a measure of the angle between the distal shoulder and proximal shoulder (Thomas 1970:40).

Other measurements used in the Monitor Valley Key are: total length, weight, thickness, base width and neck width.

The first step in the Monitor Valley Key is classifying the point as: Unshouldered, Side-notched, or Corner-notched. Unshouldered points are those on which the P.S.A. cannot be measured (Thomas 1981:26). Side-notched and Corner-notched points are defined by a combination of weight and the P.S.A. If a point weighs less than 1.5 grams it is considered to be Side-notched when the P.S.A. is greater than 130 degrees and Corner-notched when the P.S.A. is 130 degrees or less. If a point weighs more than 1.5 grams it is considered to be Side-notched when the P.S.A. is over 150 degrees and Corner-notched when the P.S.A. is 150 degrees or less. While these distinctions appear to be quite arbitrary, in actual use they work quite well.

After a point is in one of the three major categories, it is sorted into a type according to the criteria of each type. If it does not meet the criteria of a type it is considered to be out of the key. If the point is not complete enough to provide the measurements necessary to determine if it met the criteria of a type, it is considered to be too fragmentary to key. Thomas (1981:18) describes a type called the Triple T Concave base. However, this type is not included in the actual key, and it is not metrically defined so it was not used in this study. Following are discussions of the criteria for each type and any associated problems.

*Cottonwood Triangular*

The Cottonwood Triangular type (Table 1, Figure 4b) has a temporal range of 1300 B.C. to historic times in the Monitor Valley and is defined as (Thomas 1981:16):

| | |
|---|---|
| Small: | Weight less than or equal to 1.5 g.<br>Length less than 30 mm. |
| Thin: | Thickness less than 4.0 mm. |
| Triangular: | Basal width/maximum width ratio greater than 0.90. |

There are 28 points in this study that are classified as Cottonwood Triangular. They are all from Mud Springs and therefore have no temporal control. There were no significant problems in the classification of this type.

*Cottonwood Leaf-shaped*

The Cottonwood Leaf-shaped type (Table 2, Figure 4g), like the Cottonwood Triangular type, has a temporal range of 1300 B.C. to historic times in the Monitor Valley and is defined as (Thomas 1981:16):

| | |
|---|---|
| Small: | Weight less than or equal to 1.5 g.<br>Length less than 30 mm. |
| Thin: | Thickness less than 4.0 mm. |
| Basally Rounded: | Maximum width position greater than 15%. |

Only seven points were classified as Cottonwood Leaf-shaped; five are from Mud Springs and two are from Givens Hot Springs. Neither of the points from Givens Hot Springs are associated with dated features. While the temporal utility of this type is not established for these two sites, the Cottonwood Leaf-shaped type is similar to Bliss Points, as described by Plew and Woods (n.d.) which are common in southwest Idaho.

*Humboldt Series*

The Humboldt Series is given a temporal range of 3000 B.C. to A.D. 700 in the Monitor Valley. The Humboldt Series (Table 3, Figure 4c) is defined as (Thomas 1981:17):

TABLE 1

Cottonwood Triangular

Total n = 28

| | n | Mean | Mode | Median | Range | Standard Deviation |
|---|---|---|---|---|---|---|
| Weight* | 12 | 0.742 | 0.5 | 0.75 | 0.3 - 1.3 | 0.294 |
| Thickness | 28 | 3.214 | 3 | 3 | 2 - 4 | 0.738 |
| Length | 16 | 19.750 | 20 | 20 | 14 - 28 | 3.396 |
| Maximum Width | 26 | 12.500 | 12 | 12 | 9 - 16 | 1.655 |
| Base Width | 25 | 12.480 | 12 | 12 | 9 - 16 | 1.711 |

**All weights are grams, all measurements are centimeters.*

TABLE 2

Cottonwood Leaf-shaped

Total n = 7

| | n | Mean | Mode | Median | Range | Standard Deviation |
|---|---|---|---|---|---|---|
| Weight | 5 | 0.980 | 0.8 | 0.8 | 0.8 - 1.3 | 0.2489 |
| Thickness | 7 | 3.429 | 4 | 4 | 2 - 4 | 0.7868 |
| Length | 5 | 22.600 | 18 | 23 | 18 - 26 | 2.9655 |
| Maximum Width | 7 | 11.286 | 8 | 12 | 8 - 14 | 2.4299 |
| Base Width | 5 | 8.600 | 11 | 8 | 6 - 11 | 2.3022 |

TABLE 3

**Humboldt Series**

Total n = 56

| | n | Mean | Mode | Median | Range | Standard Deviation |
|---|---|---|---|---|---|---|
| Weight | 22 | 3.350 | 1.7 | 3.1 | 1.5 - 7.3 | 1.6809 |
| Thickness | 55 | 5.673 | 5 | 6 | 3 - 9 | 1.2180 |
| Length | 26 | 41.192 | 30 | 40 | 30 - 63 | 8.7270 |
| Maximum Width | 50 | 15.680 | 16 | 16 | 11 - 22 | 2.3340 |
| Base Width | 54 | 11.648 | 12 | 12 | 6 - 20 | 2.6000 |

Lanceolate: Basal width/maximum width ratio less than or equal to 0.90.
Concave Base: Basal Indentation Ratio less than 0.98.
Variable Size: Weight tends to be greater than 1.5 g. Length tends to be greater than or equal to 40 mm. Thickness tends to be greater than or equal to 4.0 mm.

There is a discrepancy in the value listed for the required length of the Humboldt Series. In the definition of the type it is listed as 40 mm. (Thomas 1981:17), but on the Key it is listed as 30 mm. (Thomas 1981:25). The smaller value, 30 mm., was used, primarily because it would allow the inclusion of more of the numerous base fragments. There are 56 points that are classified as Humboldt Series, 24 are from Givens Hot Springs and 32 are from Mud Springs. As defined by the key, the Humbolt Series does not work well for this area. The Basal width/miximum width ratio and the Basal Indentation Ratio vary more than the key permits, meaning that many of the points did not have the contracting and indented base that the criteria for this series requires. The points that do not fit the criteria will be discussed more thoroughly later. The length requirement of this series also made it very difficult to classify base fragments that would traditionally be called Humboldt bases.

Thomas (1981:17) suggests that subdividing the Humboldt Series into more specific temporal categories may be possible, but the necessary data from the Monitor Valley is lacking.

TABLE 4

**Desert Side-notched**

Total n = 100

| | n | Mean | Mode | Median | Range | Standard Deviation |
|---|---|---|---|---|---|---|
| Weight | 24 | 0.450 | 0.40 | 0.45 | 0.2 - 0.8 | 0.1615 |
| Thickness | 100 | 2.860 | 3 | 3 | 2 - 5 | 0.7660 |
| Length | 51 | 19.940 | 18 | 19 | 13 - 34 | 4.0710 |
| Blade Length | 52 | 13.190 | 12 | 12.5 | 5 - 22 | 3.7100 |
| Maximum Width | 54 | 12.520 | 12 | 12 | 8 - 20 | 2.4550 |
| Width B/S Junc. | 86 | 10.256 | 8 | 10 | 7 - 17 | 3.3470 |
| Base Width | 49 | 12.160 | 12 | 12 | 7 - 17 | 2.3220 |
| Neck Width | 96 | 6.708 | 5 | 6 | 4 - 12 | 1.9190 |
| Notch Width | 94 | 2.399 | 2 | 2 | 1 - 7 | 0.9910 |
| Notch Depth | 92 | 2.614 | 2 | 2.5 | 1 - 9 | 0.9950 |
| Notch Height | 93 | 7.591 | 7 | 7 | 4.5 - 14 | 1.8480 |
| Notch Op. Angle | 93 | 25.050 | 20 | 20 | 10 - 150 | 20.3300 |
| Notch Or. Angle | 91 | 99.770 | 90 | 90 | 70 - 120 | 9.5910 |
| D.S.A. | 94 | 193.990 | 200 | 190 | 160 - 230 | 13.8460 |
| P.S.A. | 100 | 170.900 | 170 | 170 | 140 - 210 | 12.7600 |

TABLE 5

Large Side-notched

Total n = 72

| | n | Mean | Mode | Median | Range | Standard Deviation |
|---|---|---|---|---|---|---|
| Weight | 8 | 3.000 | 1.9 | 2.65 | 1.7 - 5.7 | 1.4323 |
| Thickness | 66 | 5.136 | 5 | 5 | 3 - 8 | 0.2590 |
| Length | 26 | 31.577 | 29 | 30 | 21 - 46 | 6.7180 |
| Blade Length | 27 | 22.410 | 17 | 21 | 13 - 34 | 5.9690 |
| Maximum Width | 29 | 19.069 | 17 | 19 | 10 - 25 | 3.6540 |
| Width B/S Junc. | 46 | 17.848 | 17 | 17 | 10 - 26 | 3.6530 |
| Base Width | 40 | 18.525 | 16 | 18 | 7 - 31 | 4.5790 |
| Neck Width | 70 | 11.629 | 12 | 11 | 6 - 26 | 3.2490 |
| Notch Width | 56 | 4.161 | 4 | 4 | 2 - 8 | 1.2470 |
| Notch Depth | 51 | 3.971 | 4 | 4 | 1 - 7 | 1.3790 |
| Notch Height | 60 | 9.825 | 8 | 9.5 | 5 - 15 | 2.3260 |
| Notch Op. Angle | 60 | 29.833 | 30 | 30 | 10 - 60 | 12.2460 |
| Notch Or. Angle | 72 | 85.278 | 90 | 90 | 45 - 110 | 11.2240 |
| D.S.A. | 61 | 187.049 | 180 | 190 | 150 - 220 | 17.8270 |
| P.S.A. | 72 | 167.708 | 160 | 170 | 155 - 180 | 7.9580 |

Due to the problems this key has with classifying the Humboldt Series, it is not currently possible to divide the Humboldt Series into more specific temporal types for southwest Idaho, although it does seem likely that such types exist. The Humboldt Series is dated from Houses 2 and 4 at 10-OE-1689. The temporal range is from 4100 B.P. to 2400 B.P. (Green 1982).

*Desert Side-notched*

The Desert Side-notched type (Table 4, Figure 4d) is assigned a temporal range of A.D. 1300 to historic times in the Monitor Valley and is defined as a side-notched point that is (Thomas 1981:17):

| | |
|---|---|
| Small: | Weight less than or equal to 1.5 g. |
| Triangular: | Basal width/maximum width ratio greater than 0.90. |

100 points in the study are classified as Desert Side-notched: 92 are from Mud Springs and eight are from Givens Hot Springs. The Monitor Valley Key contains two types of Side-notched points: Desert Side-notched and Large Side-notched. According to the Monitor Valley criteria, the only distinction between these two types is weight. Side-notched points that weigh less than 1.5 grams, if they meet the Basal width/maximum width criteria, are classified as Desert Side-notched. Any Side-notched points that weigh over 1.5 grams are classified as Large Side-notched. This separation causes a problem in the classification of these two types because the weight used to separate these two types appears to be too high. Large Desert Side-notched points are indistinguishable from the small Large Side-notched points. There appears to be a continuum between the two types in terms of weight, but there does seem to be a clearer break between the two types at a weight lower than the 1.5 grams the key calls for. Because the goal of this paper is the development of temporal types, separating these two types would not be a problem if these two types are of the same age. However, these two types are associated with different temporal ranges, so a revision does seem necessary. The Desert Side-notched points from Givens Hot Springs are found above Feature 1 at 10-OE-60, which is dated at 1100 B.P., but there is no clear association with datable materials from the site (Green, personal communication).

*Large Side-notched*

The Large Side-notched type (Table 5, Figure 4e) is only assigned an upper limit to its temporal range in the Monitor Valley. This limit is placed at A.D. 1300. The Large Side-notched type is defined as (Thomas 1981:19):

| | |
|---|---|
| Large: | Weight greater than 1.5 g. |
| Side Notched: | Proximal Shoulder Angle greater than 150 degrees. |

A Large Side-notched point according to the Monitor Valley Key is any side-notched point that weighs over 1.5 grams. There are 72 Large Side-notched points in this study: 64 are from Mud Springs and eight are from Givens Hot Springs. There were only 15 Large Side-notched points recovered in the Monitor Valley research (Thomas 1981:19). Thomas calls the type a residual category, and with only 15 points a residual category is all that would seem necessary for the Monitor Valley. But more distinction is necessary for Southwest Idaho and the Northern Great Basin, where Large Side-notched points are more common (Gruhn 1961: 130). The points in this type are variable and can be separated into more than one morphological type. All of the

TABLE 6

Rosegate Series

Total n = 185

| | n | Mean | Mode | Median | Range | Standard Deviation |
|---|---|---|---|---|---|---|
| Weight | 30 | 0.820 | 0.9 | 0.8 | 0.2 - 2.0 | 0.3978 |
| Thickness | 182 | 3.395 | 3 | 3 | 2 - 6 | 0.7490 |
| Length | 92 | 23.717 | 25 | 23 | 14 - 42 | 5.2980 |
| Blade Length | 92 | 18.358 | 18 | 18 | 10 - 35 | 5.0300 |
| Maximum Width | 86 | 15.872 | 18 | 16 | 6 - 25 | 3.7940 |
| Width B/S Junc. | 142 | 14.218 | 13 | 14 | 5 - 22 | 3.0620 |
| Base Width | 165 | 6.660 | 7 | 7 | 3 - 10 | 1.2180 |
| Neck Width | 182 | 5.280 | 5 | 5 | 2 - 9 | 1.1140 |
| Notch Width | 142 | 4.095 | 4 | 4 | 2 - 9 | 1.1410 |
| Notch Depth | 130 | 4.869 | 5 | 5 | 1 - 8 | 1.3670 |
| Notch Height | 173 | 5.422 | 6 | 5 | 3 - 10 | 1.0410 |
| Notch Op. Angle | 168 | 34.643 | 30 | 30 | 10 - 120 | 18.9590 |
| Notch Or. Angle | 172 | 43.721 | 40 | 40 | 15 - 90 | 11.7400 |
| D.S.A. | 174 | 147.879 | 140 | 140 | 110 - 250 | 21.3590 |
| P.S.A. | 184 | 114.109 | 110 | 110 | 90 - 130 | 9.5590 |

TABLE 7

Elko Corner-notched

Total n = 182

| | n | Mean | Mode | Median | Range | Standard Deviation |
|---|---|---|---|---|---|---|
| Weight | 11 | 2.918 | 1.6 | 2.4 | 1.6 - 6.1 | 1.3318 |
| Thickness | 181 | 4.856 | 5 | 5 | 3 - 8 | 0.8700 |
| Length | 64 | 32.688 | 35 | 33.5 | 20 - 55 | 6.9210 |
| Blade Length | 66 | 24.879 | 25 | 25 | 12 - 47 | 6.7610 |
| Maximum Width | 47 | 21.702 | 22 | 22 | 13 - 29 | 3.6470 |
| Width B/S Junc. | 112 | 20.143 | 18 | 20 | 12 - 28 | 3.3390 |
| Base Width | 99 | 15.173 | 15 | 15 | 10 - 22 | 2.3260 |
| Neck Width | 175 | 10.617 | 10 | 10 | 6 - 18 | 2.1430 |
| Notch Width | 128 | 4.336 | 4 | 4 | 2 - 10 | 1.1570 |
| Notch Depth | 122 | 4.889 | 4 | 5 | 1.5 - 10 | 1.4350 |
| Notch Height | 159 | 7.714 | 7 | 7.5 | 5 - 12 | 1.2280 |
| Notch Op. Angle | 146 | 28.390 | 20 | 25 | 10 - 120 | 16.6080 |
| Notch Or. Angle | 156 | 57.756 | 50 | 55 | 30 - 95 | 16.2170 |
| D.S.A. | 148 | 158.514 | 150 | 150 | 120 - 250 | 20.5160 |
| P.S.A. | 182 | 131.291 | 130 | 130 | 110 - 150 | 11.2660 |

TABLE 8

Elko Eared

Total n = 54

| | n | Mean | Mode | Median | Range | Standard Deviation |
|---|---|---|---|---|---|---|
| Weight | 5 | 2.660 | 1.9 | 2.1 | 1.9 - 5 | 1.3164 |
| Thickness | 51 | 4.922 | 5 | 5 | 3 - 9 | 1.0360 |
| Length | 15 | 32.867 | 30 | 30 | 25 - 54 | 8.0350 |
| Blade Length | 15 | 25.200 | 20 | 23 | 17 - 46 | 7.4280 |
| Maximum Width | 9 | 24.222 | 22 | 23 | 18 - 32 | 4.4380 |
| Width B/S Junc. | 30 | 21.267 | 21 | 21 | 17 - 29 | 3.1510 |
| Base Width | 30 | 16.933 | 20 | 17 | 12 - 22 | 2.8640 |
| Neck Width | 53 | 11.491 | 10 | 12 | 7 - 16 | 2.2840 |
| Notch Width | 28 | 4.768 | 4 | 4.25 | 3 - 9 | 1.2940 |
| Notch Depth | 28 | 5.732 | 6 | 6 | 3 - 8 | 1.3010 |
| Notch Height | 48 | 8.135 | 8 | 8 | 6 - 13.5 | 1.4320 |
| Notch Op. Angle | 40 | 25.500 | 30 | 27.5 | 10 - 60 | 11.3910 |
| Notch Or. Angle | 45 | 57.556 | 50 | 60 | 25 - 90 | 14.7180 |
| D.S.A. | 41 | 157.073 | 150 | 160 | 120 - 180 | 12.3930 |
| P.S.A. | 54 | 134.259 | 140 | 135 | 110 - 150 | 10.0190 |

Large Side-notched points from Givens Hot Springs belong to the same morphological type so at this time it is not possible to divide this type into more than one temporal type. The Large Side-notched type is dated from Houses 2 and 4 at 10-OE-1689, the range is from 4100 B.P. to 2400 B.P. (Green 1982).

*Rosegate Series*

The Rosegate Series (Table 6, Figure 4f) is given a temporal range of from A.D. 700 to A.D. 1300 in the Monitor Valley and is defined as (Thomas 1981:19):

Small: Basal Width less than or equal to 10 mm.

Corner-notched: Proximal Shoulder Angle between 90 and 130 degrees.

Expanding Stem: Neck Width less than or equal to (basal width plus 0.5 mm.)

The Rosegate Series combines the traditional Rose Spring and Eastgate types. Thomas (1981:19) states that the Rose Spring and Eastgate types are morphological types that are combined in the Monitor Valley Key, into a single temporal type, the Rosegate Series. There are 185 Rosegate Series Points in this study, making it the most common type in the study: 165 of the points are from Mud Springs and 20 are from Givens Hot Springs. This group is highly variable in terms of individual attributes and overall point morphology but there are no clear subgroups. At this time any further subdivision of the points in this type would be arbitrary and serve no temporally diagnostic purpose. The Rosegate Series is dated by Feature 1, a pithouse feature, at 10-OE-60, which is dated at 1100 B.P. (Green 1982).

*Elko Series*

The Elko Series is assigned a temporal span from 1300 B.C. to A.D. 700 in the Monitor Valley and is defined as (Thomas 1981:20-21):

Large: Basal Width greater than 10 mm.

Corner-notched: Proximal Shoulder Angle between 110 and 150 degrees.

The Elko Series is divided into two types, Elko Corner-notched (Table 7, Figure 4g) and Elko Eared (Table 8, Figure 4h).

Elko Corner-notched: Basal Indentation Ratio greater than 0.93.

Elko Eared: Basal Indentation Ratio less than or equal to 0.93.

182 points are classified as Elko Corner-notched making it the second largest type in the study: 136 are from Mud Springs and 46 are from Givens Hot Springs. This type is associated with Houses 3 and 4 at 10-OE-1689 and Feature 1 at 10-OE-60. These features date between 2400 B.P. and 1100 B.P. (Green 1982).

54 points are classified as Elko Eared: 18 from Givens Hot Springs and 36 from Mud Springs. Thomas (1981:21) states that the distinction between Elko Corner-notched and Elko Eared is morphological, not temporal, and that the distinction is retained to emphasize the two traditional Elko Series types that have been combined into other types in the Monitor Valley Key: Elko Side-notched and Elko Contracting Stem. The distinction between the Elko Corner-notched and Elko Eared types is the Basal Indentation Ratio with the point separating the two types at 0.93. There is a continuum

TABLE 9

Gatecliff Split Stem

Total n = 11

| | n | Mean | Mode | Median | Range | Standard Deviation |
|---|---|---|---|---|---|---|
| Weight | 0 | | | | | |
| Thickness | 11 | 5.909 | 5 | 6 | 4 - 9 | 1.4460 |
| Length | 4 | 19.500 | 25 | 28 | 25 - 37 | 5.4470 |
| Blade Length | 6 | 22.500 | 17 | 20.5 | 17 - 32 | 5.5410 |
| Maximum Width | 1 | 20.000 | NA | NA | NA | NA |
| Width B/S Junc. | 5 | 18.400 | 18 | 18 | 16 - 20 | 1.6730 |
| Base Width | 6 | 11.833 | 11 | 11.5 | 10 - 14 | 1.4720 |
| Neck Width | 11 | 12.273 | 12 | 12 | 9 - 15 | 1.6180 |
| Notch Width | 5 | 9.600 | 7 | 9 | 7 - 13 | 2.4080 |
| Notch Depth | 5 | 3.000 | 2 | 3 | 2 - 4 | 1.0000 |
| Notch Height | 10 | 9.850 | 11 | 10.5 | 7 - 11.5 | 1.5990 |
| Notch Op. Angle | 10 | 91.000 | 90 | 95 | 30 - 110 | 23.7810 |
| Notch or. Angle | 9 | 58.889 | 60 | 60 | 40 - 80 | 11.6670 |
| D.S.A. | 9 | 191.111 | 190 | 190 | 160 - 220 | 19.0030 |
| P.S.A. | 11 | 101.364 | 100 | 100 | 100 - 105 | 2.3360 |

TABLE 10

Gatecliff Contracting Stem

Total n = 10

| | n | Mean | Mode | Median | Range | Standard Deviation |
|---|---|---|---|---|---|---|
| Weight | 2 | 4.850 | 4.2 | 4.85 | 4.2 - 5.5 | 0.9192 |
| Thickness | 10 | 6.200 | 6 | 6 | 5 - 8 | 1.1350 |
| Length | 3 | 38.000 | 30 | 36 | 30 - 48 | 9.1650 |
| Blade Length | 5 | 30.800 | 31 | 31 | 24 - 38 | 4.9690 |
| Maximum Width | 7 | 21.286 | 23 | 23 | 13 - 25 | 4.4990 |
| Width B/S Junc. | 8 | 21.500 | 23 | 23 | 13 - 25 | 4.2430 |
| Base Width | 4 | 12.250 | 9 | 12.5 | 9 - 15 | 2.7540 |
| Neck Width | 10 | 13.600 | 10 | 13.5 | 8 - 20 | 3.8640 |
| Notch Width | 4 | 7.125 | 6 | 6 | 5 - 11.5 | 2.9550 |
| Notch Depth | 4 | 2.750 | 1 | 2.5 | 1 - 5 | 1.7080 |
| Notch Height | 4 | 9.000 | 7 | 9 | 7 - 11 | 1.8260 |
| Notch Op. Angle | 6 | 90.000 | 90 | 90 | 60 - 120 | 18.9740 |
| Notch Or. Angle | 6 | 60.000 | 50 | 55 | 50 - 90 | 15.4920 |
| D.S.A. | 9 | 188.889 | 170 | 190 | 170 - 210 | 15.3660 |
| P.S.A. | 10 | 100.500 | 100 | 100 | 100 - 105 | 1.5810 |

between these two types in the degree of Basal Indentation Ratio and the point that separates them seems rather arbitrary. In terms of the other attributes, there are no significant differences between the Elko Corner-notched and the Elko Eared. The Elko Eared type is dated from Houses 3 and 4 at 10-OE-1689 and Feature 1 at 10-OE-60, the range is from 2400 B.P. to 1100 B.P., exactly the same as Elko Corner-notched.

*Gatecliff Series*

The Gatecliff Series is given a temporal span from 3000 B.C. to 1300 B.C. in the Monitor Valley and is defined as (Thomas 1981:23):

Size: Weight greater than 1 g.

Contracting Stem: Proximal Shoulder Angle less than or equal to 100 degrees or notch opening index greater than 60 degrees.

The Gatecliff Series is divided into two types:

Gatecliff Split Stem: Basal Indentation Ratio less than or equal to 0.97.

Gatecliff Contracting Stem: Basal Indentation Ratio greater than 0.97.

Thomas proposes the Gatecliff Series for the first time in the Monitor Valley Key. This Series combines the traditional Elko Contracting Stem type and the Pinto Series.

There are 11 points in this study that are classified as Gatecliff Split Stem (Table 9, Figure 4i): nine are from Mud Springs and two are from Givens Hot Springs. With such a small sample it is difficult to say much about the utility of this type in this area, except that these points are clearly distinct from the other points in the study. A Gatecliff Split Stem type point is associated with Feature 1 at 10-OE-60, which is dated at 1100 B.P. (Green 1982).

Ten Points in the study are classified as Gatecliff Contracting Stem (Table 10, Figure 4j). They are all from Mud Springs and therefore have no temporal control. The points in this type are quite variable and at this time I am not sure that they represent a single type that is applicable in southwest Idaho.

*Out of Key*

Forty-two points are out of the key. These points do not meet the criteria for any of the types. By far the largest group in the out of key category is large lanceolate points which would usually be classified as Humboldt points. There are 26 such points comprising 65% of the out of key points. Fourteen of these points have bases that are too large to meet the Basal width/maximum width requirement of the Humboldt Series. The other 12 of these points have bases that are insufficiently concave to meet the Basal Indentation Ratio criteria of the Humboldt Series.

The second largest group in the out of key category is seven points with bases that are too small for the Basal width/maximum width criteria of the Desert Side-notched type. Four other points were either too thick or too large to be in the Cottonwood Leaf-shaped type but did not meet the maximum width position criteria. One point was also too thick to meet the criteria of the Cottonwood Leaf-shaped type. One point fit all of the requirements of the Rosegate Series except that it had a contracting base rather than the expanding base the key calls for. The last out of key point has a Proximal Shoulder Angle that is too large for the Rosegate criteria and a base that is too small for the point to be in the Elko Series.

*Too Fragmentary to Key*

259 points were too fragmentary to key. These are points that were not complete enough to provide the measurements necessary to determine if the point met the requirements of a type. The largest group in this category is 108 points that are too fragmentary to provide the measurements necessary to place a point into a type. This group is comprised mostly of blade fragments and points with bases that are too badly

TABLE 11

Material

| | n | Obs. | Ccs. | Silts. | Grt. | Bst. | Sands. |
|---|---|---|---|---|---|---|---|
| 1. Cottonwood Triangular | 18 | 75.0 * | 7.1 | 14.3 | 0 | 3.6 | 0 |
| 2. Cottonwood Leaf-shaped | 7 | 57.1 | 14.3 | 28.6 | 0 | 0 | 0 |
| 3. Humboldt Series | 56 | 33.9 | 39.3 | 21.4 | 0 | 5.4 | 0 |
| 4. Desert Side-notched | 100 | 70.0 | 21.0 | 8.0 | 0 | 1.0 | 0 |
| 5. Large Side-notched | 72 | 66.7 | 23.5 | 8.3 | 0 | 1.4 | 0 |
| 6. Rosegate Series | 185 | 47.0 | 27.0 | 22.7 | 1.1 | 1.6 | 0.5 |
| 7. Elko Corner-notched | 182 | 74.7 | 14.3 | 6.6 | 1.1 | 3.3 | 0 |
| 8. Elko Eared | 54 | 81.5 | 14.8 | 3.7 | 0 | 0 | 0 |
| 9. Gatecliff Split Stem | 11 | 100.0 | 0 | 0 | 0 | 0 | 0 |
| 10. Gatecliff Contracting Stem | 10 | 50.0 | 50.0 | 0 | 0 | 0 | 0 |

*Obs. = Obsidian* *Ccs. = Cryptocrystalline* *Silts. = Siltstone* *Grt. = Granite*
*Bst. = Basalt* *Sands. = Sandstone*

**Figures are percents*

broken to provide the measurements necessary for their identification. The second largest group in the too fragmentary to key group is 76 base fragments that would usually be called Humboldt base fragments. It should be noted that many of these base fragments would have been out of the key because of not meeting the Basal width/maximum width requirement or the Basal Indentation Ratio criteria of the Humboldt Series. 22 points would have been classified as Rosegate Series except for lacking enough of a base to provide measurements of the Base Width, Neck Width or Proximal Shoulder Angle. 21 points would have been classified as Elko Series except they also lacked enough of a base to provide measurements of the Base Width or Proximal Shoulder Angle. 17 base fragments would have been classified as Large Side-notched but did not weigh over 1.5 grams as is required by the criteria for this type. Because the only distinction between the Elko Corner-notched and Elko Eared types is the Basal Indentation Ratio, there were 10 fragmentary Elko Series points which were not complete enough to provide a calculation of this ratio, so it was not possible to determine which type these points belonged in. There were also 4 points that were not complete enough to provide a calculation of this ratio, so it was not possible to determine which type these points belonged in. There were also 4 points that were not complete enough to determine if they weighed less than the 1.5 grams required by the criteria of the Cottonwood Triangular type.

## SUMMARY

Overall, the Monitor Valley Key worked well. The preceding discussion may have been misleading by concentrating on the problems rather than on the points that were typed without any problems. For the most part, the points that are within each type are more like each other than the points in the other types. The Cottonwood Triangular type worked well, with a few points being too large for the type requirements. The Cottonwood Leaf-shaped type with only eight points, does not seem to be established for these two sites. The Humboldt Series criteria defines one morphological type, but the variation in the out of key category raises the possibility of the definition of more than one Humboldt type in southwest Idaho. This variation may also indicate a highly variable Humboldt Series in this area. The distinction between the Desert Side-notched type and the Large Side-notched type requires revision and the Large Side-notched type has the potential to be subdivided into several morphological types. The Rosegate Series works well, morphologically and temporally. The Elko Series went through the key with the least problem of any of the types. The Gatecliff Series will require more work to establish its utility in southwest Idaho. The points that were too fragmentary to key show a limitation of a classificatory scheme that is dependent upon the presence of certain attributes. It is important to note that many of the points that were typed were not complete, and so the key did deal successfully with many of the fragmentary points. Except for the problem with the length requirement of the Humboldt Series, the number of points that were too fragmentary to key seems acceptable.

Except for the problems with the Humboldt Series and the Large Side-notched type, the problems mentioned are minor. Not that they are unimportant: such differences show differences between the Monitor Valley and southwest Idaho. But these problems can be solved with minor adjustments to the criteria for each type, such as lowering the weight limit for the Desert Side-notched type or raising the size limit for the Cottonwood Triangular. If the Humboldt Series or the Large Side-notched type are successfully divided into more temporally diagnostic types, the key can be changed to accommodate them. In other words, the Monitor Valley Key is basically workable, but will require alterations to be more accurate in southwest Idaho.

## CONCLUSIONS

The purpose of this research was to test the applicability of the Monitor Valley Key on projectile points from southwest

TABLE 12

Base Shapes

| | n | Straight | Sub-concave | Sub-convex | Convex | Concave |
|---|---|---|---|---|---|---|
| 1. Cottonwood Triangular | 28 | 17.9 | 46.4 | 10.7 | 0 | 25.0 |
| 2. Cottonwood Leaf-shaped | 6 | 33.3 | 16.7 | 0 | 33.3 | 16.7 |
| 3. Humboldt Series | 54 | 0 | 18.5 | 0 | 0 | 81.5 |
| 4. Desert Side-notched | 89 | 15.7 | 3.7 | 3.4 | 2.2 | 44.9 |
| 5. Large Side-notched | 63 | 27.0 | 34.9 | 0 | 6.3 | 31.7 |
| 6. Rosegate Series | 166 | 50.6 | 16.3 | 18.7 | 10.2 | 4.2 |
| 7. Elko Corner-notched | 165 | 41.2 | 44.8 | 8.5 | 3.0 | 2.4 |
| 8. Elko Eared | 52 | 0 | 9.6 | 0 | 0 | 90.4 |
| 9. Gatecliff Split Stem | 11 | 0 | 18.2 | 0 | 0 | 81.8 |
| 10. Gatecliff Contracting Stem | 5 | 60.0 | 20.0 | 0 | 20.0 | 0 |

TABLE 13

Blade Shapes

| | n | In. | Ov. | Tr. | C-O | P-O | Ex. | A-T |
|---|---|---|---|---|---|---|---|---|
| 1. Cottonwood Triangular | 25 | 0 | 32.0 | 56.0 | 0 | 4.0 | 0 | 8.0 |
| 2. Cottonwood Leaf-shaped | 6 | 0 | 0 | 16.7 | 0 | 0 | 83.3 | 0 |
| 3. Humboldt Series | 46 | 0 | 15.2 | 4.3 | 0 | 13.0 | 67.4 | 0 |
| 4. Desert Side-notched | 74 | 0 | 6.8 | 91.9 | 0 | 0 | 1.4 | 0 |
| 5. Large Side-notched | 43 | 0 | 16.3 | 79.1 | 0 | 0 | 4.7 | 0 |
| 6. Rosegate Series | 162 | 39.5 | 3.1 | 53.1 | 0 | 0 | 4.3 | 0 |
| 7. Elko Corner-notched | 92 | 5.4 | 20.7 | 65.3 | 1.1 | 2.2 | 4.3 | 0 |
| 8. Elko Earned | 27 | 7.4 | 18.5 | 74.1 | 0 | 0 | 0 | 0 |
| 9. Gatecliff Split Stem | 7 | 28.6 | 28.6 | 28.6 | 0 | 14.3 | 0 | 0 |
| 10. Gatecliff Contracting Stem | 8 | 12.5 | 25.0 | 62.5 | 0 | 0 | 0 | 0 |

*In. = Incurvate* *Ov. = Ovate* *Tr. = Triangular* *C-O = Contracting Ovate* *P-O = Parallel Ovate*
*Ex. = Excurvate* *A-T = Asymmetrically Triangular*

Idaho. In terms of the definition of temporal types, the Monitor Valley Key worked well. Even with the exclusion of several morphological types from the Humboldt Series and the ambiguity of the Large Side-notched type, the key defined morphological types that have a consistent association with radiocarbon dated features from Givens Hot Springs. While more specific temporal types may eventually be produced, it is important that these types are metrically defined to allow more accurate comparisons and clarification of the temporal ranges of the types. In conclusion, it is important to remember that the types described in this paper are only types of an artifact class that is called projectile points, that occur within a given temporal range, and as such can be valuable tools for archaeologists in this area. But the types described in this paper have no reality outside of their use as tools for determining a possible temporal range. In other words, these types are markers of temporal ranges, not specific cultures.

## ACKNOWLEDGEMENTS

I wish to thank Mr. Everett Clark for allowing the study of his collection of projectile points. Dr. James Christensen of Boise State University is greatly appreciated for his enthusiasm

TABLE 14

Transverse Cross Sections

| | n | BX | AB | PC | BP |
|---|---|---|---|---|---|
| 1. Cottonwood Triangular | 28 | 35.7 | 7.1 | 53.6 | 3.6 |
| 2. Cottonwood Leaf-shaped | 7 | 71.4 | 0 | 14.3 | 14.3 |
| 3. Humboldt Series | 56 | 57.1 | 14.3 | 28.6 | 0 |
| 4. Desert Side-notched | 97 | 56.7 | 2.1 | 33.0 | 8.2 |
| 5. Large Side-notched | 63 | 68.3 | 1.6 | 27.0 | 3.2 |
| 6. Rosegate Series | 180 | 69.4 | 3.3 | 20.6 | 6.7 |
| 7. Elko Corner-notched | 173 | 69.9 | 3.5 | 23.1 | 3.5 |
| 8. Elko Eared | 47 | 76.6 | 4.3 | 14.9 | 4.3 |
| 9. Gatecliff Split Stem | 10 | 70.0 | 0 | 30.0 | 0 |
| 10. Gatecliff Contracting Stem | 10 | 100.0 | 0 | 0 | 0 |

*BX = Biconvex* *AB = Asymmetrically Biconvex*
*PC = Plano-Convex* *BP = Biplano*

TABLE 15

Longitudinal Cross Sections

| | n | CC | BX | PC | BP | AC | AB |
|---|---|---|---|---|---|---|---|
| 1. Cottonwood Triangular | 28 | 17.9 | 39.3 | 27.6 | 7.1 | 7.1 | 0 |
| 2. Cottonwood Leaf-shaped | 7 | 14.3 | 85.7 | 0 | 0 | 0 | 0 |
| 3. Humboldt Series | 51 | 3.9 | 43.1 | 23.5 | 3.9 | 9.8 | 15.7 |
| 4. Desert Side-notched | 90 | 7.8 | 54.4 | 28.9 | 7.8 | 1.1 | 0 |
| 5. Large Side-notched | 52 | 1.9 | 73.1 | 19.2 | 0 | 3.8 | 1.9 |
| 6. Rosegate Series | 170 | 6.5 | 67.1 | 15.9 | 7.6 | 2.4 | 0.6 |
| 7. Elko Corner-notched | 135 | 3.7 | 66.7 | 20.7 | 3.7 | 0.7 | 4.4 |
| 8. Elko Eared | 42 | 9.5 | 83.3 | 4.8 | 0 | 0 | 2.4 |
| 9. Gatecliff Split Stem | 8 | 0 | 87.5 | 12.5 | 0 | 0 | 0 |
| 10. Gatecliff Contracting Stem | 9 | 0 | 100.0 | 0 | 0 | 0 | 0 |

*CC = Concavo-Convex* *BX = Biconvex* *PC = Plano-Convex* *BP = Biplano*
*AC = Asymmetrically Concavo-Convex* *AB = Asymmetrically Biconvex*

and patience in teaching me the use of S.A.S. I also would like to thank Glenda Torgeson for taking the photograph of the projectile points. Max G. Pavesic and Richard N. Holmer provided very valuable advice and comments on various drafts of this paper. The two individuals that I owe the greatest deal of thanks to are Kenneth M. Ames and Thomas J. Green. Ames is appreciated for taking the time to help prepare the figures and tables for this paper, for the use of computer space and also for heavily editing an earlier draft of this paper. I wish to thank Green and the Idaho State Historical Society for the opportunity, materials and support to do this research. I especially wish to thank Green for his encouragement and patience in the initial research and for providing valuable comments on every draft of this paper.

## APPENDIX

The purpose of this Appendix is to provide basic descriptions of the projectile points involved in this study. Tables 1–10 describe the quantitative attributes for each type, while Tables 11–15 describe the qualitative attributes for all of the types. The statistics in these tables were generated by the Univariate Procedure of S.A.S. (SAS Institute 1982). The Univariate procedure produces basic descriptive statistics.

For both the qualitative and quantitative attributes, attributes were only measured if they were thought to be complete. This accounts for the discrepancy in "n" for each attribute.

The qualitative attributes are reported in percentages. The names of the various shapes of the points are from Binford (1963). Tables 11–15, the qualitative attributes, are intended solely for descriptive purposes and are in table form to conserve space. The quantitative attributes are measured in grams, millimeters or degrees. Following are definitions of the quantitative attributes. (See Figure 3.)

*Thickness* is measured at the thickest part of the point.

*Length* is defined as the total distance from the top of the point to the bottom of the point.

*Blade Length* refers to the distance from the top of the tang to the top of the point.

*Maximum Width* is measured at the widest part of the point.

*Width B/S Junc.* refers to the width of the point at the Blade and Shoulder Junction.

*Base Width* is the measurement of the line of the very bottom part of the point.

*Neck Width* is the minimal between the two notches of the point.

*Notch Width* is the size of the opening of the notch and is measured at the opening of the notch.

*Notch Depth* is a measure of the depth of the notch and is measured from the outside of the notch to the inside of the notch.

*Notch Height* refers to the height of the notch measured from the top of the notch to the base of the point.

*Notch Op. Angle* is the Notch Opening Angle and is a measure of the angle between the Proximal Shoulder and the Distal Shoulder.

*Notch Or. Angle* is the Notch Orientation Angle and refers to the angle between the longitudinal axis of the point through the center of the notch.

*D.S.A.* is the Distal Shoulder Angle and is measured from the Distal Shoulder to a line drawn perpendicular to the axis of the point.

*P.S.A.* is the Proximal Shoulder Angle and is measured from the Proximal Shoulder to a line drawn perpendicular to the axis of the point.

Binford, Lewis R.
1963 A proposed attribute list for the description and classification of projectile points. In *Miscellaneous Studies in Typology and Classification*, by Anita Monte-White, Lewis R. Binford and Mark L. Popworth. Anthropological Papers No. 19. Ann Arbor.

Brown, James A.
1982 On the structure of artifact typologies. In *Essays on Archaeological Typology*, edited by Robert Whallon and James A. Brown, pp. 176-189. Center for American Archaeology, Kampsville.

Butler, B. Robert
1965 Contributions to the archaeology of Southeastern Idaho. *Tebiwa* 8(1):41-48.

Clewlow, C. W., Jr.
1967 Time and space relations of some Great Basin projectile point types. *University of California Archaeological Survey Reports*, No. 70:141-150, Berkeley.

1968 Projectile points from Lovelock Cave, Nevada. *University of California Archaeological Survey Reports*, No. 71: 89-102, Berkeley.

Ford, James A.
1954 The type concept revisited. *American Anthropologist* 56:42-53.

Green, Thomas J.
1982 House form and variability at Givens Hot Springs, Southwest Idaho. *Idaho Archaeologist*, 6(1&2):33-44.

Gruhn, Ruth
1961 The archaeology of Wilson Butte Cave, South-Central Idaho. *Occasional Papers of the Idaho State College Museum*, No. 6. Pocatello.

Heizer, Robert F. and C. W. Clewlow, Jr.
1968 Projectile points from Site NV-CH-15, Churchill County, Nevada. *University of California Archaeological Survey Reports*, No. 71:59-89, Berkeley.

Heizer, Robert F., M. A. Baumhoff and C. W. Clewlow, Jr.
1968 Archaeology of South Fork Shelter (NV-EL-11), Elko County, Nevada. *University of California Archaeological Survey Reports*, No. 71:1-59, Berkeley.

Hester, Thomas R. and Robert F. Heizer
1973 *Review and Discussion of Great Basin Projectile Points: Forms and Chronology*. Archaeological Research Facility, Department of Anthropology, University of California. Berkeley.

Holmer, Richard Newton
1978 *A mathematical typology for archaic projectile points of the eastern Great Basin*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Utah.

Huntley, James L.
1979 An Eden point from Southwest Idaho. *Idaho Archaeologist* 2(1):2-3.

Moe, Jeanne M.
1982 A Folsom point from the Owyhee Mountains of Southwestern Idaho. *Idaho Archaeologist* 6(1&2):45-46.

Moe, Jeanne M., William P. Eckerle, and Ruthann Knudson
1980 Southwestern Idaho transmission line heritage resources survey, 1979. *University of Idaho Anthropological Research Manuscript Series No. 58*. Moscow.

O'Connell, James F.
1967 Elko eared/Elko corner-notched projectile points as time markers in the Great Basin. *University of California Archaeological Survey Reports* No. 70:129-140, Berkeley.

Plew, Mark G.
1982 Prehistory of Owyhee County: A preliminary overview. *Idaho Archaeologist* 6(1&2):47-54.

Plew, Mark G. and James C. Woods
n.d. Observation of edge damage and technological effects on pressure flaked stone tools. In *Stone Tool Analysis, Essays in Honor of Don E. Crabtree*, edited by Mark G. Plew, James C. Woods and Max G. Pavesic. University of New Mexico Press (in Press). Albuquerque.

Plog, Stephen
1983 Analysis of style in artifacts. In *Annual Review of Anthropology Vol. 12*, edited by Bernard J. Siegel, Alan R. Beals and Stephen A. Tyler, pp. 125-142. Annual Reviews, Palo Alto.

Roust, Norman L. and C. W. Clewlow, Jr.
1968 Projectile points from Hidden Cave (NV-CH-16), Churchill County, Nevada. *University of California Archaeological Survey Reports* No. 71:103-116, Berkeley.

Sappington, Robert Lee
1981 The archaeology of the Lydle Gulch site (10-AA-72): prehistoric occupation in the Boise River Canyon, Southwestern Idaho. *University of Idaho Anthropological Research Manuscript Series*, No. 66, Moscow.

SAS Institute
1982 SAS user's guide: Statistics 1982 Edition. *SAS Institute*. Gary, NC.

Spaulding, Albert C.
1953 Statistical techniques for the discovery of artifact types. *American Antiquity* 18:305-313.

Steward, Julian H.
1954 The type concept revisited. *American Anthropologist* 56(1):54-57.

Thomas, David Hurst
1970 Archaeology's operational imperative: Great Basis projectile points as a test case. *University of California Archaeological Survey Annual Report* No. 12:27-60, Los Angeles.

1981 How to classify the projectile points from Monitor Valley, Nevada. *Journal of California and Great Basin Anthropology* 3(1):7-43.

Tucker, Gordon C.
1980 Quantitative affirmation of intuitive typology. *Tebiwa 22*.

Webster, Gary S.
1978 Dry Creek Rockshelter: cultural chronology in the western Snake River region of Idaho ca. 4150 BP – 1300 BP. *Tebiwa 15*.

# AND THEN THERE WERE NONE: A CONDITION REPORT ON FOURTEEN SITES IN CENTRAL IDAHO, FIFTEEN YEARS AFTER THEY WERE RECORDED

By

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Several years ago, Professor Al Bowers of the University of Idaho conducted an archaeological reconnaissance in the vicinity of what was to become the Sawtooth National Recreation Area (SNRA) (Bowers 1964: Figure 1). His study stretched from roughly the Salmon River on the east to the line between Jackson Peak and Granite Mountain on the west (Figure 1). His survey recorded twenty sites in this area, fourteen of which lie in the Sawtooth Valley in what is now the Sawtooth National Recreation Area. At the time, Bowers (Bowers 1964: 1) believed these sites were principally the reamins of a late prehistoric occupation that was marginal to these areas at lower elevations.

Since that time, a number of excavations and surveys (Butler 1971) have been carried out in the area. Sargent (1973) reported on the spectacular cache of Haskett material found in Redfish Overhang. Gallagher (1975) presented a model of central Idaho settlement and subsistence based on data from the Sheepeater Battleground and Redfish Overhang, and O'Connor (1974) reports on several interesting features found in a recent campsite near Sunny Gulch. In addition, the Sawtooth National Forest has conducted several project surveys in this area and, while doing so, increased the total number of sites known for the area (see Wylie and Flynn 1977; Wylie 1978:26-27; Wylie and Ketchum 1979:34-41, 1980:39-48; Gallagher 1981).

As a result of this work, the perspective on the prehistory of the area has been considerably changed. We know, for instance, that the occupation of the area began very early and was not heavily influenced by glacial conditions that figured in Bowers' reconstruction (Bowers 1964:20). While hunting was no doubt significant, plant gathering would also have played an important role in daily subsistence. Sites are located not just in areas of productive fishing as Bowers points out, but also near wet meadows known for camas productivity.

In his study of the archeological resources of this area, there is one factor that Bowers could not have anticipated, but which will bear heavily on the ability of future archeologists to study these same resources; that is the major increase in visitors to this area. This increase in visitors to the recreation area has manifested itself in many ways, including the construction of new campgrounds, the development of a river floating and snowmobile industry, and an expansion of tourist services. Similarly, the area now has some traffic congestion, some horse and hiker trails are being overused, and heavy use by backpackers has denuded some camping areas, forcing suspension of their use. Commercial development has been contained, but people problems have increased. The sleepy Sawtooth Valley has become the summer playground for over a million people. With all these signs of change in the area, I raised the question of the effect more visitors would have on the archaeological resources (Gallagher 1975:2-3). In doing so, I was amplifying concerns raised by Butler somewhat earlier (Butler 1971:1).

All of these contributing concerns of mine led me to undertake a reexamination of the Bowers survey data and the sites he recorded. The sites discussed below were examined in 1979, many of them on a repeated basis, to try to compensate for changes in vegetation cover through the seasons. When a site location was positively identified, it was systematically transected with added emphasis given to areas with good surface visibility. The table below summarizes the current status of the sites.

| Site Number* | |
|---|---|
| 10CR56 | Bowers reported several parts of the site had considerable concentrations of flaked tools and chipped stone. Tested by the Idaho Highway Department prior to the enlargement of the Valley Creek/Salmon River junction bridge in 1972. Little evidence of the site remained at that time (personal communication, George Rubelman 1972).<br>Fishermen and photographers frequent this area. |
| 10CR57 | Cultural material at this site is reported from informants, but Bowers saw very little.<br>The site surrounded a small hot pool that was closed due to vandalism in 1970 or 1971. It is likely that the material on this site was removed over a long period of time by hot pool users. |
| 10CR58 | Bowers reports that this site ". . . is the richest site found during the surveys." (Bowers 1964:13).<br>This site was tested in 1970 and again in 1971 by Idaho State University Museum (Butler 1971; Gallagher 1975, App. 3). No cultural material of any value was discovered in either excavation.<br>A large sewage treatment plant now occupies much of this area. Bowers' assessment may have been wrong, or his location for it been wrong. . |
| 10CR59 | This was the only sheltered site reported by Bowers. He recommended it be excavated. |

**These numbers are the same as Bowers used in his report. These sites were subsequently assigned different numbers in 1971 to eliminate duplication. They are retained here for ease of reference.*

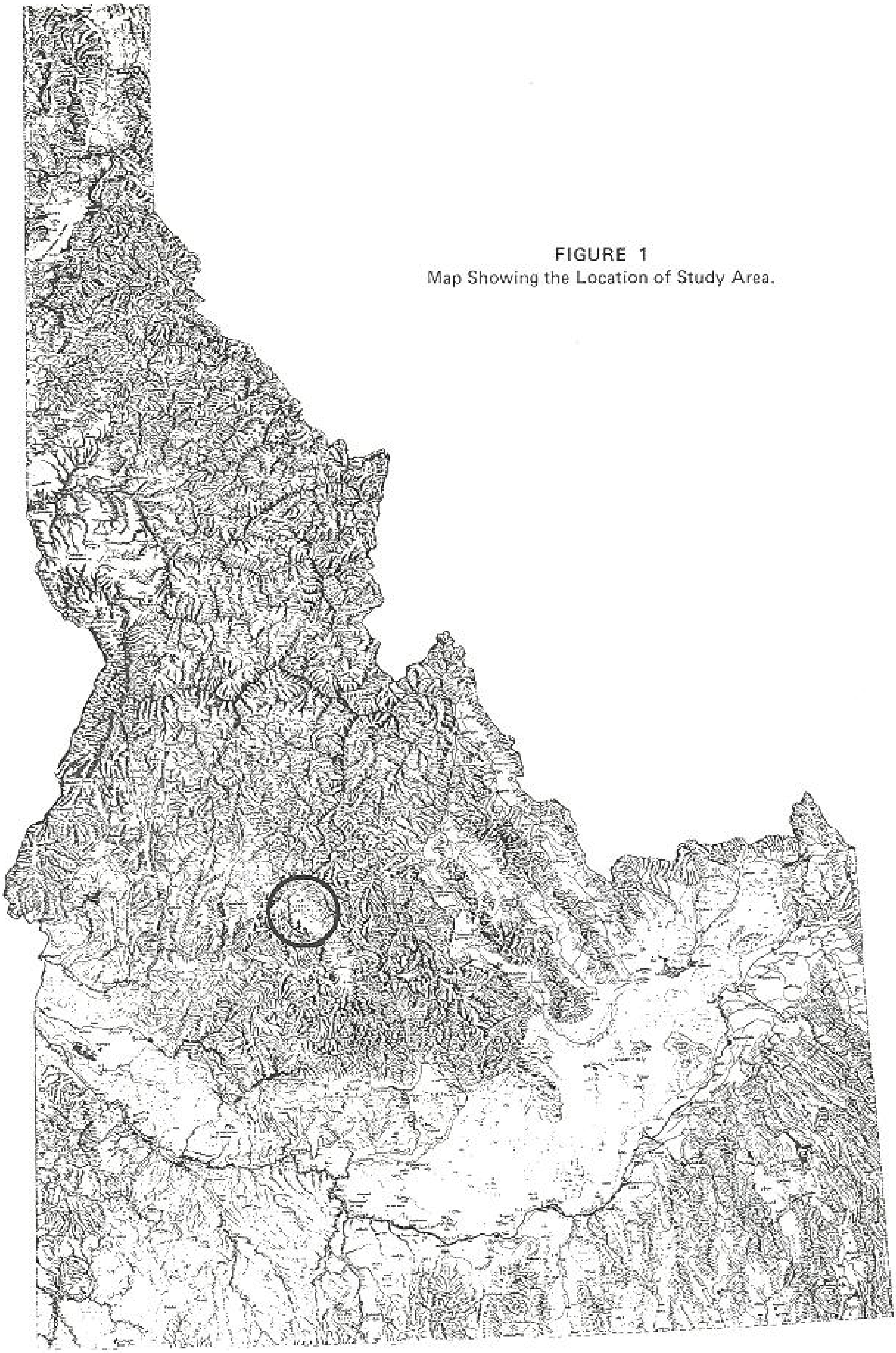

FIGURE 1
Map Showing the Location of Study Area.

TABLE 1

| Site No. | Probably Limited to Surface Materials | Scientifically Excavated | Some Surface Impacts Have Occurred | All Surface Materials Gone |
|---|---|---|---|---|
| 10CR56 | X | | | X |
| 10CR57 | X | | | X |
| 10CR58* | | | | X |
| 10CR59 | | X | | |
| 10CR60 | | | X | |
| 10CR61 | X | | | X |
| 10CR62 | | X | | |
| 10CR63 | X | X | | X |
| 10CR64 | X | X | | X |
| 10CR65 | | | X | |
| 10CR66 | X | | | X |
| 10BN20 | | | | X |
| 10BN21** | | | X | |
| 10BN22 | | | | X |

* Unable to duplicate prior results.

** Site location not certain, but search area was extensive.

This site, Redfish Overhang, was excavated in 1972 and 1973 (Sargent 1973; Gallagher 1975) and found to possess an important sequence of archae-olological material.

The site is on a self-guided SNRA tour and receives thousands of visitors each year. Campers' fires and litter are occasionally found in the shelter. The shelter was stabilized after 1973 excavations and again in 1979.

10CR60 Bowers' description of this site is short, but he mentions surface material consisting of points, knives and scrapers.

This site is now located near developed camp-grounds and a floatboat launch area. It is fre-quented by fisherman who use a nearby turnout to park.

One flake was seen in 1979, although surface visibility was good.

10CR61 This site is located near a regularly used though informal picnic area. Artifacts noted by Bowers are the same as 10CR60.

No surface material was seen in 1978.

10CR62 This site was reported to have a surface scatter of small notched points, knives and scrapers in ad-addition to lithic debris.

In 1971 this site, Sheepeater Battleground, was excavated and a report prepared (Gallagher 1975). Most surface materials were collected by the excavation crew. The site was known to be frequented by arrowhead hunting Boy Scouts from a nearby scout reservation.

10CR63 Bowers reported the site was in poor condition due to flooding.

This site was tested in 1971 and found to be limited to a thin surface scatter.

10CR64 This site is reported by Bowers to have had abun-dant evidence of aboriginal occupation.

In 1971 this site was tested. Very little surface material was seen at the time and the excavations did not produce evidence for a buried component.

10CR65 When initially reported upon, Bowers indicated it was similar to 10CR62 in location and surface assemblage.

No tools are present on the surface of the site at this time.

10CR66 This is the only site Bowers reports in the high lake area of the Sawtooth. He states, "Worked chips and flakes of good quality and transparent obsidian were abundant in the sand of the site." (Bowers 1964:16).

When this site was revisited in October of 1979, only three obsidian chips could be discovered. The site occurs at a main junction of the Sawtooth trail system and most of the sand Bowers observed is gone. These flakes were determined by Lee Sappington, University of Idaho, to be from Timber Butte. The site was probably a mountain goat/sheep hunting site, as these are the only resources of consequence in this location.

10BN20 Bowers reports this was an impressive site marked by ". . . firepits in the meadow floor, broken flake tools, notched arrowheads, and rock-lined stream channels which probably marked the location of fish traps" (Bowers 1964:18).

Surface material is no longer present at this site. No firepits were detected that could be attributed to aboriginal populations, although many were clearly recent in origin. Fish traps could not be seen.

10BN21 Of this site Bowers states, "Evidence of human occupation west of the outlet of Alturas Lake was noted in a cut made through a low knoll 100 yards north of Alturas Lake Lodge. Numerous firepits were observed" (Bowers 1964:18).

The lodge has since been moved and the site could not be relocated, although intensively searched for.

10BN22 Bower's description of this site is vague, although the location is clear enough from his maps. He does mention collectors on the site when he visited the area.

Presently, there is nothing on the surface of this site.

## DISCUSSION OF IMPACTS TO SITES IN SAWTOOTH VALLEY

Bower's report is not an ideal document against which to measure changes in site condition over time. Site descriptions tend to be uneven and subjective and no real quantification of artifacts or artifact types is presented. Bowers makes no mention of his survey methodology. It is, though, the only professional description of these sites prior to the recreational boom in Sawtooth Valley. Table 1 summarizes the apparent changes in the condition of the prehistoric sites discussed in this paper.

It is clear from this table that few sites have escaped some level of disturbance. Eight of the fourteen sites can no longer be located, they have been so thoroughly gleaned during casual collection; while all the others have witnessed at least moderate to severe impacts in the form of artifact collecting by residents and tourists alike.

Many of these sites are located near some attraction: a flat for picnics, good fishing areas, impromptu viewpoints, or a good place to park the family RV while tubing the Salmon River. With annual use in Sawtooth Valley near 1,000,000 visitor days, casual collectors of artifacts can easily be seen as a source of significant impact to prehistoric (and historic) sites in the area. Site destruction by local avocational artifact collectors may also be a factor.

The Forest Service's cultural resource specialist(s) for this area are concerned nearly full-time with project clearance surveys. Site monitoring such as that used for this report has to be "bootlegged" while on some other project; Forest Service funding generally does not fund more than site discovery and custodial management of even the most important of its cultural properties. While the SNRA 's management has an enlightened view of cultural resources, the fiscal realities of current budgets do not allow for many management options.

## THE FUTURE

For a variety of reasons, the visitor use of the Sawtooth NRA has somewhat leveled off so that the rate of site loss may not continue to grow. At the same time, though, Forest Service budgets are likely to diminish and emphasize more production oriented resources. This will further reduce our capability to manage cultural resources.

While the Forest Service has begun to improve its record on project survey coverage through the development of a strong paraprofessional program, the need for management oriented research in the NRA and similar recreation oriented administrative units, such as wildernesses, becomes more critical. Indeed, while the Forest Service is capable of locating sites and inventorying forest projects, it is not in the business of conducting research even where it may have resource enhancement value. In the case of the Sawtooth NRA, the large amount of survey work that the Forest Service has undertaken since 1977 has not markedly improved our understanding of the prehistory of this area. The usefulness of this work has been in making management decisions to resolve resource conflicts.

What is vitally needed in these areas are field schools and grant-supported research that will provide long-term research of a steady and productive nature (c.f. Butler 1981:Forword). Work of this kind would benefit many. The Intermountain Region through its office in Ogden, Utah, can occasionally provide financial support in exchange for a research report. Local administrative units can occasionally provide housing and per diem to volunteers involved in research.

In concluding this paper, it is important to point out that the Sawtooth NRA is an area that intuitively would seem to be a safe haven for cultural resources. The legislation that established the NRA cited the special nature of the cultural values in it as one reason for its existence. Also, the NRA is not managed primarily for the production of traditional forest products and outputs. Yet, the evidence would seem to suggest that legislative intent alone is inadequate to protect these fragile resources. The discovery of such widespread loss of cultural values should be a warning to all of us that even those areas that should be "untrampled by man" may be in danger of losing all evidence that man was ever there.

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