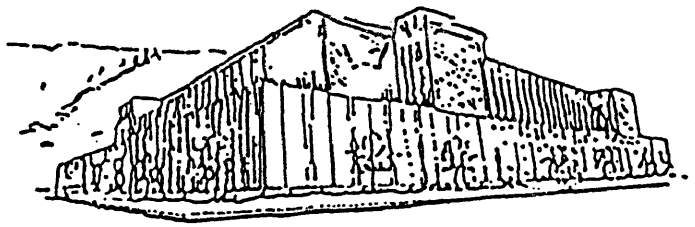
1996

An Investigation of the Aesthetic Dimension of Projectile Point Morphology

Jennifer Jo Yoneji
The University of Montana



Maureen and Mike
MANSFIELD LIBRARY

The University of **MONTANA**

** *Please check "Yes" or "No" and provide signature* **

Yes, I grant permission ✓
No, I do not grant permission ____

Author's Signature Jennifer Lowry

Date May 5, 1996

AN INVESTIGATION OF THE AESTHETIC DIMENSION OF PROJECTILE POINT MORPHOLOGY

by

Jennifer Jo Yoneji

B.A., Miami University - Oxford, Ohio 1974

Presented in partial fulfillment of the requirements

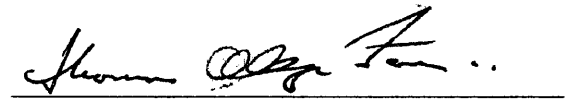
for the degree of

Master of Arts in Anthropology

University of Montana

1996

Approved by



Chairman, Board of Examiners

Dean, Graduate School

5-7-96

Date

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

Yoneji, Jennifer Jo, M.A., April 1996 Anthropology

An Investigation of the Aesthetic Dimension of Projectile Point Morphology

Director: Thomas A. Foor

A set of ten working hypotheses was established to investigate the thesis that beautifully-crafted projectile point styles are produced by people who are heavily dependent upon projectile point technology for the procurement of a primary resource and who are experiencing stress. The concept of beauty as a universally-perceived, biologically-based, culturally-filtered phenomenon and its role in human adaptation was explored. The role of style as communication was evaluated. The relationship between stress and magical thinking was explored. The impact of technological innovation and environmental conditions upon human behavior was investigated. The effect of adverse climatic conditions on vegetation, bison, and human populations of the Great Plains was analysed.

The principles of cultural ecology, cognitive archaeology, and aesthetic anthropology formed the theoretical framework for the study. The Avonlea projectile point style and cultural system was the focus of the work; information regarding Folsom and Solutrean points and cultures was supplemental.

A collection of Avonlea points from the Fantasy site in north-central Montana and data from eight Avonlea site reports was used to develop a method for measuring projectile point aesthetics. A method for ascertaining whether or not projectile points were used in a ceremonial context prehistorically was also produced.

Lack of consistent data made it impossible to fully investigate the thesis. The ten working hypotheses were supported by information in the literature; only two of the hypotheses were supported by the data obtained from collection analysis and site reports.

A great deal of information regarding the Avonlea cultural system was consolidated in this study. The study demonstrates that interpretation of the aesthetic dimension of projectile point morphology is integral to a thorough understanding of the archaeological record. It also supports the contention that the concept of beauty not only plays a functional role in human adaptation, but that it is defined by the qualities that give structure and meaning to human existence.

Acknowledgements

I would like to acknowledge the assistance, support, and advice of the following individuals: Mr. John Brumley, Ethos Consultants, Inc.; Dr. Colby Courrier, University of Great Falls; Dr. Les Davis, Museum of the Rockies; Dr. Jack Fisher, Montana State University; Mr. Dale Herbort, Montana Department of State Lands; Mr. Gene Munson, GCM Services; Mr. Steve Platt, Montana Department of Transportation; Mr. Pat Rennie, Montana Department of State Lands; Dr. Tom Roll, Montana State University; two special faculty members: Dr. Randy Skelton and Dr. Tobie Weist; and the members of my thesis committee: Dr. Susan de France and Dr. Jeff Gritzner.

Two individuals who deserve special recognition are my advisor, Dr. Tom Foor, who made it possible for me to begin and continue my graduate studies, and my husband, Dr. Jerry Yoneji, who provided advice and unfailing support and encouragement for all my endeavors.

Table of Contents

Table of Contents cont.

List of Tables

List of Plates and Figures

I. Introduction

Human beings have produced lithic projectile points for thousands of years. Some points are beautifully-crafted and others, mediocre. However, at particular times and places, people have produced projectile point *styles*, i.e. "distinctive form(s) occurring in a consistent temporal or stratigraphic context...possessing spatial continuity" (Husted 1969:8) which are exceptionally well-made and aesthetically pleasing.

In this thesis, I propose that beautifully-crafted projectile point styles are the result of stress related to resource procurement in societies that are heavily dependent upon projectile point technology. In addition, I propose that stress can trigger an increase in spiritual activity accompanied by the production of ritualized objects associated with the source of stress. Because these objects are used by people seeking social stability, their morphological attributes reflect the sought-after qualities of balance, order, symmetry, and harmony: qualities associated with beauty. I further hypothesize that the production of such objects is adaptational: an attempt by human beings to control their environment and order their lives.

In this thesis, I investigate the relationship between beauty, spirituality, stress, and human adaptation. To do so, I address projectile points as art, explore the meaning of style, and examine the significance of "beauty" in human

adaptation.

Theoretical Framework

"It is the aim of the anthropologist to discover the processes which have structured the anthropological universe, and to formulate the laws which have governed these processes" (Wobst 1974:147). It is the ultimate aim of anthropology to formulate a body of general theory regarding culture (Wobst 1974:147).

Anthropologists have formulated various theoretical frameworks to assist them in analyzing and interpreting the archaeological record. I employed three of these frameworks in my study: cultural ecology, cognitive archaeology, and aesthetic anthropology. Collectively, they provided guidance for my approach and substantiation for my belief that cognition and ideology can be derived from the archaeological record.

Cultural ecology is a systemic approach that views "technology, those tools and social relationships which articulate the organism with the physical environment, as closely related to the nature of the environment" (Binford 1962:218). It is based on the conviction that "(T)he formal structure of artifact assemblages together with the between element contextual relationships should and do present a systematic and understandable picture of *the total extinct* cultural system" (Binford 1962:219). Therefore, even though "it has often been suggested that we cannot dig up a social

system or ideology" (Binford 1962:219), it is still possible to draw conclusions regarding prehistoric ideology from the material record.

Cognitive archaeology is based on the theory that "past ways of thought [can be] inferred from material remains" (Renfrew 1994:3). Existing methods of archaeological inquiry are used to investigate the early use of symbols and the development of cognitive processes (Renfrew 1994:4). Interpretations are based on "structures of inference," i.e. a series of logically-interconnected inferences which are derived from, based upon, and supported by empirical data as opposed to "interpretive leaps" in which unexplained and/or indefensible gaps exist between the data, the argument, and/or the final conclusions (Renfrew and Zubrow:5,10). Cognitive archaeologists demand that the investigator "make explicit the assumptions and the inferences which sustain the argument" when proffering interpretations (Renfrew and Zubrow:11). The effectiveness of this approach lies in the testability of the interpretive arguments (Bell 1994:15).

Aesthetic anthropology is based on the premise that aesthetic "configurations reflect the vital experiences of men confronting the physical and social environment" (Maquet 1971:32). Aesthetic phenomena are perceived as permeating cultural systems at all levels: societal, technological, and ideational (Maquet 1971:19). "Aesthetic anthropology attempts to disentangle the intricate relationships which

connect aesthetic phenomena to other cultural phenomena" (Maquet 1971:19). Aesthetic anthropologists strive to define aesthetic phenomena in empirical terms that are cross-culturally applicable. Even though an understanding of the cultural milieu surrounding aesthetic material is essential, aesthetic appreciation is not perceived as culturally-determined. The stimuli underlying aesthetic expression are seen as universal, observable, and measurable. These stimulae may be assessed by the formulation of testable hypotheses.

Methods

My challenge in this investigation was to design a method that would allow me to test my thesis. To accomplish this, I developed a body of working hypotheses and selected three projectile point styles as the subjects of the study: Avonlea, Folsom, and Solutrean. Each of the point styles is associated with societies that were heavily dependent upon big game; each has been repeatedly referred to as "beautiful" in the archaeological literature.

Limitations imposed by the nature of my study allowed me to focus on only one point style. I selected Avonlea because it was the projectile point style that prompted the questions from which I developed my thesis. Avonlea points first appeared in the northern reaches of the Great Plains at approximately A.D.200. They have usually been found in conjunction with bison kill sites. The nature of the cul-

ture associated with the point style has been discussed and debated ever since the point was first identified in the 1940's. The enigma surrounding its origins and the relationship between Avonlea point-producing people and their contemporaries intrigued me. I hypothesized that there were factors involved in the production of Avonlea points that did not pertain to point styles contemporaneous with them. These factors contributed to the production of an aesthetically exceptional point style. I further hypothesized that similar factors prompted the production of Folsom and Solutrean points.

I developed the following set of working hypotheses:

1. The concept of beauty is based upon universally-perceived, biologically-based, culturally-filtered qualities of symmetry, order, balance, harmony, and mastery of a medium.
2. Stress may result in increased spiritual activity in human beings.
3. Stress-related spiritual activity often involves ritual and beautifully-crafted, symbolic objects associated with the source of stress.
4. Stress can be detected in the archaeological record; nutritional stress is reflected in skeletal anomolies; social stress may be indicated by change in style and artifacts.
5. Detrimental climatic conditions and technological

innovation can produce stress.

6. Ceremonialism can be detected in the archaeological record. In the Plains, rock effigies, cairns, juxtaposition of hearths and artifacts indicating offeratory activity may indicate ceremonialism.
7. Lithic materials selected for ceremonial projectile points are the finest available and differ from materials used in the production of non-ceremonial tools.
8. The range in variation of morphological attributes of points intended for ceremonial use would be limited and well-defined.
9. Ceremonial points should be beautifully-crafted, i.e. characterized by regular, well-ordered flaking patterns; symmetry; quality lithic materials; balanced proportions; and mastery of the medium.
10. A high percentage of the most outstanding points would be found in close proximity to possible ceremonial features.

I investigated these hypotheses as thoroughly as possible with regard to the Avonlea cultural system. I incorporated additional information from the Solutrean and Folsom cultural contexts.

I developed two objectives in conjunction with applying my hypotheses to the Avonlea record:

1. To develop a standard by which projectile point

aesthetics can be measured;

2. To develop a method for ascertaining whether or not projectile points were used in a ritual context, prehistorically.

I gathered information on art and aesthetics, the meaning of style, technological innovation, stress and its effect on human thinking and behavior, and paleoclimate and its effect on prehistoric ecology. I obtained information regarding projectile point metrics, faunal remains, lithic materials, and archaeological features from numerous site reports. I analyzed one provenienced collection of Avonlea projectile points to obtain information on morphology, lithic material, and the relationship of points to other artifacts and features. My goal was to identify patterns in lithic selection, morphology, provenience, and environment so that I could either support or refute my thesis.

A complete investigation of this thesis would entail a comparative analysis of the archaeological record of a society that is neither heavily invested in projectile point technology nor dependent upon big game as a primary resource. Theoretically, such a society would not produce a beautifully-crafted projectile point style. Such an undertaking was not possible at this time.

The greatest frustration in conducting my investigation was the lack of comparable archaeological data. There is no common standard to which archaeologists in the Plains adhere

when investigating a site and reporting their work. The resulting inconsistencies in data collection and recording complicated my research. However, by utilizing the data that were available, it was possible to build a "structure of inference" which provided some meaningful insights.

Significance of the Study

The results of my work are significant in several ways:

First, I have consolidated a great deal of information and produced a summary of the Avonlea cultural system to date. I believe that I have also contributed new information regarding the message contained in Avonlea projectile point morphology.

Second, my work illustrates that analysis of the aesthetic dimension of projectile point morphology is instrumental in interpreting the archaeological record.

Third, the methods I have developed for assessing the nature of projectile point aesthetics and for applying the information to the archaeological record both facilitate analysis of the aesthetic dimension of projectile point morphology and substantiate its importance.

Last, my research illuminates the significance and adaptational function of beauty. The concept of beauty appears to be biologically-rooted and based on qualities of symmetry, order, balance, unity, and mastery of a medium. Beautiful phenomena seem to instill a sense of peace in human beings. This sense of peace appears to spring from

the satisfaction of an innate desire for a seemingly unattainable "wholeness" for which human beings are continually striving. By producing and/or viewing beautifully crafted objects, human beings temporarily gain a vicarious sense of completeness that is psychologically and physiologically beneficial. Such an aesthetic experience seems to be strongly associated with spirituality - the human need to be a part of something greater than one's self.

The creation of beautifully-crafted technological devices is a means by which human beings invest pragmatic objects with spiritual qualities. If my thesis - that beautifully-crafted projectile point styles were produced by prehistoric hunters under stressful circumstances in an attempt to exert control over the environment - is supported by evidence for stress-related spiritual activity involving beautifully-made projectile points in the Avonlea archaeological record, then the theory that beauty plays a functional role in human adaptation can be supported. The theory can be applied to not only the archaeological record, but to living populations as well.

II. Aesthetic Expression, Human Self-Awareness and the Archaeological Record

"(T)he human organism always functions as a whole, physically and psychically" (Arnheim 1949:168). Human beings produce material objects that reflect intellectual processes and emotional states. In order to interpret accurately the archaeological record, archaeologists should have an appreciation for the biological and cultural bases of aesthetic expression and "art," the concept of beauty, and the connection between aesthetics and human self-awareness.

Aesthetic Expression

Aesthetic configurations entail more than form and stylistic detail; they also embody attempts by human beings to exert control over their environment. "(T)he artifices ...that arise from the human creature's inherent efforts to deal with (to control) the uncertainties of its world tend also to be...what are called `aesthetic' or `arts'" (Dissanayake 1992:77).

Aesthetic expression involves perception, emotion, and material form. An aesthetic experience "extends thought, stretches the mind and leads us into new and uncharted territory" (Coote 1992:247). "Whereas intelligence and formal rationality search for logical order, aesthetic experience searches for a higher form of `order'... a synthesis of the opposites and unity of the diversities" (Minai 1993:298). Aesthetic expression reflects cognitive

processes to the extent that "(u)ltimately...problem-solving ...represent[s] aesthetic choices" (Adams 1973:276). Aesthetic experience is universal and innate (Tuan 1993:19); it is part of our "full definition as human beings" (Crowther 1993:206). "In one way or another esthetic pleasure is felt by all members of mankind" (Boas 1955:9). It is active rather than passive (Cupchik 1981:469) and is based on recognizing and responding to a combination of technical skill and emotion (Boas 1955:11; Gombrich 1984:150).

The universal nature of aesthetic behavior appears to have its roots in a "behavioral tendency that helped individuals who possessed it...to survive better than individuals and groups who lacked the tendency" (Dissanayake 1992: 42). Aesthetic behavior is the result of "five major human adaptations": environmental exploration, play, attention to spatial configuration, fine-grained perceptual discrimination, and the transformative process exemplified by the linguistic metaphor (Alland 1989:6).

"(G)enetically determined braincoded universals do exist in the realm of aesthetics"; "aesthetic feelings and activities do have adaptive significance for social life" (Alland 1989:13,6). Aesthetic perception is "rooted in the physiology of the human organism...particularly in its nervous processes" (Maquet 1971:9). Primate studies substantiate the contention that human artistic expression has deep biological roots and is strongly self-rewarding (Morris 1962).

The biological basis for aesthetic perception is associated with highly developed cognitive and psychological aspects of human nature that produce a "human need to... influence, forestall, transform, or otherwise control the disturbing `other', to bring extreme or untrustworthy situations under control by extraordinary intervention" (Dissanayake 1992:76). "Control of one's own behavior, by making it stylized or otherwise extraordinary, seems to be universally performed by humans as a way of controlling the unknown and the unpredictable..." (Dissanayake 1992:126).

Art

Art is the result of "making conscious processes visible in permanent materials" (Boas 1955:14). Art, in its broadest sense, is a refined way of understanding who and what we are (Arnheim 1974:5). Art gives "form to a feeling" (Dissanayake 1992:46); it makes "transient subjective feeling objective and enduring" (Tuan 1993:221). Art is a "representation of the whole system of which it is a part" (Washburn 1984:4). All human societies engage in some form of artistic activity (Dissanayake 1992:xii, Boas 1955:9, Wolfe 1969: 3). "The essence of art is nothing less than *the conservation of human experience itself*" (Crowther 1993:7).

According to many investigators, the qualities of balance, harmony, and order are universally apparent in artistic expression (Washburn 1984:4,6; Arnheim 1974: 60,62; Alland 1989:9). These qualities appear to be physiologi-

cally, cognitively, and psychologically significant to human beings. "Art structures describe aspects of the balance, harmony, and order within a given culture that makes life comfortable and predictable for its members" (Washburn 1984: 6). "(E)lement details will vary, but the structuring of those elements will be culturally consistent" (Washburn 1984:5).

The Concept of Beauty

The concept of beauty is an aesthetic perception that involves the qualities inherent in artistic expression, i.e. order, balance, and harmony. It is further defined by mastery of a medium and the quality of symmetry (Arnheim 1974: 33, Morris 1962:34, Boas 1955:11). Symmetry is associated with the adaptational and evolutionary concept of fitness (Thornhill 1993:36, Arnheim 1974:33); i.e. wholeness and wellness. The most definitive quality of beauty, however, is the *feeling* it instills in the observer. Though unquantifiable, at least by current scientific procedures, the feeling is real.

The perception and/or production of beautiful objects appears to stimulate the excretion of biochemical substances that results in pleasurable sensations (Whybrow 1984). The sense of well-being that accompanies a pleasurable aesthetic experience encourages the observer/participant to repeat the activity that produced the sensation. The desire to engage in and repeat pleasurable, beneficial activities enhances

survival (Dissanayake 1992:42).

Survival, for human beings, is strongly linked with technology. As human beings became technologically adept, they "gilded the lily, making sure that their technology `worked' by deliberately reinforcing it with emotionally satisfying special elaborations and shaping" (Dissanayake 1992:95). "The Fulani, like many people, believe that something that looks nice will be more effective than something that does not" (Dissanayake 1992:79). Mathematicians and physicists have stated that "a sense of beauty is the ultimate guide to the significance and truth of their work" (Tuan 1993:16).

The perception of beauty, although biologically-based, may be culturally filtered. "Though rooted in nature... (beauty) is directed and ordered by culture" (Tuan 1993:7). Due to cultural variation, members of different cultures may not initially perceive the same phenomena as beautiful. The discrepancy is due not to a lack of universal principles of beauty, but to ignorance of the cognitive, psychological, and adaptive processes of a particular culture. For outsiders, the underlying principles of order, balance, and harmony may be obscured.

Even though the perception of certain phenomena as beautiful appears to be culturally-based in some cases and to a certain extent, some theorists propose that there exists a fundamental concept of beauty that transcends time

and space (Paul 1988:20). Such a concept is based on the *feeling* that results from viewing certain phenomena. This feeling is based on "man's rational need to uplift the inner and outer world into his spiritual consciousness as an object in which he recognizes again his own self" (Crowther 1993:122). Beauty is "associated with all our notions of order, of goodness, of health and of more complete life" (Lee 1912:30). It is "self-rewarding" (Paul 1988:26). It "expands our senses and minds" (Tuan 1993:220). "It is the echo of our aspirations to live a life with overall direction and organization" - "the fact that in our relation to human society we need to be part of a whole..." (Crowther 1993:137). It is "what makes us happy" (Tuan 1993:220).

"A fundamental characteristic of successful living organisms is a high degree of order and their ability to maintain that order in the face of the physical world which ...tends toward disarray" (Whybrow 1984:60). The need for order is closely tied to human survival. Beauty is not an "extra"; it "fill(s) a fundamental human need, (it) satisf(ies) an intrinsic and deeply human imperative" (Dissanayake 1992:34). Beautiful objects objects and events combine the qualities of symmetry, balance, rhythmic pattern, order, harmony, and technical skill (Boas 1955:11) in such a way that they touch the human spirit and reflect its desire to possess the defining qualities of beauty for itself. Ironically, beautiful objects simultaneously create feelings

of satisfaction, wonder, and yearning.

The concepts of aesthetic expression, art, and beauty are closely entertwined. All three are rooted in biological and physiological processes which are the result of evolutionary and adaptational forces. All three are perceptions and expressions of the recognization of and need to express "self" and "other"; the universal need for order, balance and harmony - for the inner self as well as the external environment - expressed in culturally-specified ways.

The information presented in this section supports Hypothesis #1: The concept of beauty is based upon universally-perceived, biologically-based, culturally-filtered qualities of symmetry, order, balance, harmony, and mastery of a medium.

Accepting this hypothesis indicates that all human beings, regardless of cultural background or temporal setting, perceive phenomena defined by order, balance, harmony and mastery of a medium that instill them with a feeling of wonder as "beautiful." Therefore, if a projectile point style is described as "beautiful" by contemporary human beings, it was also considered beautiful by those who produced it.

Aesthetic expression in the material record is recognized in *style*. In *style*, aesthetic expression articulates with archaeology.

III. Style, Stress, Magical Thinking, and Projectile Point Morphology

Hypotheses 2,3,6,7,8,9, and 10 deal with the issues of stress, increased spiritual activity, magical thinking, and the morphology and provenience of ceremonial projectile points. My research indicates that these hypotheses are supportable.

The Concept of Style

Style is aesthetic expression in tangible form. It is "a way to culturally encode messages in an artistic way" (Eibl-Eibesfeldt 1988:54). Style provides access to cognitive processes (Adams 1973). It is the archaeologist's window to past systems of "doing, thinking, and being" (Wiessner 1990:112). Interpretations of stylistic expression are based upon linking "careful descriptions and analysis...of as many different classes of artifacts as possible...with information on economy, exchange, politics, settlement patterns, etc." (Wiessner 1990:111). "(T)he understanding of stylistic variation depends heavily on understanding the behavior that generates it" (Wiessner 1983:256).

"...style operates at a number of levels and serves numerous functions" (Eibl-Eibesfeldt 1988:51). It can be interpreted as passive and/or active (Conkey 1992:10; Sackett 1977:370), ideational and/or functional (Sackett 1977:370; Eibl-Eibesfeldt 1988:51). Style and function are

entertwined (Sackett 1992:34) and account for all formal variability in physical objects (Sackett 1977:370).

At its most basic level, the concept of style refers to a configuration of morphological attributes. However, "style is more than formal variation...it is communication" (Conkey 1992:10) - "communication based on doing something in a certain way" (Wiessner 1990: 106).

Style is the "formal variation in material culture that transmits information about personal and social identity" (Wiessner 1983: 256); it communicates information regarding the cultural balance between the two (Wiessner 1989:56). Style embodies "the process of social comparison, through which the self is differentiated from others and the ingroup from the outgroup" (Wiessner 1983:257). Style expresses the relationship between various social components by relating the "individual event to a greater whole..." (Wiessner 1990: 110).

Depending upon circumstances, stylistic behavior may be used by a social group to emphasize either social cohesion or the importance of individual self-expression (Wiessner 1990:109). If a society experiences fear, inter-group competition, and/or aggression, the need for cooperation will be exemplified by minimal variation in stylistic expression. If, however, opportunities for individual economic gain predominate or if social insitutions disintegrate, then variation in stylistic expression will reflect

self-assertion rather than group solidarity (Wiessner 1990:109).

Style, Stress and Magical Thinking

Although it is not possible to interview or observe extinct human populations, it is possible to employ ethnographic analogy and the theory of psychic unity in order to interpret the meaning of style in the archaeological record. I rely on this approach to establish the connection between style, stress and magical thinking.

"(S)tyle is accentuated by socioeconomic stress" (Wiessner 1983:271). Socioeconomic stress is based on competition for and availability of resources. As competition increases and/or resource availability decreases, stylistic expression plays an increasingly important role in "the maintenance of internal cohesion" (Hodder 1979:446).

Stress is a very real phenomenon that affects human beings both psychologically and physiologically. Stress is measured by "the extent to which an individual experiences deprivation or injury because, by his own biological and cultural criteria, his access to important resources is too limited or too unreliable" (Cowgill 1975:127). "In a nutshell, stress can be seen as a projection of anxiety" (Breznitz 1994:169). Stress has physiological manifestations characterized by "increased catabolization of protein ...with a net loss of nitrogen from the tissues. Antibody production is low...healing is slow...and a variety of

symptoms of a serious nature are likely to develop..." (Rappaport 1969:189). In order to impact a cultural style, a significant segment of the society must experience stress at the same time.

Sources of the kind of stress that would impact a significant portion of the population include technological innovation (Burkhardt and Brass 1990:106) and undesirable environmental change (Wiessner 1983:271; Hayden 1981:520). Each may occur independently of the other. However, resource deprivation resulting from climatic changes "can be assumed to have provided the occasional motivation needed for technological innovation and environmental manipulation" (Hayden 1981:523).

Both technological innovation and environmental change increase uncertainty, which is characterized by "an inability to predict future outcomes" (Burkhardt and Brass 1990: 106). The introduction of uncertainty affects social stability. "As...uncertainty is introduced, changes in interaction patterns may occur" as individuals attempt to "structure, organize, and interpret" their world (Burkhardt and Brass 1990:106). Changes can occur in the balance of social power. "Those who are able to reduce uncertainty for themelves and others can increase their power" (Burkhardt and Brass 1990:107). A change in the balance of power may be accompanied by changes in social practices and beliefs. Such changes can be produced and facilitated by magical

thinking.

"The higher the stress experienced by individuals and the lower their tolerance for ambiguity, the greater the probability that they (will) exhibit magical thinking" (Keinan 1994:52). Exposure to stressful situations results in uncertainty and a feeling that control over events and circumstances has been decreased or lost (Keinan 1994:52). "Magical thinking can be viewed as one of the coping strategies adopted by individuals to maintain or regain such control" (Keinan 1994:52). Magical thinking is closely tied to religion; both are "special modes of behavior...pragmatic attitudes(s) built up of reason, feeling, and will..." (Malinowski 1954: 24). Both are expressed through ritual.

Religious rituals are adaptive mechanisms characterized by "the prescribed performance of conventionalized acts manifestly directed toward the involvement of nonempirical or supernatural agencies in the affairs of the actors" (Rappaport 1969:182). Ritual "gives the members of the society confidence, it dispels their anxieties, it disciplines their social organization" (Rappaport 1969:182) by regulating relations within the subsystems of a large social complex as well as within the complex system itself (Rappaport 1969:198). It is a form of communication and information-processing that provides stability for human society (Rappaport 1971:25).

Religious rituals are directed at ameliorating stressful

social conditions by fulfilling human obligations to supernatual powers (Malinowski 1954; Jones 1990). The use of material objects directly related to the source of the stress is a significant aspect of ritual behavior (Malinowski 1954; Ottaway 1970). The ritual behavior of the Trobriand Islanders and the Cheyenne of the Great Plains illustrate this concept.

The Trobriand Islanders have developed ritual activity to ameliorate their fear of venturing into the dangerous and unpredictable ocean that surrounds their island home (Malinowski 1954). This activity involves stylized adornment of their canoes (Malinowski 1954). When the Islanders set out to sea, they depend upon their canoes to take them safely to and from their destination. They attempt to insure their safety by beseeching supernatural powers for protection. In conjunction with supplicative ritual, they embellish their canoes with decorative motifs. If the islanders faithfully follow the prescribed ritual for obtaining and applying the magical motifs, they believe that their safety will be insured.

Traditionally, the most sacred religious objects belonging to the Cheyenne were the four "medicine arrows": two Buffalo Arrows used in buffalo-procurement ritual and two Man Arrows used in preparation for war. Use of the arrows was restricted and ritualized (Ottaway 1970:94). The arrows symbolized "support in tribal protection and aid in

providing sustenance, the Sacred Arrows stood between the Cheyenne and calamity" (Ottaway 1970:95). They were "proof against ultimate disaster, an assurance that in spite of everything all will prosper" (Ottaway 1970:95).

These two cases provide general substantiation for Hypothesis 2, (stress may result in increased spiritual activity in human beings), and Hypothesis 3 (stress-related spiritual activity often involves ritual and beautifully-crafted, symbolic objects associated with the source of stress). They also indicate that stress associated with resource procurement can result in magical thinking that simulates production of stylized ritual objects and motifs directly associated with the source of stress.

Style, Stress, Magical Thinking and Projectile Point Morphology

Projectile point style is produced by a combination of three factors: mental template/cognition, technical competence, and raw material (White et al.1977; Tacon 1991, Bamforth 1991). In producing a projectile point, a flint-knapper relies upon an *idea* of proper projectile point *form*. Form is dictated by function (Sackett 1977: 370). Therefore, because the purpose of a projectile point is to penetrate and kill, it must be designed with a tip. To be most effective, it must be haftable. These basic requirements dictate the basic form, i.e. an elongated or triangular shape.

Other attributes such as width, thickness, length, raw material, and flaking pattern are variable. Morphological attributes are determined by cognitive processes and the technical skill of the knapper as well as by the norms of the social group (Bamforth 1991: 310; Barnett 1953:16). Some investigators propose that "major" morphological characteristics "reflect community/cultural standards" while "minor" characteristics, such as flake scar depth, "reflect variations in the habits of individual stone-workers" (Bamforth 1991:312).

Cultural groups develop distinct projectile point styles (White et al. 1977; Wiessner 1983). "The close relationship between technique and morphology gives an industry its characteristic features" (White 1963:4). Morphology is the product of skill and style. The production of projectile points involves problem-solving. The knapper must visualize the finished point and know what steps to take - and in what sequence - to produce the desired object. Problem-solving represents aesthetic choices (Adams 1973:276). Aesthetic choices are expressed stylistically. Style is communication. Projectile point morphology is message embodied in material form through technique. The knapper's ability to faithfully reproduce the mental template determines whether or not the finished point accurately conveys the desired message.

Because members of the same cultural group share a basic

idea of what a projectile point should look like, those points that most closely meet the agreed-upon form are considered "better" than others (Wiessner 1983). Symmetry is an important characteristic of quality points according to the Kahalari San (Wiessner 1983:262). A knapper who produces symmetrical points that look alike is considered more skillful than one whose points are asymmetrical and disparate in appearance (Wiessner 1983:262).

According to the information presented above, hunters whose primary game resource is very large, fierce, and unpredictable and who live in a cultural system that is economically dependent upon projectile point technology would manufacture their weapons as carefully as possible. Based upon the connection between stress and magical thinking, they would develop hunting ritual to aid them in their pursuit of potentionally lethal prey. Projectile points would be incorporated into ritual activity. Theoretically, projectile points set aside for such purposes would be distinguished by a "marked difference in workmanship" that would identify them as ritual objects: they would be beautifully made. If procurement of the primary game resource is seriously impeded, rital activity, theoretically, would intensify. One result of the heightened spiritual activity would logically be the production of a beautiful projectile point style.

Two cases in which projectile points have been utilized

in ceremonial contexts are discussed below. The first case, an account of Joan Gero's archaeological investigations at Huaricoto, involves the ritual use of projectile points by a prehistoric society. The second, based on ethnographical accounts of the inhabitants of Arnhem Land, Australia, illuminates an ideological milieu in which projectile point production is ceremonialized.

In her work at Huaricoto, Gero found that projectile points were used in a ceremonial context during the pre-ceramic and Initial period (Gero 1991). They were characterized by "more formal, standardized morphological definitions and by (more valuable) exotic raw materials" than those in non-ritual contexts (Gero 1991:184). Her explanation for the special attention given to ceremonial points is that they were substituted for, or used in conjunction with, meat which was a highly valued resource, in ritual offerings. During the Initial period, a much higher percentage of projectile points was found in the "ceremonial sectors' of temple and plaza...and ceremonially prepared hearths" than in later periods (Gero 1991:183). As the economy shifted from big game hunting to agriculture, the percentage of carefully-made points decreased and the use of local lithic materials increased (Gero 1991:184). Prestige simultaneously shifted from projectile points to other social accoutrements (Gero 1991:186).

In the quarries of Ngilipitji, located in northeastern

Arnhem Land, Australia, the aborigines mined a highly prized, finely-grained, pinkish-grey, silicious quartzite (Jones 1990:26). It was referred to as *larr djukarr*: "fat, flaking stone" (Jones 1990:26; Tacon 1991:203). The stone quarries were connected to powerful ancestral, spiritual beings through the belief that the stone represented the ancestors' bones. The quartzite mined in the quarries embodied the cosmological concept of *bir' yun* which refers to the brilliance of shimmering light. It is exhibited not only by sparkling stone, but also by fat, blood, and purple hematite. *Bir' yun* represents life and Ancestral Beings (Jones 1990:28; Tacon 1991:198). The aborigines "profoundly believed that they curated the natural environment; that through their actions, they sustained the life forces which allowed the renewal of species; that without their intervention, the land might return to its pre-dreaming chaos" (Jones 1990:32). Ritual was the medium through which the landscape became ordered and humanized (Jones 1990:32). The Ngilipitji quarries were considered sacred places of great *marr*, i.e. spiritual essence. If too much *marr* was concentrated in one place for too long, its power would threaten the integrity of the aboriginal world. Therefore, the distribution of *marr* was imperative. This was accomplished by the production of ceremonial projectile points that were traded widely throughout Western Australia. Such points were manufactured in special places and under differ-

ent circumstances than points used in ordinary hunting (Tacon 1991:202). These points symbolized the "larger symbolic complex and belief system of which they were a part" (Tacon 1991:205). Although there were social and economic advantages obtained through the ritualized trade of ceremonial projectile points, the primary force driving the activity was "an overriding sense of obligation to fulfill the human part of the contract with the supernatural powers" (Jones 1990:45).

These two accounts demonstrate the fact that in additon to their technological role, projectile points can also embody cosmological concepts. They can play a significant ritual role in the life of a culture.

Summary

The discussion in this and previous sections supports Hypotheses 2, 3, and 6-10. Human beings act positively to structure and control their environments in the face of uncertainty caused by stress (Thoits 1994). Through ritual, they seek protection and assistance from supernatural powers. Objects directly associated with sources of stress are embued with power through ritualistic behavior. Ritual objects have sacred qualities and, because of their supplicatory nature, are usually made as beautifully as possible - they are both offerings to the gods and material expressions of the inner self. Therefore, if a society that is heavily dependent upon game procured with projectile points experi-

ences stress caused by uncertainty associated with the availability of that game, projectile points would play a significant role in game-procurement ritual. These points would be beautifully made.

In the following sections, the climate of the Great Plains and the ecological relationship between bison and human beings is examined. The findings are applied specifically to the Avonlea cultural system to establish whether or not the production of beautifully-crafted Avonlea points could have been associated with ritual game procurement stress.

V. Ecology of the Great Plains

"One of the fundamental assumptions of cultural ecology is that mankind is part of an ecosystem and is therefore limited by the environment or his abilities to alter it"
- Syms 1977:10

"Plant cover is obviously almost always likely to stand in relation to culture. It largely expresses climate; it tends heavily to determine the fauna; and it enters directly into subsistence..." - Kroeber 1969:350

A basic tenet of my thesis is that projectile point form can be influenced by stress. I have postulated that climatic conditions could be the source of such stress. In this section, I discuss the impact of climatic conditions - especially drought - upon ecological relationships and the way archaeologists use climatological data to interpret the prehistoric material record. Because my thesis focuses on a point style that apparently originated in the Great Plains, I concentrate on this grasslands ecosystem; specifically, the relationship among climatic conditions, vegetation, bison herds, and human populations. I demonstrate that prehistoric populations who depended heavily upon bison for sustenance would be compromised by climatic changes that adversely affected bison herds.

Paleoclimate and the Archaeological Record

In interpreting the Holocene, Plains archaeologists often refer to a climatic model developed by Reid Bryson. This model (Figure 1) depicts the environment in terms of "short episodes of climatic stability caused by rapid climatic shifts" (Antevs 1955:322). Each period in this

	Climatic Episode (Bryson & Wendlund 1967)	Climatic Conditions
A.D. 1850		
	Neo-Boreal	Cold, moist; cool summers
A.D. 1550		
	Pacific II	Warm, moist
A.D. 1450		
	Pacific I	Drier, cooler
A.D. 1250		
	Neo-Atlantic	Warm, more moist
A.D. 870		
	Scandic	Warm, arid
A.D. 280		
	Sub-Atlantic	Cool, cloudy; hot summers
B.C. 950		
	Sub-Boreal	Cooling trend; increased moisture; essentially modern
B.C. 2730		
	Atlantic IV	Return to maximal warm temperatures
B.C. 4050		
	Atlantic III	Increased precipitation
B.C. 4500		
	Atlantic II	Maximal warm temperatures and aridity
B.C. 5780		
	Atlantic I	Shift to summer-dominant storms; warming trend
B.C. 6500		
	Boreal	Wind intensity peaks; drying and seasonality trends continue
B.C. 7700		
	Pre-Boreal	Cold, drying winds; increased seasonality (winters colder, summers warmer)
B.C. 8550		
	Late-Glacial	Warming trend, glacial melt; winter-dominant storms; relatively low seasonality

Figure 1. Chart of Paleoenvironmental Periods of the Great Plains (Munson 1991)

model is characterized by a change in a dominant set of climatic conditions as well as fluctuations within a particular set. The model is based on the premise that historic data can be extrapolated to prehistoric situations in order to ascertain the environmental situation at any given time (Bryson and Murray 1977).

The most influential force in the determination of climate is the sun (Bryson and Murray 1977:133). The uneven distribution of heat generated by the sun results in the development of air currents that determine the earth's atmospheric conditions and, therefore, its climate (Bryson and Murray 1977:133). By understanding the effect of the sun upon the earth's atmosphere and the tangible results of that effect, archaeologists can infer paleoclimatic conditions by analyzing pollen profiles, plant microfossils, paleosols, and other geological data (Hoffman and Jones 1970:359).

"Climates are most directly related through a continuous westerly air flow, at high altitudes, around the earth's poles" (Bryson and Murray 1977:13). Variables involved in the production of climate are the patterns of air circulation at and above the earth's surface, precipitation, effective moisture (precipitation minus evaporation), net radiation, wind speed, and wind direction (Barnosky et al. 1987:315). "...numerically small changes in climatic variables may produce significant environment changes..."

(Bryson 1974:759).

Variations in the pattern of the westerlies affect the overall pattern of air circulation around the globe. In North America, climatologists have shown that "(A)n expansion of the pattern of westerlies, the flow around the pole, would bring arctic air further south - and cause the (boreal) forest to retreat from its northern boundaries..." (Bryson and Murray 1977:28). When, however, the westerlies are contracted around the pole, moist air from the Gulf of Mexico can penetrate into the plains.

Changes in atmospheric circulation bring changes in temperature and precipitation (Bryson 1974:754). In mountainous regions without moisture surpluses, where "the pattern of rainfall is uneven and derives in part from the wind direction and local topography," even small decreases in precipitation can be devastating (Bryson and Murray 1977:7), resulting in drought. Evidence of drought can be found in old, filled arroyo channels exposed in the walls of modern arroyos, by a "maxima of grass-chenopod-composite pollens, low lake levels, wind erosion, calichification, and narrow tree rings (Antevs 1955: 320).

"... a reliable record of climate in one place does not necessarily describe the climate 50 miles away. Increased dryness in one area may be accompanied by increased moisture in an adjacent area (Hoffman and Jones 1970:361). For an area of diverse topography, such as the Great Plains, paleo-

climatic data from one locale may not be applicable to another locale even within the same time period.

The Bryson model portrays ecotones as the areas most sharply affected by climatic oscillations. The Great Plains region, characterized by many diverse, adjoining habitats, i.e. ecotones, pulsates with climatic oscillations. The concept of "ecotones", however, has not been well-defined, even by ecologists (Rhoades 1978). The environmental and ecological nature of these particular habitats may have been quite different prior to intensive human settlement and/or cultivation. Paleoclimatic conditions have to be interpreted carefully, especially in an area as volatile as the Great Plains.

In order to assess whether or not an archaeological population experienced stress due to environmental conditions, archaeologists must be sensitive to the many variables involved in the composition and regulation of ecosystems. Accurate interpretation of the archaeological record of the Great Plains must be based upon the "dynamic, periodically fluctuating nature of the shortgrass ecosystem" (Rehrer 1978:39).

The Grasslands of the Great Plains

The Great Plains is a vast geographic area of diverse topography that extends from northern Canada to the Rio Grande and eastward from the Rocky Mountains for approximately 400 miles (Coupland 1958:277). Elevations range from

1500 feet to 5500 feet (Coupland 1958:276). Soils vary from the brown soils of arid locales to the rich, dark chernozem soils of more humid areas. The area of concern in this study is the northern portion of the Great Plains situated between the Wyoming-Colorado boundary and Calgary, Alberta.

The northern portion of the Great Plains consists of "terraced plains, wide valleys, isolated mountain remnants such as the Black Hills and the Cypress Hills, as well as ridges, hills, cliffs, and flat-topped buttes" (Syms 1958: 15). There are four major biomes: grassland/steppe, deciduous forest, coniferous forest, and alpine forest (Hoffman and Jones 1970:357). The latter two are found in isolated mountain/hill ranges (Hoffman and Jones 1970:357). The vegetation patterns are basically zonal and are determined by elevation (Barnosky et al. 1987:293).

Climate

"The grassland biome, especially the western portions, has the most variable climate in North America" (Rehrer 1978:32). The region is semi-arid, receiving approximately 15 inches of rain per year (Rehrer 1978:32). "The climate of the Great Plains is controlled largely by the rain shadow of the Rocky Mountains which intercept a westerly flow of Pacific air" (Baker and Waln 1985:192). This rain shadow "lengthens and becomes drier as west winds blow more strongly" (Bryson and Murray 1977:33). The portion of the grasslands covered by the rain shadow is wedge-shaped and is re-

ferred to as the "prairie peninsula." When the westerlies are contracted around the northern pole, "moist air can penetrate northward from the Gulf of Mexico" and the driest portion of the prairie peninsula contracts (Bryson and Murray 1977:29). "The plains are drier along the western edge and become progressively moister eastward as Gulf of Mexico airmasses play increasingly important roles in causing precipitation" (Bryson and Murray 1977:29). "Thus the basis for the Grassland's climate may be found, as one should expect, in the pattern of the general circulation of the atmosphere together with the orography and position of the North American Continent in the belt of westerlies" (Borchert 1950:29).

"There is much evidence for the existence of a strong mean westerly circulation pattern during the periods...from about 5000 to 1000 B.C. and again from about 400 to 1000 A.D." (Borchert 1950:38). The time period of A.D. 400-1000 corresponds with the presence of Avonlea projectile points in the northern Great Plains, although their appearance is recognized at approximately A.D. 200.

Vegetation

The Northern Great Plains has a dynamic environment. Its vegetational composition has fluctuated between forest and steppe in response to climatic conditions. "(C)hanges from parkland to deciduous forest to grassland to mixed boreal to deciduous forest to historic parkland vegetation"

have taken place over the past 2500 years (Syms 1958:33). The fluctuation is attributed to fire, grazing, browsing, and cultivation, as well as climatic variables (Syms 1958: 33).

Prior to cultivation, the Great Plains was a vast prairie consisting of four basic types of grasslands: tall grass or true prairie in the east containing bluestem (*Andropogon* spp.), panic grass (*Panicum* spp.), and spikemoss (*Sorghastrum nutans*) (Baker and Waln 1985); mixed grass to the west; short grass - buffalo grass (*Buchloe dactyloides*), grama grass (*Bouteloua* spp.), needle and thread or spear-grass (*Stipa comata*), western wheatgrass (*Agropyron smithii*), and June grass (*Koeleria cristata*) (Baker and Waln 1985; Smoliak 1956:89) extending from the mixed grass area to the foothills of the Rocky Mountains; and bunch-grass in Montana and Wyoming (Smoliak 1956:39). The mixed prairie can be subdivided into xeric and mesic types depending upon the ratio of grass types (Morgan 1979). Tall, mixed, and short grasses combine with taiga in the north to form the "Aspen Parkland" (Morgan 1979). Even though the vegetation of the grasslands appears scraggly and sparse, it is rich in available protein and capable of supporting herds of large animals (Frison 1991:8). Trees were usually found only in river valleys. Perennial forbs, sedges, and shrubs constitute the balance of grassland vegetation.

The vegetation of the grassland is adapted to a climate

of relatively dry winters and summers (Borchert 1950:34). Low precipitaion, low temperatures, and drying winds produce a short growing season (Morgan 1979) characterized by moisture deprivation (Borchert 1950:34). In order to survive, the short grasses of the steppe have "dense, fibrous, shallow root systems" designed to take full advantage of the low intensity summer rains (Morgan 1979). The initial appearance of the grasses in the spring and the length of the growing phase depend upon the level of soil moisture (Morgan 1979). The curing phase, which reduces nutrient loss, occurs at the end of the growth cycle (Morgan 1979).

Factors of significance in the production of grassland forage include number of hours of bright sunlight, seasonal mean temperature, and wind mileage (Morgan 1979). However, the most significant factor is the amount of rainfall during the months of May and June. May-June precipitation is "more closely related to forage production than any other factor studied" (Smoliak 1956:90).

"Mean summer rainfall decreases very sharply westwards from the 100th meridian across the Great Plains. The westward decrease is greatest across the southern Plains in May and June and across the northern Plains in July and August. There is a sharp decrease in summer rainfall from the forests of Alberta and Saskatchewan southward...to central Montana, especially in July and August" (Borchert 1950:6). There is an increase in rainfall intensity as one

goes eastward from the short grass to the tall grass prairie: not more *days* of rain, but more rain from each event (Borchert 1950:7). The short grass steppe receives significantly less precipitation than the areas further east of the Rockies (Borchert 1950:17). However, going northward from the steppe in Montana, there is an increase in actual days of rainfall with southern Saskatchewan receiving less rainfall than surrounding areas (Borchert 1950:8).

Interestingly, the earliest documented appearance of the Avonlea projectile point style is in southern Saskatchewan. The initial appearance of this projectile point in an area that receives less precipitation than areas around it indicates that there might be an association between environmental conditions and projectile point morphology. If a lack of precipitation resulted in poor vegetation and reduction in herds, human societies in this area may have been stressed. In reaction to either an anticipated or actual loss of control in resource - especially bison - procurement they might have produced a beautifully-made projectile point style that was used both in ritual and the actual hunt. The production of such a point would have been an attempt to restore order in their lives.

Vegetational Response to Climatic Change and Drought

"(T)he character of the grasslands responds markedly to changes in weather conditions" (Coupland 1958:286). "Effective moisture... is the main limiting parameter for the pro-

ductivity" of the grasslands (Rehrer 1978:33). Areas of high elevation are much "cooler and moister than the semi-arid basins" (Baker and Waln 1985:192). Average summer cloud cover and relative humidity are lower in the prairies than in forest regions (Borchert 1950:8).

Because climatic conditions are so variable, especially summer precipitation, "the prairies are subject to more frequent and severe drought than the areas of similar average rainfall to the east, northeast, and southeast" (Borchert 1950:11). The "supreme factor in control of life in the prairie has been drought" (Coupland 1958:305). "The historic record indicates that droughts turned parts of the Plains into a wasteland in which rivers dried up, shallow lake beds became dust bowls, sloughs could no longer support water fowl, grasshopper infestations consumed most edible plants, and fires were frequent" (Syms 1977:55).

Droughts occur during periods of "abnormally strong westerly circulation" which bring "abnormally dry and warm" conditions to the area east of the Rockies (Borchert 1950: 20). In periods of drought, the "abnormally high temperatures of dry summers...are accompanied by, and are the immediate result of, below-average cloud cover and rainfall and above-average frequency of hot, continental winds" (Borchert 1950:16; Coupland 1958:285-6).

Drought produces "significant losses in grass biomass and basal cover" (Borchert 1950:33). The early years of

drought are characterized by a rapid decrease in plant density with concurrent loss of shade and debris resulting in a loss of soil moisture which exacerbates and promotes the adverse conditions associated with the onset of drought. With extended periods of low moisture, 70-90% of the biomass can be lost (Borchert 1950:33).

This loss "can be equated with drastic reductions in carrying capacity" (Borchert 1950:33). During the drought of the 1930's, the *Bouteloua-Buchloe* (short grass) community dropped to one-quarter of its original numbers; the *Andropogon scoparius* (tall grass) community experienced a 60% reduction. By the late 1930's, the basal cover was 5% or less of its original size in 40% of the mixed prairie ranges studied from Oklahoma to South Dakota. From 1933 to 1937 in southeastern Montana, there was an 88-98% reduction in the density of dominant grass species under moderate grazing conditions (Borchert 1950:33). This condition translated into a 64% loss in carrying capacity from 1933 to 1934; in 1936 the carrying capacity was 23% less than in 1934 (Coupland 1958:288). In southeastern Alberta in 1936, seventy acres of grassland were required to produce the same amount of forage that twelve acres produced in 1942 (Coupland 1958: 288). When forage decreases, herd animals must seek food in other areas or starve. Human populations that depend upon the herds must follow them, resort to other forms of subsistence, or starve (Syms 1970:55).

In mixed communities of mid and short grasses, mid-grasses usually are eliminated earlier than short species (Coupland 1958: 302). Grasses that develop in the early spring may evade the effects of drought and increase their numbers (Coupland 1958:305). Response to drought varies in different regions for the same plants (Coupland 1958:308). Drought causes a "reduction in forage yield" (Coupland 1958: 286). Reduced plant height is the first step in reduced forage yield. During prolonged drought, it is followed by a reduction in vegetation (Coupland 1958:287). The effects of drought occur sequentially: first comes wilting; then, straw-like coloration; finally, the bluish-gray color of death (Coupland 1958:291).

Recovery from drought, under conditions of sufficient moisture, can take place in four to six years (Coupland 1958:291). Rate of recovery depends on the kind of pre-drought vegetation, the degree of depletion, the type of survivors, the dust damage, the amount of grazing and trampling during recovery, and the amount and distribution of local precipitation (Coupland 1958:297). In areas where buffalo grass (*Buchloe dactyloides*) - a short grass - is present, recovery is fairly rapid, under the proper conditions, due to its ability to reproduce stoloniferously (Coupland 1958:297).

Ever since records have been kept, "(l)arge droughts have characteristically affected the Great Plains about

every 21 years" with the most severe droughts occuring every other time (Rehrer 1978:32). "Drought periods of 35 or more consecutive days may be expected annually and periods of between 60 and 70 days once in 10 years. Less frequently a drought period may reach 90 days in the northern Great Plains..." (Coupland 1958:283). Major droughts occurred in 1889, 1890, 1894, 1901, 1910, 1917, 1930, 1931, 1933, 1934, and 1936 (Borchert 1950:12).

During drought years, the April-June rains are not as altered as the July-August rains (Borchert 1950:12). The following excerpt from the July 1901 issue of Monthly Weather Review vividly describes conditions during a drought:

> The one overshadowing feature of the weather of the month was the long and practically unbroken period of intense heat and drought that prevailed during the month over the great central valleys of the country. The blighting effect of the merciless rays of the sun day after day, supplemented by an almost entire absence of rainfall, threatened the great agricultural regions with ruin so widespread and disasterous to be scarcely estimated.

During this same time, conditions in the Ohio Valley were "distinctly tropical"; cloudiness and precipitation were unusually high in the southeastern states (Borchert 1950:15).

Drought can "create severe stress without actually eliminating a particular habitat" (Butzer 1971:508). "Re-establishment of...original environmental conditions ...would...entail the fragmentation of ranges and a compli-

cated process of ecological shifts and readjustments for both plants and animals" (Butzer 1971:508).

The Grassland-Bison-Human Ecological Relationship

Even though bison alone were not "entirely sufficient for support of a Plains adaptation" (Rehrer 1978:28), "(t)he people of the Plains were dependent upon the bison and constructed their material culture, socio-economic system, and nomadic existence around its acquisition" (Quigg 1978: 53). "Throughout the Northwestern Plains region, bison served as the primary subsistence focus for its aboriginal occupants" (Quigg 1978:53). Bison behavior largely dictated human economic activities (Frison 1972:18). These activities were organized in a seasonal round based on "mobility, aggregation, and dispersion...attributed largely to seasonal variation in buffalo behavior and numbers" (Rehrer 1978:29). Human predation on bison is affected primarily by two basic factors: migration and sex. Seasonal migratory behavior determines the location and size of the herds. Sexual behavior influences herd composition and disposition.

Bison Migration and Movement

Bison migration has been described as a "locally roaming movement in a generalized region" (Quigg 1978:43). Movements are dictated by seasonal change and forage availability. There is a "fundamental zonal regularity ...from one season to the next. Superimposed upon these zonal or regional patterns were a number of local, as well as tempor-

al, variations" (Moodie and Ray 1976:46). Bison herds frequent large areas that are divided into summer and winter ranges (Moodie and Ray 1976:46; Morgan 1979:121).

Basically, bison inhabit the open prairie in the summer and the sheltered, wooded foothills in the winter (Quigg 1978: 53; Moodie and Ray 1976: 46). Bison appear to be more nomadic in the summer, i.e. wider-ranging and dispersed (Morgan 1979:121). However, the extent of the roaming depends on the nature of the herd - some herds wander less than others (Morgan 1979:121) - and the availability of forage. Since grasses and sedges are a bison's major foods, the herds seek areas where these vegetation types are most prolific (Morgan 1979:60).

Bison tend to leave the summer range throughout August and September (Morgan 1979:60). Factors stimulating movement to the winter range include availability of water and superior forage. The curing stage for vegetation in the winter range comes later in the year than on the summer range. Winter range vegetation, therefore, is more desirable during the late summer and early fall than the grasses on the open plains (Morgan 1979:60). Movement to the summer range is stimulated by the appearance of new grass in the spring (Morgan 1979:60). Although a migration between summer and winter ranges is normal, if forage is available in one location throughout the year, bison will not migrate (Morgan 1979:133). In situations where mild winters enabled

bison to remain on the summer range for protracted periods, human groups who moved onto the winter range in accordance with the normal seasonal cycle may have experienced hardships until the bison appeared (Morgan 1979).

"For groups on the Plains, the normal reaction to seasonal movement of bison was to hunt them in large groups when they gathered in vast herds during the summer, and then divide into bands to hunt smaller herds during the winter" (Syms 1977:52; Arthur 1974). If the bison congregated in large herds during the winter, then the people who hunted them could remain in larger groups.

Bison Behavior

The average bison male weighs 1800 pounds, stands six feet at the shoulder, and is between ten and twelve-and-a-half feet long (Soper 1941:398; Arthur 1974:45). Poor eyesight makes bison dangerous if confronted unexpectedly (Soper 1941:399). Their keen sense of smell enables them to detect predators and take flight before they themselves are detected (Soper 1941:399). They possess great agility and strength. "Considering the huge bulk, [the bison's] ability to wheel and charge with swiftness and deadly impact from a standing position, is not the least amazing" of its traits (Soper 1941:401).

There are two basic types of bison herds: the cow/calf herd and the bull herd (Arthur 1974). Cow/calf herds are composed of a cow and her offspring of the previous three or

four seasons; larger herds are generally an agglomeration of smaller cow/calf herds. Bull herds are composed of young bulls who remain somewhat apart from the cow/calf herds except during the rut. However, bulls are never far from the larger cow/calf groups and are ever-ready to protect the young (Soper 1941). Additionally, there are lone bulls whose positions of dominance have been usurped by younger, stronger males.

Knowledge of the behavior of one group or individual is not necessarily applicable to all bison. "The actions of the individual herds are quite conflicting. While some are notably phlegmatic, others again snap into flight almost instantly upon detection" (Soper 1941:398). "Between the extremes exemplified in the ultra bold and the excessively timid, every conceivable shade of attitude and behavior is displayed; all of this goes to show that, as a reactionist, the ways of the buffalo can never be accurately predicted" (Soper 1941:398).

During the rut, from early July to late September, behavior becomes especially aggressive and unpredictable (Morgan 1979). "The males were fighting in every direction, with a fury which I have never seen paralleled...There were many hundreds of these battles going on at the same time..." (Soper 1941:391). "(I)n the confusion of roaring and running, bellowing and tramping, the volume of noise rolled, said plainsmen, two or three miles away" (Soper 1941:391).

Bison Hunting

Prehistoric bison hunting was a dangerous and somewhat unpredictable undertaking (Arthur 1974; Soper 1941:399; Schaeffer 1978: 244). Because of the size, tremendous power, and unpredictable nature of the bison, successful bison hunting required stamina, intelligence, courage, and knowledge of herd activities and disposition. Bison were hunted by stalking, surrounding, driving, and jumping (Arthur 1974:46; Kehoe 1973). Although the first three techniques could be practiced on any number of bison, some investigators believe that in order for a jump to be successful, a minimum of perhaps 100 animals was required (Kehoe 1973). Jumping and pound-driving probably required the involvement of at least twenty adults and required sophisticated preparations (Kehoe 1973; Frison 1991; Frison 1972). Bison jumping took place in winter as well as summer (Arthur 1974).

Although herds are more sedentary in the winter than in the summer, their presence is never guaranteed (Arthur 1974). Even though they once populated the plains in huge numbers, there were times when bison could not be found (Arthur 1974; Rehrer 1978: 28).

Evidence, both ethnohistoric and archaeological, supports the existence of ceremonial and ritual activities in conjunction with bison procurement (Kehoe 1973; Frison 1972; Frison 1991; Syms 1977:90). According to information pre-

sented earlier in this paper, the danger and uncertainty associated with bison hunting and the importance of the bison in the lives of the Plains people, would stimulate supplication of supernatural powers for assistance and protection in hunting endeavors. Such supplication would become increasingly important if bison procurement was threatened. In situations where adverse climatic conditions reduced or dispersed the herds, ritual activity would most likely increase and intensify.

Impact of Climatic Conditions

Even though bison are capable of tolerating a wide range of environmental conditions (Hoffman and Jones 1970:380), they are sensitive to climatic change. "(B)uffalo numbers could fluctuate significantly in response to climatic variation" (Rehrer 1978:29). Although exact data on bison population densities under such conditions do not appear to exist (Rehrer 1978:34), severe winters and drought seem to be the two climatic situations with the greatest adverse impact upon bison.

Severe winters take a toll among the newborn and sickly and, if severe enough, can destroy entire herds. In 1839, "a winter occurred of unexampled severity and depth of snow ...nearly all the herds perished, and never recovered their footing" in the northern reaches of the Great Plains (Soper 1941:404).

A drought has equally serious repercussions for bison

populations. In the late 19th century, a 20% decrease in precipitation would have resulted in a 50-75% decrease in the bison population based on the carrying capacity for cattle (Bryson 1974:754), i.e. 660 pounds of forage per month for a mature beef cow (Smoliak 1941:91).

Before perishing, bison will attempt to find refuge from adverse conditions. Extreme cold and snowfall are difficult to escape, but conditions of drought can be evaded, at least temporarily, by seeking water and forage in less-stricken areas, such as foothill environments (Rehrer 1978:35; Morgan 1979:145). During drought, herds would, theoretically, congregate near water sources and remain for shorter periods on the summer ranges (Morgan 1979:183). This situation, in turn, would affect the activities of the human populations that depended upon them.

Summary

Human existence on the Great Plains could be severely impacted by adverse climatic conditions. Adaptive behavior for prehistoric people who depended heavily upon bison for subsistance was regulated by circumstances which either favored or impeded bison procurement. During adverse conditions, some relief could probably be obtained through trade (Syms 1977:59). However, if trade networks were dissolved or obstructed, individual groups would be left to their own devices. Under such conditions, stress would increase and, theoretically, so would ritual activity.

"Investigation of the response of cultural systems to stress caused by buffalo population fluctuations will... depend upon definition of the frequency and amplitude as well as other characteristics of climatic events" (Rehrer 1978:29). In the next section, I present the results of my investigation of the Avonlea cultural system.

VI. The Avonlea Cultural System: Description, Data, and Analysis

In this section, I examine the archaeological and paleoenvironmental records associated with the Avonlea point style. I discuss my methodology and the problems I encountered, present background information on the Avonlea projectile point style, and address my hypotheses in terms of information taken from site reports. I conclude the section with a comparative analysis of data obtained from both selected site reports and a collection of projectile points.

Methods and Problems

I studied reports from as many Avonlea sites as possible to obtain information about projectile point measurements, stratigraphic isolation and/or admixture of point types and varieties, lithic materials, faunal species and relative abundance, seasonality, site type, associated artifacts and features, evidence of stress and/or ritual, and the relationship between Avonlea people and their immediate predecessors, contemporaries, and successors. I was especially interested in information about projectile point aesthetics (defined by shape, flaking attributes and lithic materials), association of projectile points with archaeological features of possible ritual significance, and distinctions between projectile points and other tools.

My attempts to collect and compare data in a meaningful way for many of the above categories were frustrated by lack

of data; collection of consistent data from all of the categories was impossible. There is no standard procedure for the collection and reporting of archaeological data from the Plains (Hudecek- Cuffe 1992:329; Davis and Fisher 1988:114). The "dearth of detailed, truly comparable data from one reported Avonlea site to another" (Davis and Fisher 1988:114) and the "differences in lithic categorization and terminology and tool typologies (Hudecek-Cuffe 1992:329) make it difficult to obtain consistent data. Additionally, the Avonlea point style has not been clearly defined. Most significantly for my purposes, very little attention has been paid to the significance of projectile points as aesthetic objects. Descriptions of flaking pattern per point, lithic material per point, and archaeological provenience of specific points are not available in the literature.

I attempted to determine whether or not Avonlea projectile points had ritualistic significance for the people who produced and used them by investigating the relationship between point attributes, lithic materials, and provenience in the archaeological record. The information I needed was not consistently available in the site reports. Access to original data and projectile point collections which might have provided the necessary information was not possible due to constraints of time and expense, as well as collection inaccessability.

I was able to analyze only one provenienced collection of Avonlea projectile points: a collection of 87 points from the Fantasy kill site in northern Montana. Although the analysis of only one collection is an inadequate basis upon which to formulate substantive conclusions, I was able to develop parameters for future investigations.

Although many investigators have referred to Avonlea points as "beautiful," I needed to determine whether or not the points exhibit the qualities by which I have defined "beautifully-crafted" objects, i.e. symmetry, order, balance, harmony, and mastery of a medium. I needed to develop a method for evaluating these qualities quantitatively.

To do so, I defined beautiful projectile points as bilaterally symmetrical in notch size, notch shape, notch placement, base height, cross-section and overall shape. The symmetry of these attributes can be assessed objectively. Flaking should be well-patterned and bifacially uniform. A well-flaked point has bilaterally symmetrical flake removal and flake scars of uniform size that are rhythmically proportioned to the size of the point, i.e. proportionately small and well-aligned. All flaking characteristics should indicate that the point is the work of a master knapper: no lumps, hinge fractures, cortex remnants, etc. The sum of the parts should result in a harmonious, aesthetically-pleasing whole.

Lithic materials used in beautifully-made points should

be fine-grained with no flaws or inclusions. Color is a consideration. I looked for patterns in color, material, and quality of workmanship. I postulated that beautifully-made points would represent the finest materials available, that certain colors might be favored, and, if coloration *patterning* is present, it would be in harmony with point morphology. I also postulated that beautifully made points would be crafted from different lithic materials than other tools.

Chronological Appearance, Distribution and Origins of the Avonlea Point Style

"Evidence of Avonlea first appears in the northern Plains at about A.D. 200 and persists until about A.D. 800 to A.D. 1000" (Brumley and Dau 1988:40). It is directly preceeded by and overlaps materials referred to as Besant; it overlaps and is succeeded by Prairie/Plains - or Old Women's - material.

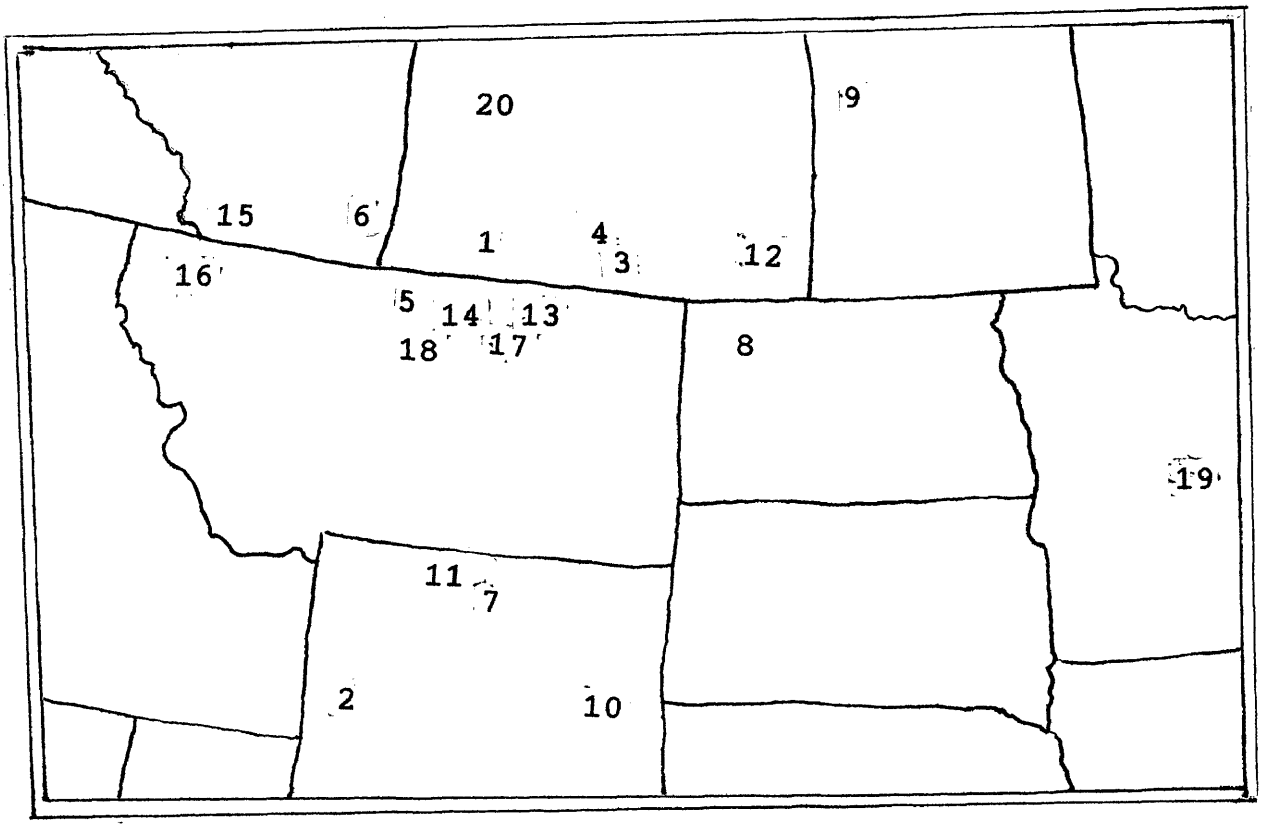
"At one time, this projectile point type was thought to have a very restricted distribution in the Northwestern Plains (i.e. exclusively in Saskatchewan, Alberta, and northern Montana)...We now find sites that contain Avonlea points unevenly distributed over the southern one-half of Alberta and Saskatchewan, southwestern Manitoba, all of Montana, western North and South Dakota and northern Wyoming" (Roll 1979:94). There are also purported Avonlea sites in Minnesota, Idaho and possibly Iowa (Morgan 1979;

Bleed 1960; Higgenbottom: personal communication; Foor: personal communication).

"The center of the point's distribution is in southwestern Saskatchewan, and sites in this locality have produced what appears to be the earliest Avonlea points..." (Kehoe 1961:137). These early points appear in Alberta and Saskatchewan at approximately A.D. 150-250 (Fredlund 1981: 46). Although some investigators state that "(T)he most recent dates come from the western and southern margins" (Roll 1988:247), this does not appear to be the case (Figure 2). Avonlea points in Minnesota, which appear to constitute the eastern extent of the distribution, also appear to be comparatively recent (Bleed 1969). "(A)ll localities exhibit dates in the A.D. 600 to A.D. 1000 range" (Roll 1988:247). "At about A.D. 1100 and the onset of the Pacific episode, Avonlea essentially disappeared..." (Fredlund 1988:171).

There are two intriguing gaps in the distribution of Avonlea points: the northeastern portion of Montana (Brumley and Dau 1988:40) and the Black Hills of South Dakota (Hannus and Nowak 1988:187). Future excavation may reveal the presence of Avonlea sites in these areas; however, at present, no Avonlea sites have been documented for them.

Several theories have been proposed regarding the origins of the Avonlea "culture." All theories fall into one of two categories: the "external introduction" category



Site	Date A.D.	Site	Date A.D.
1. Gull Lake	210±60	11. W. Shelter	700
2. Wardell	350	12. Lebret	700
3. Avonlea	450	13. Henry Smith	770
4. Garratt	500±70	14. Lost Terrace	850
5. Wahkpa Chu'gn	500	15. Manyfingers	860
6. Larson	530±150	16. LAURD	873
7. Beehive	550	17. Fantasy	930±100
8. Evans	600	18. H. Birdtail	980± 60
9. Pas Reserve	625	19. Petaga Point	1200
10. Irvine	650±100	20. Yellowsky	1230

Figure 2. Selected Avonlea Sites Arranged Chronologically

or the "indigenous development" category. Although some theories are more plausible than others, none have been unquestionably disproved.

One proponent of the external introduction school, Kehoe, attributed Avonlea assemblages to a movement of Athabascan people into the northern Plains at approximately A.D. 100-300 (Kehoe 1966:84). He described the development of the Avonlea point type as a "response to the stimulus of a new method of hunting and/or restriction on the importation of projectile point raw material" (Kehoe 1961:139). He also credited the first "indisputable evidence for large-scale communal bison hunting" to the creators of the Avonlea point style (Kehoe 1961:839). He perceived the development of a modified Avonlea occupation in the southern portion of the point-style range, i.e. the Montana-Wyoming border, at approximately A.D. 800 (Kehoe 1961:839). A portion of Kehoe's argument has been neutralized by the fact that large-scale bison driving was practiced by Plains people since at least 2000 B.C., i.e. McKean complex times (Husted 1969:95; Reeves 1983:169). There are, however, some similarities between Avonlea assemblages and the Arctic Small Tool Tradition which existed from approximately 2000 to 800 B.C. (Fagan 1991:151-163). These include the introduction of the bow and arrow, "delicate, miniature flakes," distinctive blades/knives (Meyer 1983:148), and assymetric bifaces (Reeves 1983:161). Evidence for a link between this tradi-

tion and Avonlea assemblages would strengthen Kehoe's argument.

Another proponent of the "external introduction" school is Morgan (Morgan 1979:212). Her theory is based on Syms' hypothesis that Avonlea is affiliated with Middle Woodland Laurel groups that immigrated into the Plains (Fredlund 1981:48). Morgan hypothesizes that cooler climatic conditions in the Upper Mississippi Valley and Great Lakes region at approximately A.D. 200-700 resulted in a shorter growing season which adversely disrupted the agricultural basis of Hopewellian society (Morgan 1979; Griffin 1960:32). "The gradual decline and demise of the Hopewell culture in the Ohio and northern Mississippi Valley appears to correlate well with the cold period from around A.D. 200 to A.D. 700" (Griffin 1960:28). Morgan proposes that the climatic change resulted in a resource shortage which precipitated a population movement to the Great Plains (Morgan 1979). The cooler, moister conditions in the Ohio and Mississippi valleys occurred at the same time as the dry conditions in the Plains and the Whitewater Drought in the Southwest (Griffin 1960:28).

Morgan supports her argument by citing the presence of: bell-shaped pestles (Woodland artifacts) at the Garratt and Gull Lake sites in Saskatchewan; a high percentage of Knife River Flint in Avonlea artifacts; and evidence of the bow and arrow in stratigraphic layers pre-dating Avonlea layers

at the Garratt site (Morgan 1979). She believes that the bow and arrow was introduced to the Plains from culture groups who originated east of the Avonlea heartland (Morgan 1979).

However, points in the eastern extremity of the range appear to have been affiliated with cultural deposits from a later time period than that in which Avonlea flourished on the Plains (Bleed 1969). Also, Syms' theory regarding Avonlea-Laurel affiliation has been debated: some investigators find no significant resemblance between Avonlea and Laurel ceramic ware (Morgan 1979) while others do (Meyer, Klimko, Finnigan 1988:39).

Proponents of indigenous development endorse an *in situ* development of the Avonlea point. "Since it is improbable that such a finely produced artifact suddenly appeared in its highly developed condition devoid of any relatable prototype, it may be presumed that Avonlea point makers appeared rather suddenly on the plains scene from some dis4tance away" (Davis 1966:113). Reeves states that Avonlea is an "indigenous outgrowth of Pelican Lake" prompted by the diffusion of the bow and arrow from British Columbia (Reeves 1983:166). He theorizes that the point style originated in southern Alberta and Saskatchewan at approximately A.D. 200. It progressed south at approximately A.D. 400-700 and east into South Dakota at approximately A.D. 800-1000 (Fredlund 1981:46). In Reeves' universe, Avonlea is a phase of the

Tunaxa tradition and existed simultaneously with the Besant phase of the Napikwan tradition (Reeves 1983:164).

Brumley and Rennie also believe that Avonlea people are descendants of the Pelican Lake culture group (Brumley and Rennie 1993:33). In their scheme, Avonlea is a phase of the Alsask tradition. They distinguish several divisions within the Avonlea phase based upon differences in assemblages. Brumley and Rennie detect fine craftmanship in Avonlea points and attribute it to ritual associated with the adoption of the bow and arrow (Brumley and Rennie 1993:43).

Regardless of theoretic preference, it is fairly certain that Avonlea scholars would agree that "(w)hatever its actual ethnic reference or geographic area of origin, the Avonlea point and attendant culture remain somewhat enigmatic" (Davis 1966:113).

Avonlea Assemblages

Avonlea assemblages are characterized by "delicate, well made projectile points and distinctive pottery" (Klimko 1985:64) and are usually associated with bison kill middens (Johnson 1970:51; Syms 1977:92; Kehoe and McCorquodale 1961:181). The pottery may be conoidal, fabric-impressed, bossed, punctated, and/or parallel-grooved (Johnson 1970:54; Fredlund 1988:141). Net-impressed and parallel-grooved ceramics are seldom found at the same site (Fredlund 1988: 142). Net-impressed pottery appears most commonly in the Prairie Provinces of Canada; parallel-grooved is most often

found in Montana and the Dakotas (Fredlund 1988:142). Knives are characteristically bifacially chipped, sharpened on one edge only, and formed from either thick triangular or rectangular flakes (Johnson 1970:54). Asymmetric bifaces may also be characteristic (Reeves 1983:161).

According to some investigators, the Avonlea point is usually "the sole type in the stratigraphic layer in which it occurs" (Kehoe and McCorquodale 1961:179; Johnson 1970: 51). Admixture with other points occurs in unstratified sites or as a result of post-depositional disturbance (Johnson 1970:51). One author states that his perusal of the archaeological literature indicates that pure Avonlea components do not exist (Ruebelmann 1988:199).

The Avonlea Projectile Point Style

A description of the Avonlea point is offered by Kehoe and McCorquodale:

> "The most distinguishing feature of the Avonlea point is its delicate aspect, produced by the thinness of the blank struck off for the point. Flaking on the Avonlea points is extraordinarily well-executed, contributing to the delicacy of the projectile point...flake scars as a rule are so shallow and well-executed they can hardly be noticed. Even when irregular and conchoidal flaking occurs, it is evident that the workman had excellent over-all control of his method. It is indeed rare to find an Avonlea point on which both faces are less than entirely dressed...Small, shallow, but fairly wide side notches are placed extremely low on the blade of Avonlea points...The notches are always symmetrically opposed and equidistant from the base...the edges of the triangular blade are very regular, and frequently exhibit fine serration...The base may be wider, equal to, or narrower than the proximal end of the blade...Usually, the corners of the base are

> rounded, rather than sharp...small ears are typical, projecting at about a 65 angle to the longitudinal axis of the point"
>
> (Kehoe and McCorquodale 1961:184).

According to this description, Avonlea points do exhibit symmetry, order, and mastery of the medium. Other investigators concur: "an almost indescribable feel, which results from an extraordinarily fine chipping technique...The fineness of overall chipping is emphasized by the delicate thinness of the points" (Forbis in Morgan 1979:321); "the high quality of workmanship" "particularly evident in earlier Avonlea assemblages which have at times been referred to as `classic' Avonlea ..." (Brumley and Rennie 1993:42); "fine lithic craftsmanship" (Duke 1988:268).

Avonlea points are more finely crafted than other points from the same time period. Besant points are characterized as bulky with irregular/oblique thinning, obvious and off-center body ridges, and the presence of cortex (Duke 1988:268). "Old Women's phase shared more attributes with Besant than with Avonlea" (Duke 1988:268).

The delicate appearance of Avonlea points is the result of a knapping process that produces "thin expanding ovoid flakes produced by a billet...then modified into a triangular preform and finally notched by a pressure technique" (Fredlund 1981:190). "The removal of flakes from a core to produce Avonlea points entails the production and selection of extremely thin and relatively wide interior...

flakes" (Stanfill 1988;254). "The ability of the knapper to produce a relatively flat flake was a key to the success of this process...the direction and force of the blow were critical..." (Fredlund 1988: 176).

How does one judge whether or not Avonlea knappers were `masters of their medium'? Opinions differ with regard to the level of skill required to produce thin flakes and small, low-placed notches. On the one hand, it has been suggested that the "extremely small notches and extremely thin preforms required skilled knappers" and that only master flintknappers possessed the ability to produce these points (Fredlund 1988:178). On the other hand, several contemporary flintknappers have stated that small, thin flakes and small, shallow notches can be produced quickly, with minimum effort, and with "less breakage potential" than other kinds of points that require greater notch depth (Stanfill 1988:255) and the skill required to produce technically demanding points is not necessary for the production of Avonlea points (Higgenbottom:personal communication; Herbort:personal communication).

"The strategy followed in producing Avonlea points focuses on extreme efficiency: minimum investment of time and energy for maximum production of intended functional product" (Fredlund 1988:252). "Avonlea assemblages... consistently exhibit even greater efficiency in manufacturing strategy than any other assemblage of the Late

Prehistoric period, and any other period for that matter" (Fredlund 1988:252). "There is little waste and little risk of failure, little time invested and maximum productivity in comparison to other projectile point manufacturing strategies" (Fredlund 1988:255).

The impression of at least a few contemporary knappers is that the aesthetic appeal of the Avonlea point is incidental - a side effect of an attempt to produce a projectile point in the most efficient manner possible. However, a projectile point can still be functional and not be beautifully shaped and flaked (Fredlund 1988: 176). The symmetry, delicacy, bifacial flaking, and lithic materials attributed to Avonlea in the literature indicate that the prehistoric artisans who crafted these points designed many of them to be beautiful as well as functional.

The Issue of Type

Although the description of Avonlea points quoted from Kehoe and McCorquodale indicates that Avonlea points are uniform in space and time, in reality there is variability within the point style. Some investigators have discerned patterns in the variability which have prompted them to distinguish different varieties.

Three Avonlea varieties have traditionally been recognized (Figure 3): Gull Lake, Timber Ridge Sharp-eared, and Carmichael Wide-eared (Kehoe 1966:829-830). These varieties were initially recognized by Kehoe in his work at

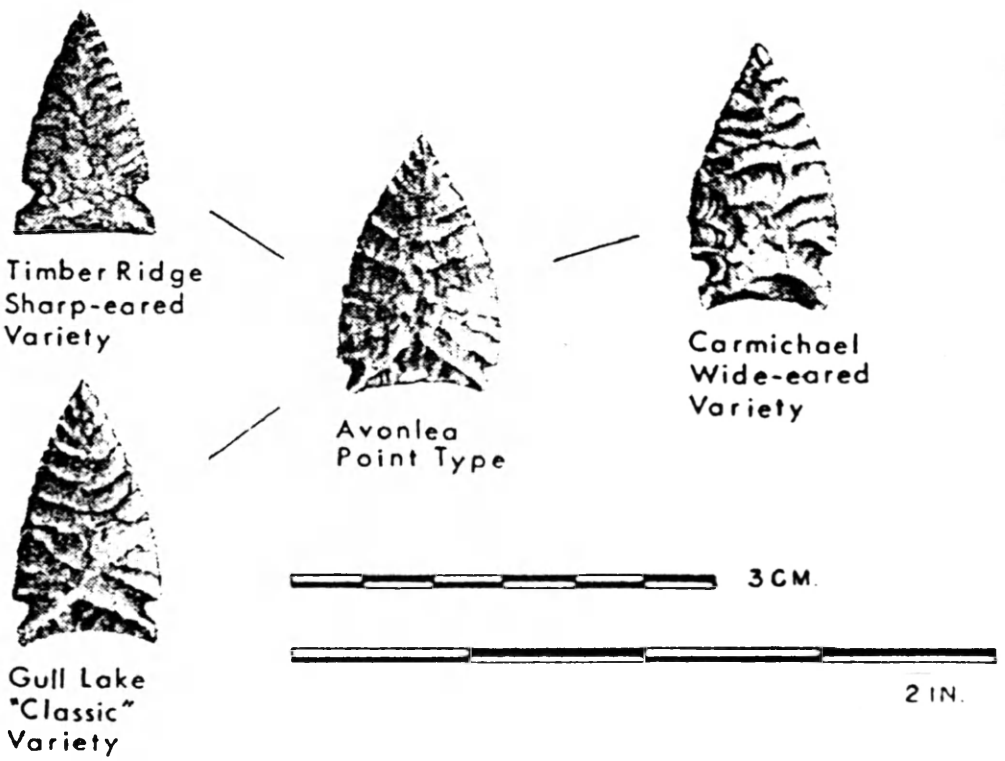


Figure 3. The Avonlea Point and Varieties (Kehoe 1966)

the Gull Lake Bison Drive in southwestern Saskatchewan. "The Gull Lake variety (A.D. 250) is the `classic' Avonlea point...slightly narrower, slightly thinner, and lighter than the other varieties" (Kehoe 1966:829). "The Timber Ridge Sharp-eared (A.D. 660) is essentially similar to the Gull Lake variety, except that it is generally larger in all dimensions [and] appear[s] to be more common farther south, in northern Montana..." (Kehoe 1966:829). "The workmanship on the Carmichael Wide-eared (A.D. 730) points is markedly inferior to that on other Avonleas" (Kehoe 1966:830).

The existence of these varieties has been questioned: "...the gradation within the type is such that frequently it is impossible to assign a point to one of Kehoe's particular varieties. Thus, in view of the expanded data, it is perhaps no longer advisable to distinguish these varieties of Avonlea points" (Johnson 1970:46). The fact that some archaeologists recognize the varieties and others do not complicates interpretation of the data.

Investigators originally thought that as distance from the Saskatchewan "hearth" area increased, the quality of Avonlea craftmanship decreased. The term "degenerate" was applied to points which retained the hallmarks of the Avonlea style, but exhibited inferior workmanship: "`Degenerate Avonlea', although not well defined, is used to designate points which are Avonlea-like, but later in time, and which exhibit not nearly as fine a workmanship as true

Avonlea points" (Johnson 1970:48). However, as information regarding Avonlea sites increased, it was found that "data do not...tend to support the hypothesis that Avonlea points on the southern periphery of the region defined by Kehoe and McCorquodale are less true-to-type than the `classic' Avonleas. Rather true-to-type Avonleas extend to the farthest known southern limit of Avonlea distribution as well as to the eastern and western limits...a comparatively uniform distribution of `classic' and degenerate Avonleas exists" (Davis 1966: 112).

Further complicating the typology issue are archaeological materials from the periphery of the Avonlea distribution area, e.g. both the Benson's Butte-Beehive complex of southeastern Montana and Wyoming (Fredlund 1988:171) and the Warex phase from northwestern Montana (Roll 1988:242). These complexes contain Avonlea-like points and appear within the same time frame, but they exhibit characteristics that distinguish them from traditional Avonlea assemblages. "Many of these assemblages of projectile points have had sufficient similarity to Avonlea to permit arguing for affinities. Whether or not these affinities actually exist remains in many cases to be satisfactorily demonstrated" (Frison 1988:155). The assemblages from these sites "stand out as strikingly different from other and more numerous archaeological sites in the same area during the same time period...the Avonlea dates peak at the same time

that the non-Avonlea dates peak and...the Avonlea dates represent only a small fraction of the total dates recorded (Frison 1988:167).

Additionally, small, triangular, unnotched bifaces quite often appear in conjunction with Avonlea materials (Greiser 1988:123). "Compared with the Avonlea side-notched points from the [Fantasy] site, the unnotched points are shorter, thicker and slightly wider" (Tratebas and Johnson 1988:96). The function of these unnotched artifacts is undetermined. They may be unnotched projectile points, preforms, knives, or some other type of cutting or perforating tool. Interestingly, they are most commonly found in camp sites rather than kill sites (Tratebas and Johnson 1988:96).

Archaeologists classify projectile points according to whether or not the attributes of the point conform to those of an "aesthetic ideal" (Kehoe 1988:8). The "aesthetic ideal" defined by the archaeologist may or may not correspond to the template in the minds of the knappers. One of the frustrating aspects of the Avonlea cultural system is the lack of point style definition. As more information is retrieved from the archaeological record, investigators may be able to interpret the meaning of the stylistic variations and define the morphological parameters succinctly.

Lithic Materials

In Hypothesis 7, I hypothesized that ceremonial points are manufactured of only the finest, and possibly rarest,

lithic materials and that tools other than projectile points are made from different lithic materials.

One of the major obstacles in my study was the lack of standardization in lithic identification. Terms such as chert, flint, jasper, etc. are used inconsistently (Syms 1977:28); at times the same term is used to identify dissimilar materials. Some investigators have resorted to going no farther in lithic identification than to state that a material is or is not cryptocrystalline; this is most likely accurate, but not very informative. Some materials require inspection in thin section under a microscope in order to be reliably identified. Until lithic identification is standardized, it will be difficult to compare data from site reports in a meaningful way.

The predominant impression of Avonlea lithics is that they were locally obtained (Brumley 1990:54; Fredlund 1981: 180; Johnson 1970; Kehoe and McCorquodale 1961:184). "Avonlea lithics assemblages...strongly indicate primary utilization of locally available lithics. Evidence of use of such lithics as Madison Formation cherts, Knife River Flint, obsidian or porcellanite is generally rare in Avonlea assemblages...when non-local lithics are present they are most commonly Knife River Flint" (Brumley and Dau 1988:41).

However, some investigators have found evidence to the contrary (Davis and Fisher 1988:113; Ruebelmann 1980). Investigators at the Lost Terrace site on the Missouri River

in north-central Montana found that "(t)he presence of exotic lithics such as obsidian, Tongue River silicified sediment and salt-and-pepper Kootenai formation siltstone reflect wide-ranging interactions of these people..." (Davis and Fisher 1988:113). At the Henry Smith site, located on the Milk River in northern Montana, a large number of complete projectile points was found among bison remains suggesting that "the hunters did not attempt to reuse them, even though the materials from which they were made are scarce in the region" (Reubelmann 1980).

In a comparison of Canadian and Montana sites, Davis found that "(t)he chief differences...lay in the incidence of petrified wood and chalcedony...and frequency of siliceous siltstone... (Davis 1966: 107). Also, points fashioned from obsidian were found only in Montana" (Davis 1966: 107). Unfortunately, the identification of siliceous siltstone and quartzite is confounded by discrepancies in labeling practices between Canadian and Montana investigators (Davis 1966:108). Furthermore, contrary to Davis' findings, the use of obsidian for Avonlea points has also been documented for the Waterton Lake, Alberta region (Johnson 1970:52).

A comparison of the lithics used in the production of Avonlea and Besant projectile points reveals that Besant materials are characterized by a "higher level use of argillite and a corresponding reduced use of quartzite...

Besant and Avonlea show almost equal levels of usage of Montana chert..." (Brumley 1990:54). "(T)he Besant assemblage displays significantly higher frequencies of Knife River flint and porcellanite, and significantly lower frequencies of Bear Paw chert, orthoquartzite, Swan River chert, and natural glass" (Brumley 1990: 54). However, in the Avonlea and Garratt sites, both located in south-central Saskatchewan, Knife River flint is the lithic material from which the largest percentage of projectile points is made (Klimko 1988:27; Morgan 1979). At the Gull Lake site, in south-western Saskatchewan, petrified wood, which is very similar to Knife River flint, is the predominant lithic material for projectile points (Kehoe 1973).

I was particularly interested in the distribution of Knife River flint artifacts in the Late Prehistoric archaeological record. Knife River Flint is a dark brown, waxy-looking chalcedony that is often confused with petrified wood. Because of its "fairly uniform, non-porous texture and its conchoidal fracture, it makes an excellent tool material (Clayton et al. 1970:287). I thought, therefore, that it would be a material of choice for projectile points. Further, if it was difficult to obtain, I thought that its scarcity would have increased its value and made it desirable for the production of ceremonial points, if they existed.

"Most of the Knife River Flint used by Indians was

probably quarried from secondary sources in the Knife River valley of Dunn and Mercer Counties, North Dakota" (Clayton et al. 1970:282). Artifacts made from North Dakota Knife River flint have been found in Alberta, Missouri and Ohio. The distance between the source of raw materials and the place of artifact deposition would indicate that this material was a desirable and significant trade good. At least one cache of Knife River flint has been discovered (Syms 1977:29). The contents indicate that it was transported in "trade blocks" (Syms 1977: 29).

It is possible, however, that sources of Knife River flint may exist in eastern Montana, eastern Wyoming, southern Saskatchewan, northwestern South Dakota, and Souris, Manitoba (Clayton et al. 1970: 287). If so, rather than being a trade item, Knife River Flint would have been locally available in areas outside of North Dakota. The existence of a Manitoba source may explain the high percentage of Knife River flint in Manitoba assemblages from Paleoindian times through the Late Prehistoric.

Until the range of variation in Knife River flint is better known, it will not be possible to positively identify the source of the material from which various artifacts have been made. Investigation into an apparent discrepancy between the Besant and Avonlea assemblages in the percentage of artifacts fashioned from Knife River flint could provide further insight into the relationship between these two

co-existing archaeological populations, the social situation at the beginning of the Late Prehistoric period, and the nature of Avonlea point-producing people.

In many cases, Avonlea projectile points were fashioned from non-local materials while unnotched bifaces, other tools, and debitage were made from locally-available lithics (Quigg 1988:72; Klimko 1988; Morgan 1977; Brumley 1990; Fisher and Davis 1988). The discrepancy between the lithics of finished points and debitage indicates that projectile points were often produced in a location other than that in which they have been discovered archaeologically and other than that in which other tools were produced. The use of different lithic materials in the production of projectile points in comparison to other tools indicates that the manufacture of projectile points was an activity that occurred under a different set of circumstances. This may be the case in all lithic tool industries; I, however, can only attest to the apparent selectivity of the Avonlea industry.

In terms of Avonlea sites, Hypothesis 7 (lithic materials selected for ceremonial projectile points would be the finest available and would differ from lithics used in the production of non-ceremonial tools) can neither be totally supported nor totally rejected.

Subsistence Strategy

In Hypothesis 3, I postulated that beautifully-crafted

ritual projectile points would be produced by people who were heavily dependent upon projectile point technology for big game hunting. The archaeological record indicates that the majority of Avonlea sites are characterized by heavy reliance upon bison. The people who fashioned Avonlea points have been referred to as "bison hunters *par excellence*" (Klimko 1985:64). "The archaeological record from the region for Avonlea shows a dominant subsistence emphasis on bison, most often to the exclusion of other food species" (Davis and Fisher 1988:102). "Bison dominated the subsistence system with minor use of other smaller species" (Milne 1988:65).

Therefore, Hypothesis 3 would be supported by the Avonlea situation, assuming that at least some of the projectile points were ritual objects. However, in some areas within the Avonlea distribution range, usually on the periphery, other resources were utilized. In central Saskatchewan and Manitoba, Avonlea assemblages indicate a boreal adaptation (Meyer et al. 1988:41). The Avonlea record at the Lebret site in the southeastern Saskatchewan Parklands reveals an "...unusual faunal assemblage, most notably the presence of fish remains in large quantity" (Smith and Walker 1988:81). In southeastern Montana, Avonlea points are associated with "evidence of mixed fauna utilization and indirect, but consistent evidence for plant processing" (Fraley 1988:133). Finally, in northwestern Montana, an area outside of the

Great Plains, Avonlea points are associated with a faunal record that consists primarily of deer remains (Roll and Smith 1982).

In pondering this situation, one archaeologist asked, "Are we dealing with elements of a single widespread and very diverse culture or with two, or more, discrete cultures?" With more information and insightful analysis this question will, hopefully, be resolved.

Climate at the Onset of the Avonlea Period

In Hypothesis 5, I postulated that adverse climatic change and technological innovation can produce social stress.

"Something was apparently happening climatically at about the beginning of the Christian era" (Frison 1991:199). Archaeological and paleoenvironmental evidence indicates that during the time in which Avonlea projectile points appear in the archaeological record, at approximately A.D. 210±60, a warming trend known as the Scandic period was settling over the Great Plains. "From about A.D. 350 or 400 onward, warming occurred, accompanied by relatively dry conditions in the midcontinent..." (Wilson 1988:221). This climatic period was characterized by "decreased precipitation and higher annual temperatures" (Duke 1988:268).

In the Pine Breaks region of southeastern Montana, archaeological remains indicate increased population density at approximately A.D. 280 (Munson 1991:15-12). This corre-

sponds with the traditionally-cited date for the onset of the Scandic (Munson 1991:15-12). The population increase is attributed to an influx of people from drier regions of the Plains to the oasis-like Pine Breaks area. Interestingly, in another study of southeastern Montana, it was suggested that "an apparent drop in number of radiocarbon-dated sites could be correlated with climatic stresses of the warm, dry Scandic" (Munson 1991: 15-12). In this study, it is proposed that the Scandic began 200 to 300 years later, i.e. A.D. 600-700, than the date proposed by Bryson and Wendlund for the same climatic episode (Munson 1991:15-12).

Although the dates for the onset of the Scandic period appear to be different in different areas, there is evidence for an arid interval in portions of the Great Plains between A.D. 1 and A.D. 790 (Joyes 1988:228; Fisher et al. 1994; Davis and Fisher 1988; Wilson 1988). Evidence of a drought at approximately A.D. 200-400 may be found in evidence for "extensive arroyo formation" at this time (Fredlund 1981: 139). Investigators at the Long Creek and Mortlach sites produced the following list of drought periods: A.D. 12-60, 162-181, and 375 (Wettlaufer and Mayer-Oakes 1960:85).

During the Scandic period, the theoretical drought-like conditions would have created a reduction in both the quality and quantity of forage for bison. "(A)s the Scandic conditions persisted, lowered bison availability would have translated into severe human readaptations" (Duke 1988:269).

Such readaptations would have impacted both the material and the non-material aspects of the culture, e.g. technology and ritual.

The information presented above indicates that climatic conditions during the time in which Avonlea points appeared were deteriorating. Having explained earlier the connection between drought, vegetation reduction, and bison herd depletion, it is logical that deteriorating climatic conditions would result in stress for human populations that depended on bison for sustenance. The archaeological record for the Avonlea cultural system indicates that adverse climatic conditions could have resulted in social stress. Therefore, the first part of Hypothesis 5 is tentatively supported.

Adoption of the Bow and Arrow

I postulated, also in Hypothesis 5, that technological innovation can produce social stress. The literature contains support for this hypothesis, in general (Burkhardt and Brass 1990). However, I needed to test my hypothesis against the Avonlea archaeological record. The pertinent aspect of the Avonlea cultural system was the adoption of the bow and arrow.

The Avonlea projectile point is the herald of the wide-spread use of the bow and arrow in the northwestern Plains. Although the bow and arrow may have been known among Plains societies prior to the appearance of Avonlea points (Brumley and Dau 1988:37; Morgan 1979:213), it was

not until the appearance of Avonlea that the use of this technological system can be firmly supported. The transition from atlatl/spear to bow and arrow appears to have occurred between A.D. 1 and 200 (Brumley and Dau 1988:38). By "A.D. 600-800, all cultural complexes in the northern Plains are clearly dominated by projectile points apparently used with the bow and arrow" (Brumley and Dau 1988:38).

The advantages of the bow and arrow include "accuracy at short range and rapid fire" (Davis and Fisher 1988:114). The bow has a "longer range than the atlatl and dart, and proficiency with the former is more quickly and easily attained than with an atlatl and dart" (Frison 1991:212). An archer is able to fire accurately from a wider range of positions than an individual relying upon an atlatl (Frison 1991:212). The activity of the archer is less noticeable to the prey. If several shots are required to fell a quarry, the greater velocity of the arrow decreases the distance gained by the intended victim (Frison 1991:212). Furthermore, the various components of the bow and arrow require smaller amounts of material, can be made more quickly, and can be transported in greater quantities than those associated with the atlatl/spear (Frison 1991:212). As a superior system, bow and arrow technology would be desirable any time; if a primary game resource was becoming moe difficult to obtain, it would be not only desirable, but necessary.

Even though bow and arrow technology is highly effective

and desirable, its adoption would be stressful to some degree due to changes in the balance of power, etc. (Burkhardt and Brass 1990). If the introduction and dispersion of the bow and arrow occurred simultaneously with environmentally and/or culturally stressful conditions, the pre-existing stress could be compounded. If new technology is introduced during a period of stress, there is an even greater need for it to be successful. Therefore, the adoption of the new technology might be characterized by ritual, ceremony, and the use of the finest materials available in order to promote success in the use and manufacture of the new equipment. Support for this contention can be found in the examples offered in the Section III of this paper.

In pondering the shift from atlatl/spear to bow and arrow, one author states that "the technological shift may be more productively viewed as an adaptive response to an influence external to the lithic technological system" and that "the nature of this change is symptomatic of broad-sweeping systemic alterations which should also be evident in resource availability, procurement scheduling, technology, mobility, social organization and population dynamics" (Stanfill 1988:255-6). The second portion of Hypothesis 5, regarding the stressful impact of technological innovation, in this case, cannot be supported directly. Support may be inferred through logical argument based on technological innovation literature (Burkhardt and Brass 1990) and other

aspects of the Avonlea record.

The introduction of the bow and arrow, deteriorating climatic conditions, and the appearance of Avonlea projectile points in the Plains apparently occurred simultaneously. At this time, as a result of drought and/or extremely harsh winters, it is quite possible that bison became less available. "One or more summer droughts followed by winter famine could have left people unprepared for winter because typically dependable bison were not exploitable in late summer to early winter because of their change in range" (Davis and Fisher 1988:113). Such a situation would have impacted resource availability, procurement scheduling, social organization, and population dynamics. It would probably have resulted in increased mobility and stress. In some areas, the appearance of Avonlea points appears to have been accompanied by a population decrease and in others, an increase (Milne 1988:65; Frison 1972:16; Duke 1988:268; Munson 1991:4-2). Further investigation in these areas is needed.

Evidence of Stress

In Hypothesis 4, I postulated that stress is detectable in the archaeological record. Palynological material, the presence of dental and skeletal anomolies, reduced numbers of primary game animals, and comminuted bone can indicate stress. Archaeological evidence supporting the contention that stressful conditions existed during the time in which

Avonlea points were produced includes enamel hypoplasia and genetic anomolies in bison dentition, aberrations in faunal mortality curves, and extensively fragmented bone.

Enamel hypoplasia is defined as "lines of growth arrest, or perturbation, of enamel" (Wilson 1988:218). It is a defect that indicates nutritional stress resulting from the inability of an animal to mineralize its skeleton due to lack of protein (Wilson 1988:218). "Enamel hypoplasias record seasonally identifiable metabolic stresses, and their widespread occurrence is suggestive of environmental causes" (Wilson 1988:221). "High tooth polish and spalling suggest ingestion of grit with forage...this could help to pinpoint drought conditions" (Wilson 1988:221).

Hypoplasia has been documented at the Henry Smith (Wilson 1988: 203) and Koepke (Fisher et al. 1994:44) sites; the former, an Avonlea site and the latter, dated immediately before Avonlea. The Henry Smith site is located in northeastern Montana and is dated at approximately A.D. 770-1040. The Koepke site is located in east-central Montana and is dated at approximately 50 B.C. Both sites exhibit a high number of dental anomolies and pathologies that indicate that the "bison were under environmental stress" (Wilson 1988: 203). In addition, at the Koepke site, genetic anomolies indicate the existence of isolated gene pools - a situation resulting from a fragmented bison population (Fisher et al. 1994:44).

At the Lost Terrace site (A.D.840+100-905+180) in north-central Montana, the faunal record consists primarily of antelope - a feature that is unusual for an Avonlea site. The faunal remains are remarkable for the "disproportionately low frequencies of individuals in age groups III and IV" (3 and 4-year-olds) which may "be an effect of successive years of abnormal aridity" (Davis and Fisher 1988:109). "The broken 1st and 2nd phalanges probably had been cracked open to extract marrow, behavior that suggests marked subsistence stress" (Davis and Fisher 1988:108). "The cultural deposits at Lost Terrace are, thus, understood to be the archaeological consequences of a technical solution of food stress provoked by continuously adverse summer, fall and winter conditions (Davis and Fisher 1988:112). "It is possible that short-term or even protracted aridity in the Northwestern Plains could have led to a significant reduction in summer and autumn food procurement success for human groups. The consequent lack of storable food surpluses could have resulted in food deprivation during winter" (Davis and Fisher 1988:111).

The material record from these three sites offers evidence in support of Hypothesis 4. It also indicates that stressful conditions existed for at least some Avonlea point-using people.

Contrary to the heavy butchering of antelope at the Lost Terrace site, information gained from the bone distribution

at the Henry Smith site "indicates that many bison were not totally butchered and that much of the meat was wasted" (Ruebelmann 1980). Evidence of stressed faunal populations appears at both sites, but evidence for human stress in the form of maximum utilization of food resources exists only at Lost Terrace. This situation could mean that faunal stress does not translate into human stress. Alternatively, the Henry Smith site may have been something other than an ordinary kill site.

"The Henry Smith site consists of a complex of widely spaced features, including six drive lines, two anthropomorphic effigies, six rock cairns, 21 tipi rings and a multicomponent impoundment or pound area" (Ruebelmann 1988:191). "...the effigies, tipi rings and cairns are all roughly clustered along the east side of the drive lines about 250m south of the pound area" (Ruebelmann 1988:191). "Clearly, the anthropomorphic effigies on the drive lines near the tipi rings at the Henry Smith site must be related to some kind of ceremony that was performed as part of bison procurement" (Ruebelmann 1988:200) "It is hypothesized... that the bison utilization pattern documented at the Henry Smith site is one of small-scale drives through much of the year. Peak periods were winter...and summer..." (Wilson 1988:222). "The hypothesis of winter emphasis...with repeated small-scale drives, is unprecedented for a site of this scale in northern Montana...but agrees with evidence

from the southern Alberta chinook belt" (Wilson 1988:223).

A projection regarding the number of bison killed at the Henry Smith site, based on the fact that only 15% of the site was excavated, reveals that "...some 800 bison were possibly killed at the site over a period of roughly 200 to 250 years, for an average of about three to four bison per year" (Wilson 1988:217). More precisely, in stratigraphic layers that have been radiocarbon dated, minimum number of individuals per layer is: 12 for A.D.770±120, 12 for A.D. 850±120, 5 for A.D. 870±130, 12 for A.D. 910±110, 15 for A.D. 930±100, and 26 for A.D. 1040±100; a fairly constant rate of attrition except for the low in A.D. 870±130 which corresponds with Lost Terrace and a high of 1040±100 which falls in the Neo-Atlantic - a wetter climatic period more conducive to the well-being of bison.

If, in fact, much food was wasted at the Henry Smith site, where there is so much evidence of ceremonialism, it would be interesting to compare the extent of butchering at other Avonlea sites while, at the same time, evaluating the evidence for ceremonialism in order to determine whether or not the Henry Smith site was primarily a ceremonial site and whether or not other similar sites exist. Further analysis and comparison of the faunal remains in stratified sites would provide a more precise picture of the availability of bison throughout the Avonlea time period both site-specific and area-wide.

Ceremonialism

In Hypothesis 6, I postulated that ceremonialism was detectable in the archaeological record. Basing my thinking primarily upon Gero's work (Gero 1991), I believe that the association of projectile points with hearths and/or other features that may be affiliated with ceremonialism would indicate prehistoric ritual behavior.

Ceremonialism was an important component in the procurement of bison both prehistorically and historically. "Ethnological studies ...yield good evidence of ceremonial activity surrounding buffalo jumping and pounding on the northwestern Plains..." (Frison 1972:17). "We can assume... that there were considerable amounts of ceremonial activity associated with these Late Prehistoric period sites..." (Frison 1972:17). Although the anthropomorphic effigies of the Henry Smith site are rare phenomena (Ruebelmann 1988:194), there is evidence of ritual associated with other Avonlea sites, e.g. the association of Avonlea points with hearths (Hannus and Nowak 1988:185), ovens (Munson 1989: 10-13), petroglyphs (Munson 1989: 10-13), and ceremonial structures (Frison 1972:14).

Two investigators have suggested that the "stylistic form and high level of workmanship reflected by Avonlea points is non-functional, and instead reflects a set of ritual observances probably associated with the introduction and use of bow and arrow technology at the end of the

Pelican Lake phase" (Brumley and Rennie 1993:42). In their thinking, the variability in the quality of Avonlea points is "viewed as a reflection of how various groups... differentially adopted and/or retained the ritualism associated with the introduction of bow and arrow technology" (Brumley and Rennie 1993:43). This ritualism may have been designed, in part, to inhibit the adoption of the bow and arrow by non-Avonlea groups (Brumley and Rennie 1993:48). Conversely, it may have been designed to reinforce it among groups who did adopt it. Although there is evidence for ceremonialism in the Avonlea material record, I cannot substantiate the use of projectile points as ceremonial objects, at this time.

Summary

The Avonlea cultural system is not well-defined. Certain aspects are fairly well-established: chronological parameters, bison-based economy, remarkable aesthetic qualities, evidence of ritual, first bow and arrow point style on the Plains, and apparent association with the onset of the Scandic period. Not clearly delineated are its origins, lithic materials, geographic distribution, and its relationship to preceding, successive, and contemporary cultural groups. In the next section I compare data from specific site reports to gain greater insight into the nature of the Avonlea cultural system.

Analysis of Specific Site and Projectile Point Collection Data

In order to test my hypotheses with archaeological data, I gathered reports from a sample of Avonlea sites. I selected a sample of sites representative of both the chronological and geographic distribution of the Avonlea point style (Figure 5, p.97). I looked for information regarding projectile point measurements, lithic material descriptions, faunal remains, seasonality, and stratigraphy analysis in addition to dates, type of site, feature description, and geographic location. Eight sites provided fairly complete metric data; information in the other categories was variable. Even though it was not used in the analysis, the Petaga Point site is indicated in Figure 5 because it delineates the easternmost extent of Avonlea distribution, as far as I know, at this time.

With sufficient data, I hoped to determine:

1. the aesthetic nature of Avonlea points according to objective as well as subjective criteria
2. the existence of a ceremonial context for projectile points
3. the presence or absence of strict adherence to a specific mental template by measuring the range of variation in Avonlea points both within and among sites
4. the existence of environmental and/or cultural

stress in conjunction with the appearance, and throughout the existence, of Avonlea points

My first step was to devise a standard by which projectile point aesthetics could be measured. To do this, I applied information regarding the nature of beauty to projectile point morphology via attributes of shape, flaking pattern, lithic material, and mastery of a medium. Analysis of the projectile points from the Fantasy site collection (Plates I and II) provided information which was used to develop a measure of projectile point aesthetics.

For my analysis, lithic material was identified according to the guidelines developed by Brumley (Brumley 1990). Measurements were taken with Mitutoyo calipers No. 505-637-50 and were rounded to the nearest millimeter except when the measurement was exact to the half-millimeter. These data may be found in the Appendix.

For a point to be fully analyzed, it had to be intact or very nearly so. Some points that might have qualified as "beautiful" were damaged to the extent that the necessary observations and measurements were unobtainable. Therefore, the percentage of "beautiful" points is only approximate.

Analysis of Fantasy Site Projectile Point Collection

The Fantasy projectile point collection consisted of 87 points removed from the Fantasy bison kill site (24PH1324) in north-central Montana. Sixty-three of the points were identified by the excavator as Avonlea. Seven attributes

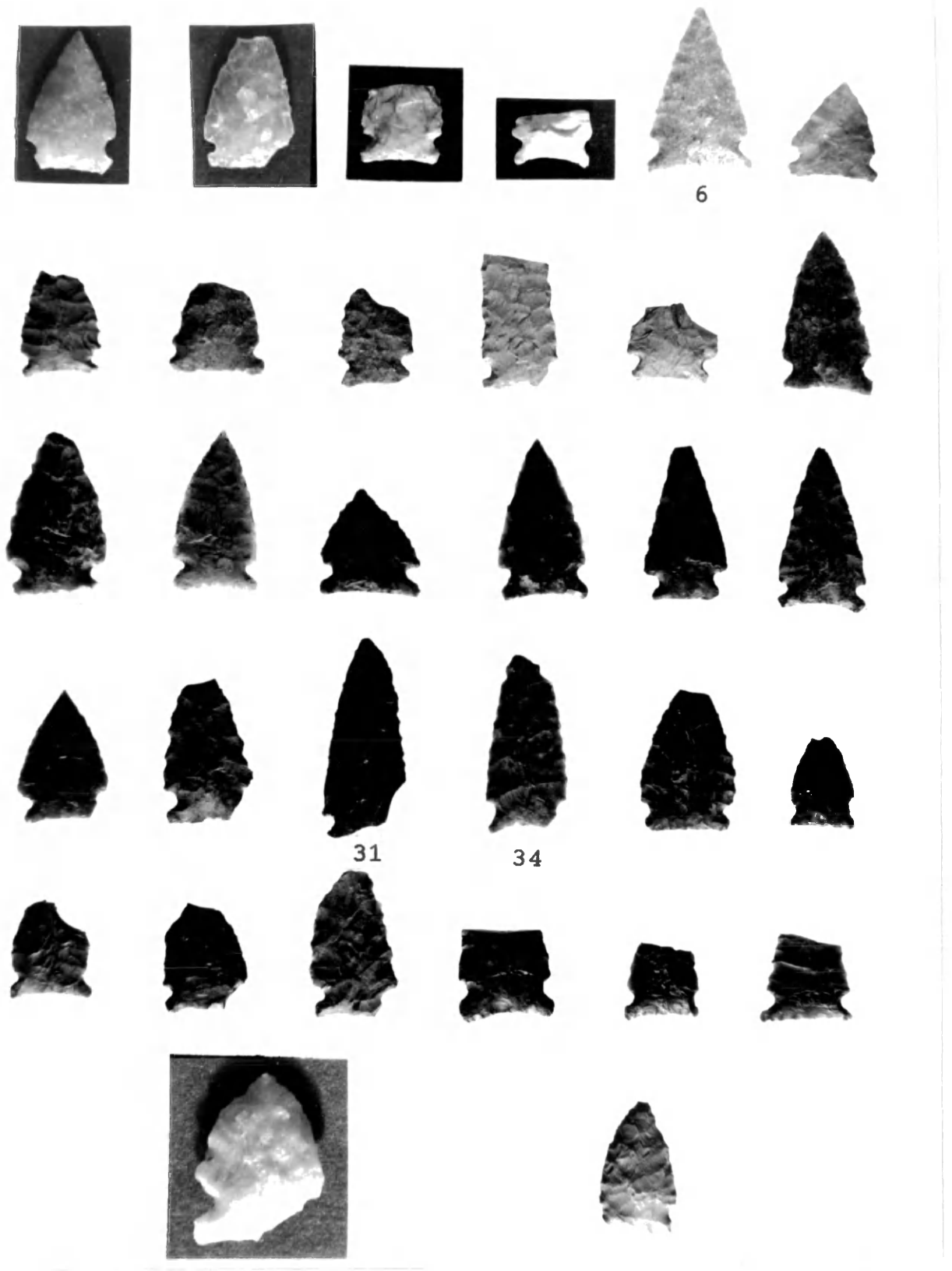


Plate I. Projectile Points from the Fantasy Site

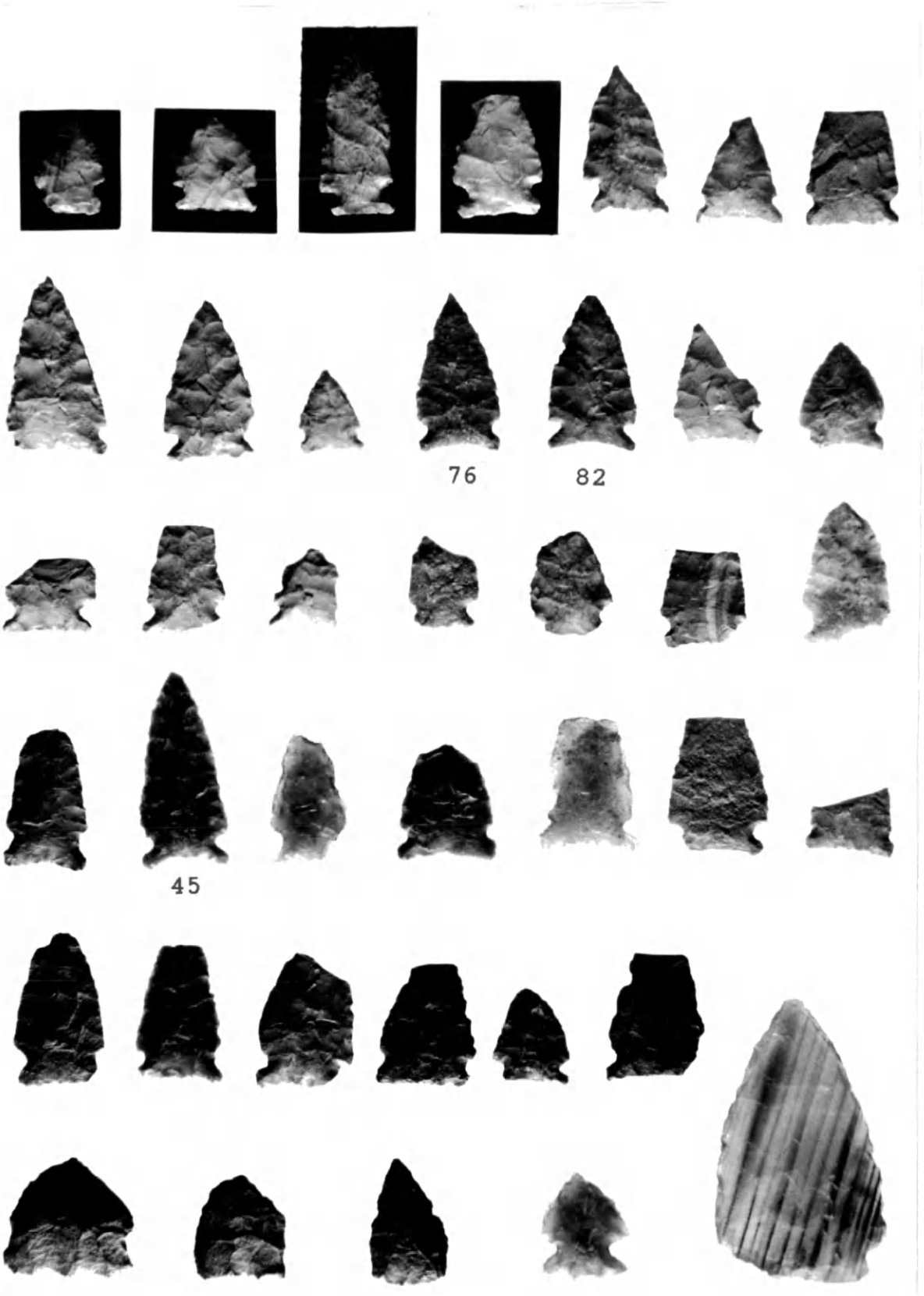


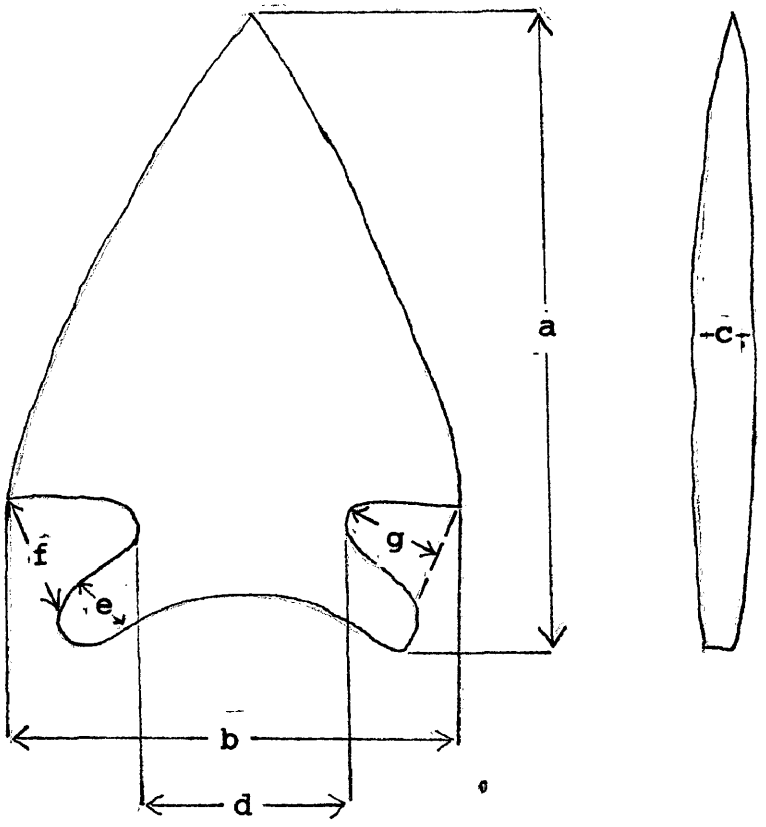
Plate II. Projectile Points from the Fantasy Site

were measured: total length, blade width, thickness, neck width, base height, notch width, and notch depth. Measurement landmarks are illustrated in Figure 4.

Based on the qualifications stated in the previous section, six (9.5%) of the 63 side-notched Avonlea points in the Fantasy collection qualified as "beautiful": numbers 6, 31, 34, 45, 76, and 82 (Plates I and II). Points 6 and 76 were composed of mottled chalcedony/quartzite; Points 31, 34, and 45 were composed of opaque yellow chert; and Point 82 was composed of black chert. All three materials are either fine-grained or very fine-grained. With respect to the entire collection of 87 points, 7% of the points (6 points) were mottled chalcedony/quartzite; 16% (14 points) were opaque yellow chert, and 6% (5 points) were black chert. For the 63 Avonlea points, 10% (6 points) were mottled chalcedony/quartzite, 22% (14 points) were opaque yellow chert, and 6% (4 points) were black chert. Opaque yellow chert is the most frequently appearing projectile point material in this collection.

The only material that appears in both the beautifully-made projectile points and other tools (3 endscrapers and 2 bifaces) is opaque yellow chert. This is a locally-available material and not rare.

All six of the outstanding points exhibited well-patterned flaking. Four were bifacially uniform. Two, however, were not. Both Point 76 and Point 82 were well-pat-



a = Total Length
b = Total Width
c = Thickness
d = Neck Width
e = Base Height
f = Notch Width
g = Notch Depth

Figure 4. Measurement Landmarks

terned with secondary retouch on one side, but, on the opposite side, Point 76 showed incomplete well-patterned flaking and Point 82 was flaked in the margin only; the flaking, however, was well-patterned. Even though strict adherence to the objective criteria would dictate that Points 76 and 82 not be considered "beautiful," the flaking was well-patterned and the sum of their attributes created the type of harmonious whole that satisfies the definition of a beautiful object.

All six points were symmetrical in cross-section and overall shape. Due to breakage in two points (#31 and #34), it was impossible to determine symmetry for base height and notch size. However, the remaining four points were symmetrical in all characteristics. Metric information for these points is contained in Tables I-V and Figures 6-8.

The results of my aesthetic analysis are probably not an accurate reflection of the true nature of the collection or of the Avonlea style because of limitations imposed by breakage. However, I was surprised that only six points qualified as beautifully-made. Based on the description of Avonlea points in the literature, I expected that a majority of the points would be beautifully-made. My definition of a "beautiful" point *style* states that a majority of the points will exemplify the qualities found in beautiful objects. At this point in my investigation, I concluded that either the Fantasy collection was not representative of the Avonlea

projectile point style or the Avonlea projectile point style was not aesthetically beautiful according to my criteria. Without analyzing other Avonlea point collections, the nature of the Fantasy collection as representative of the point style as a whole cannot be determined. I hoped to gain enough insight to make a valid interpretation of the nature of Avonlea aesthetics by gathering additional metric data from site reports.

Provenience of Beautifully-crafted Points

All six of the beautifully-crafted points were located in the same excavation unit (Brumley and Rennie 1995: unpublished manuscript). This unit contained a concentration of rocks and burned, pulverized bone. Points 6, 31, and 34 were located in intact material and Points 45, 76, and 82 were located in material that had eroded from the bank. Because of the recovery conditions, it is not possible to state whether or not the projectile points were originally in direct assocation with a feature.

Site Report Data

The metric data obtained from site reports was analyzed both separately and collectively. Analysis of the projectile point data generated information regarding variation within the style as a whole and on a site-by-site basis. I compared the projectile point data with information regarding site features, faunal material, radiocarbon dates, geographical location, etc. to establish whether or not certain

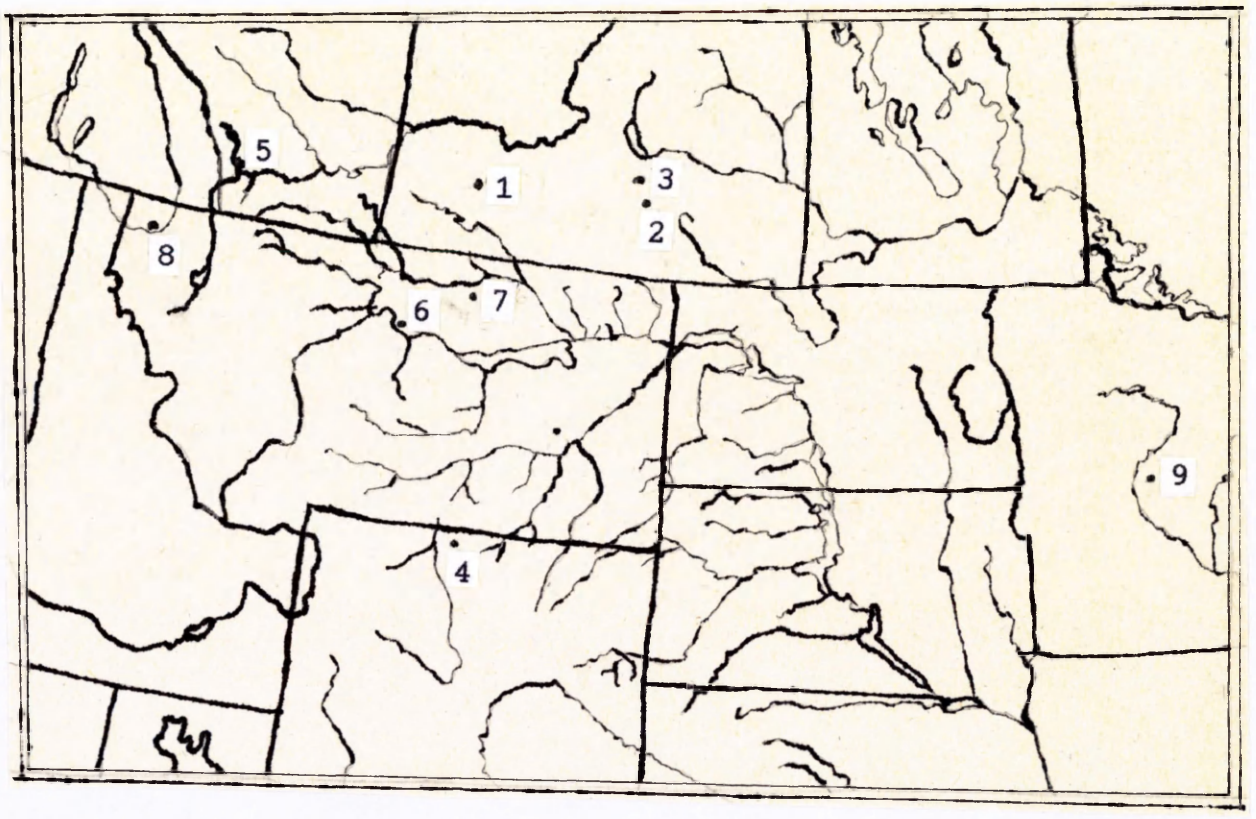
projectile point characteristics were associated with certain types of sites and environmental/cultural conditions.

Metric Data

The sites I selected for this part of my analysis were Avonlea (EaNg-1), Garratt (EaNj-7), Gull Lake (EaOd-1), Fantasy (24PH1324), Lost Terrace (24CH68), Wortham Shelter (48BH730), LAURD Project sites (24LN10, 528, 1020, 1125), and Manyfingers (DhPj-31) (Figure 5). Mensural data from only the side-notched variety, not the corner-notched variety, was used from the LAURD site because of my uncertainty about type classification of the corner-notched points.

Certain sites appear more than once in the Tables and Figures because they contain "varieties" of the Avonlea point style, e.g. the Gull Lake and Wortham Shelter sites. Reporting each variety and its associated data was deemed more informative than lumping all varieties together. The results may be skewed due to lumping of two or more varieties by some investigators and the separation of varieties by others. The criteria used to distinguish the varieties was not provided in the site reports.

Sample sizes for the Manyfingers and Lost Terrace sites are small. The data from these sites are included in order to create the largest possible view of the Avonlea metric universe, but the results are of questionable value.



1. Gull Lake (EaOd-1)
2. Avonlea (EaNg-1)
3. Garratt (EcNj-7)
4. Wortham Shelter (48BH730)
5. Manyfingers (DhPj-31)
6. Lost Terrace (24CH68)
7. Fantasy (24PH1324)
8. LAURD Project
9. Petaga Point

Figure 5. Sites Selected for Analysis

Table I and Figure 6: Mean Values

In Table I and Figure 6, the mean values for each of the seven projectile point attributes are listed and compared. The subset of "beautiful" points from the Fantasy site - Fantasy-6 - is also included, but not calculated into the actual comparison since it is a subset of one of the collections. An asterisk identifies notable Fantasy-6 values. Information regarding cross-section and overall symmetry was not available in site reports and, therefore, could not be included. Underlining indicates the least values for a given attribute; values in boxes are the greatest. In Figure 6, the values are graphed; value ranges and spreads are provided.

Because variation is restricted by function, to a certain extent, figures for ranges and spreads should be interpreted in the context of the attribute for which they are given. The range of variation for length can be large and projectile points at both ends of the spectrum will be functional. However, once a point thickens beyond functional limits, it becomes useless. These figures would, perhaps, be most meaningful in a comparision of variation between point styles. Mode values would also be helpful in obtaining a more meaningful interpretation of variation.

The site represented most often by the largest values was the Gull Lake site - Timber Ridge variety. This variety had the largest mean values for total length, blade width,

Table I. Comparison of Projectile Point Attribute Mean Values by Site with Sample Size and Standard Deviations (mm)

	Gull Lake' (Classic)	Avonlea'	Garratt^	Gull Lake' (T.Ridge)	Wor.Sh.~ (Classic)
Total Length	21.4 n=125 *	23.0 n=24 *	17.5 n=10 *	/26.6/ n=22 *	22.0 n=37 sd=4.3
Width	12.9 n=215 *	14.3 n=44 *	12.7 n=15 *	/14.4/ n=58 *	13.7 n=37 sd=1.5
Thickness	2.6 n=235 *	2.7 n=65 *	2.6 n=17 *	2.6 n=22 *	2.4 n=37 sd=.3
Neck Width	10.4 n=210 *	* * *	9.8 n=17 *	/11.2/ n=20 *	10.2 n=37 sd=1.6
Base Hght	2.4 n=222 *	2.4 n=36 *	* * *	3.0 n=23 *	2.1 n=31 sd=.7
Notch Wdth	2.7 n=215 *	2.8 n=52 *	2.4 n=17 *	3.0 n=23 *	3.0 n=37 sd=.7
Notch Dpth	1.3 n=213 *	1.3 n=54 *	* * *	1.5 n=22 *	1.9 n=37 sd=.7

' = Davis 1988
^ = Morgan 1979
~ = Greer

Table I cont.

	Wor.Sh.~ (T.Ridge)	Gull Lake' (Carmich)	Manyfingers'	Lost Ter.'
Total Length	26.2 n=5 sd=4.0	21.3 n=24 *	22.7 n=6 sd=1.8	22.3 n=5 sd=4.7
Width	14.2 n=5 sd=1.2	13.8 n=24 *	12.7 n=6 sd=1.3	12.3 n=8 sd=.9
Thickness	2.8 n=7 sd=.3	/2.9/ n=70 *	2.7 n=10 sd=.3	2.6 n=9 sd=.4
Neck Width	9.8 n=6 sd=1.4	/11.2/ n=48 *	10.6 n=7 sd=1.2	9.8 n=8 sd=1.3
Base Hgt	3.9 n=7 sd=.8	3.1 n=69 *	2.7 n=7 sd=.2	4.4 n=8 sd=.4
Notch Wdt	3.0 n=7 sd=.3	3.0 n=60 *	2.6 n=7 sd=.2	* * *
Notch Dpt	/2.1/ n=7 sd=.3	1.4 n=59 *	1.4 n=7 sd=.2	* * *

' = Davis 1988
~ = Greer 1978

Table I cont.

	Fantasy'	LAURD'	Fantasy-6'
Total Length	24.4 n=31 sd=5.3	16.9 n=30 sd=4.3	29.8* n=6 sd=2.7
Width	14.0 n=55 sd=1.4	13.0 n=41 sd=5.2	14.6* n=6 sd=.8
Thickness	3.0 n=59 sd=.5	2.4 n=62 sd=.5	2.8 n=6 sd=.3
Neck Width	11.0 n=55 sd=1.1	9.2 n=49 sd=1.0	10.7 n=6 sd=1.2
Base Hgt	3.3 n=62 sd=.6	/4.5/ n=54 sd=1.1	3.1 n=6 sd=.2
Notch Wdt	/3.1/ n=101 sd=.6	2.7 n=61 sd=.6	3.1 n=6 sd=.5
Notch Dpt	1.6 n=105 sd=.4	1.5 n=62 sd=.5	1.8 n=6 sd=.2

' = Davis 1988

Key to Figure 6 - Site Names and Point Varieties:

1 = Gull Lake - Classic variety

2 = Avonlea

3 = Garratt

4 = Gull Lake - Timber Ridge variety

5 = Wortham Shelter - Timber Ridge variety

6 = Wortham Shelter - Classic variety

7 = Gull Lake - Carmichael variety

8 = Manyfingers

9 = Lost Terrace

10 = Fantasy

11 = LAURD

F-6 = the six "beautiful" points from the Fantasy site

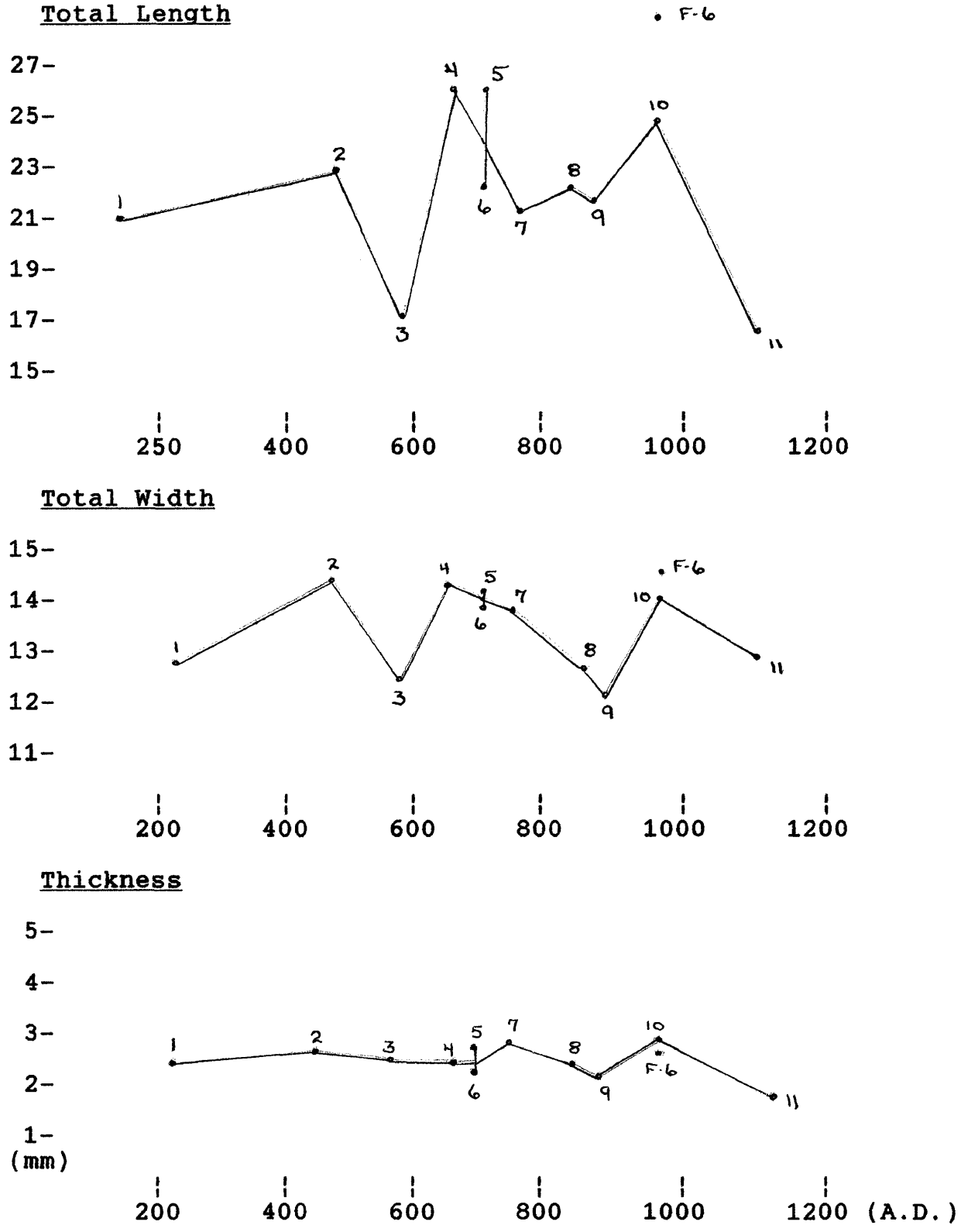


Figure 6. Attribute Means for 8 Sites/11 Samples

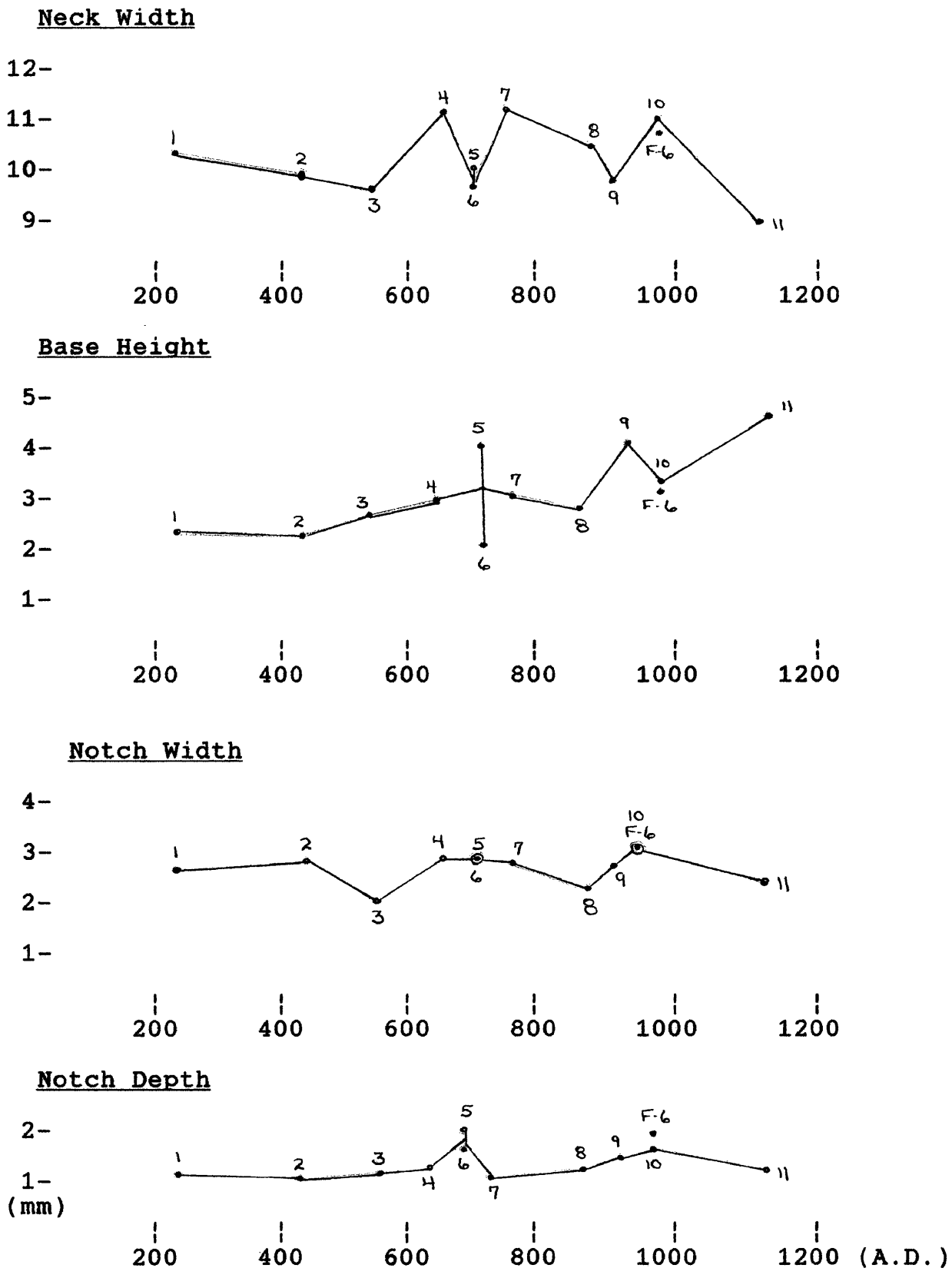


Figure 6. cont.

and neck width. The LAURD Project sites displayed the greatest number of values at the low end of the scale: total length, thickness, and neck width. Interestingly, the LAURD sites had the greatest value for base height.

The attribute with the greatest spread was `total length'. The attribute that varied the least was `thickness'. In ranked order of variation from greatest to least, the attributes are: total length, base height, blade width, neck width, notch depth, notch width, and thickness. The range of variation for the last three attributes is less than a millimeter.

The spread for total length may be attributable to the fact that projectile points were often resharpened for reuse. Therefore, if total length measurements are taken on *all* projectile points rather than only those that appear to be in their original state, the range of variation would be greater. It would be interesting to know if there is significant aesthetic distinction between the points that are apparently resharpened and those that are not. The fact that thickness is the attribute with the least amount of variation indicates that the use of thin flakes was important to Avonlea knappers.

It also appears that total length and neck width vary in direct relation to one another. The longer the point, the wider the neck and *vice versa*. Base height and blade width apparently vary independently of the other variables.

Table II. Attribute Ranges of Variation (mm)

	Length	Width	Thickness	Neck
Wortham				
G.L.'	18.0 - 35.3	13.0 - 16.2	1.8 - 3.0	7.7 - 14.3
T.R.^	20.0 - 32.2	13.0 - 14.7	2.4 - 3.3	7.4 - 11.8
Manyfingers	20.0 - 24.9	10.2 - 14.6	2.3 - 3.2	8.8 - 12.4
Lost Terrace	17.5 - 30.0	10.5 - 13.0	2.5 - 3.0	8.0 - 11.5
Fantasy	14.0 - 33.0	10.0 - 16.0	2.0 - 4.0	9.0 - 14.0
Fantasy-6*	26.0 - 33.0	14.0 - 16.0	2.5 - 3.0	10.0 - 13.0

	Base Height	Notch Width	Notch Depth
Wortham			
G.L.'	1.0 - 3.4	1.6 - 4.3	1.0 - 4.0
T.R.^	2.8 - 5.3	1.3 - 4.3	1.6 - 2.5
Manyfingers	2.5 - 3.2	2.3 - 3.2	1.3 - 1.6
Lost Terrace	4.0 - 5.0	*	*
Fantasy	2.0 - 4.5	1.5 - 5.0	1.0 - 2.5
Fantasy-6*	3.0 - 3.5	2.5 - 4.0	1.5 - 2.0

' = Gull Lake Classic variety
^ = Timber Ridge variety
* = the six "beautiful" points

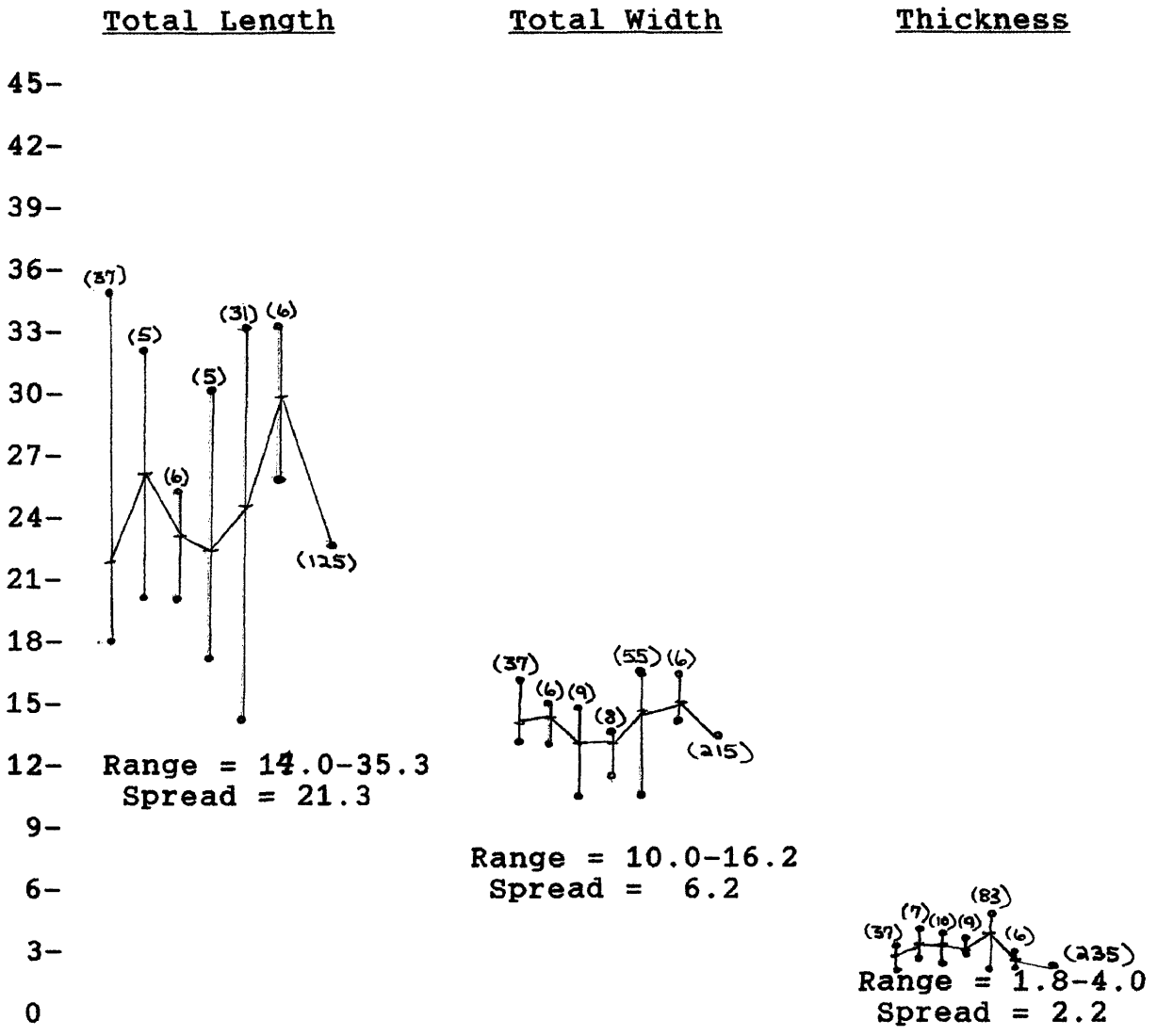


Figure 7. Ranges in Variation (mm) - Mean Values Graphed; n=( )

Key to Figure 7:

Sites are listed in the following order from left to right for each category:

Wortham Shelter - Classic variety

Wortham Shelter - Timber Ridge variety

Manyfingers

Lost Terrace

Fantasy

Fantasy-6

Gull Lake - Classic variety, Mean value

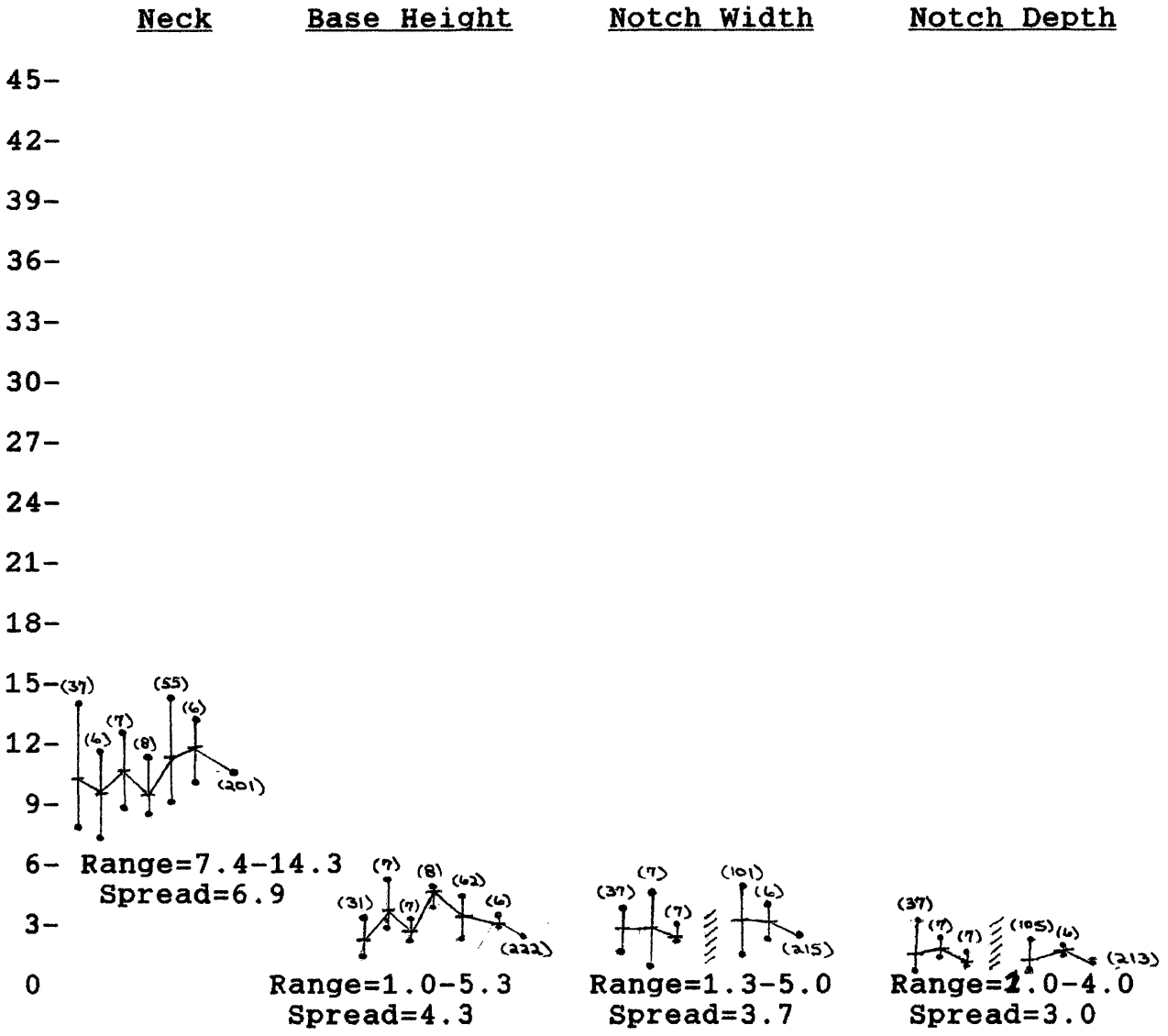


Figure 7. cont.

Table IIIa. Spreads in Attribute Values: Means and Actual (mm)

	Means			Actual		
	LAURD		GLTR	Fantasy		WShGL
T. Length	16.9	-	26.6	14.0	-	35.3
	L.Terr.		GLTR	Fantasy		WShGL
Width	12.3	-	14.4	10.0	-	16.2
	WShGL LAURD		GLCarm	WShTR		WShGL
Thickness	2.4	-	2.9	1.8	-	4.0
	LAURD		GLTR GLCarm	WShTR		WShGL
Neck Wdth	9.2	-	11.2	7.4	-	14.3
	WShGL		LAURD	WShGL		WShTR
Base Hgt	2.1	-	4.5	1.0	-	5.3
	Garratt		Fantasy Fantasy-6	WShTR		Fantasy
Notch Wdth	2.4	-	3.1	1.3	-	5.0

Table IIIb. Sites with the Most and Least Attribute Variation (mm)

	Most		Least	
T. Length	Fantasy	19.0	Manyfingers	4.9
Width	Fantasy	6.0	WShGL	1.7
Thickness	Fantasy	2.0	Fantasy-6 Lost Terrace	.5 .5
Neck Wdth	Fantasy	5.0	Fantasy-6 Manyfingers	3.0 3.4
Base Hgt	WShGl Fantasy	2.5 2.5	Fantasy-6 Manyfingers	.5 .7
Notch Wdth	Fantasy	3.5	Manyfingers	.9
Notch Dpth	WShGL	3.0	Manyfingers	.3

There appears to be no direct relationship between either time and attribute variation or geographical location and attribute variation. For this particular group of sites, variation neither increases nor decreases in a patterned fashion geographically or chronologically.

Tables II, IIIa and IIIb; Figure 7: Actual Values and Ranges

In Table II and Figure 7, actual values and ranges for each site are listed and compared. Once again, Fantasy-6 values are indicated. Table IIIa compares the mean and actual values for the point attributes; Table IIIb lists the sites with the most and the least attribute variation.

Considering all the sites together, the greatest spread was once again in total length; the least was, also once again, thickness. Ranked according to variation from greatest to least, the order for all sites commulatively was: total length, neck width, blade width, base height, notch width, notch depth, and thickness. Compared to the ranking of the mean values, base height and neck width exchanged places: base height moved to fourth in variation and neck width to second; notch width and notch depth exchanged places: notch width became fifth and notch depth became sixth.

Comparison of individual sites to one another revealed that the Fantasy site has the most variation - six of the seven attributes: total length, width, thickness, neck

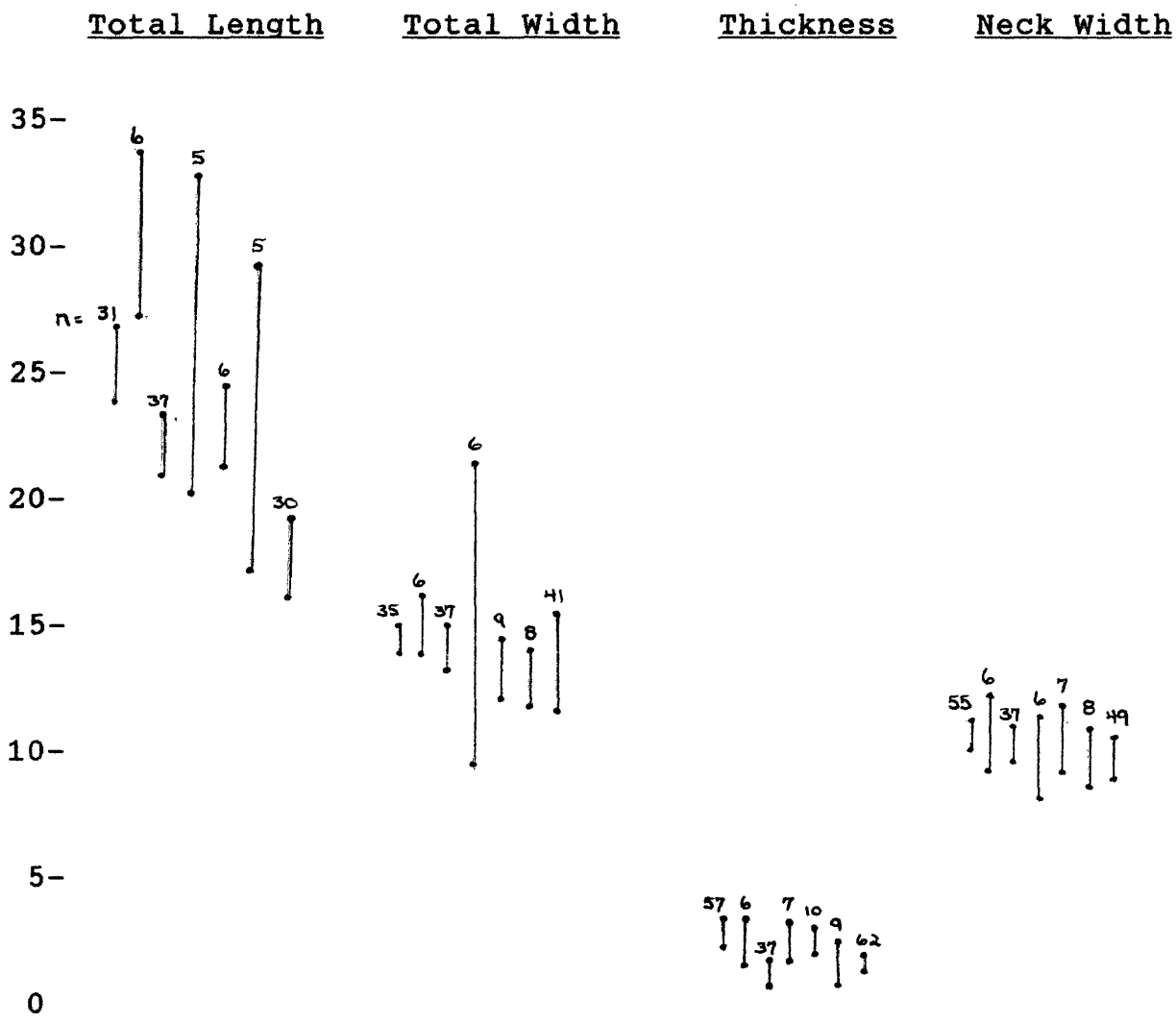
width, base height (shared with Wortham Shelter-Timber Ridge variety), and notch width. In only one attribute did another site exhibit greater variation than the Fantasy site - Wortham Shelter-Gull Lake variety in notch depth. The site that had the least variation was the Manyfingers site. It was least in four of the seven attributes: total length, base height, notch width, and notch depth. The variation in the Fantasy site points indicates that the situation there was somehow different from that of the other sites, especially the Manyfingers site.

Table IV and Figure 8: Measurement of Significant Variation

The mean values for the seven projectile point attributes for the Gull Lake site Classic points were used as standard values against which variation in points from other sites was measured to determine whether or not the attribute variation observed in the metric data was significant. If my thesis is supportable, the Gull Lake Classic points from the Gull Lake site should be as beautifully crafted as any other collection of Avonlea points since they are the earliest-appearing points in the style, i.e. the "prototype". Because first-hand analysis of this collection was impossible, I have to *assume* this is the case. I feel justified in making this assumption because even if the Gull Lake points are not "beautiful", they still provide a measure of significant variation for points from

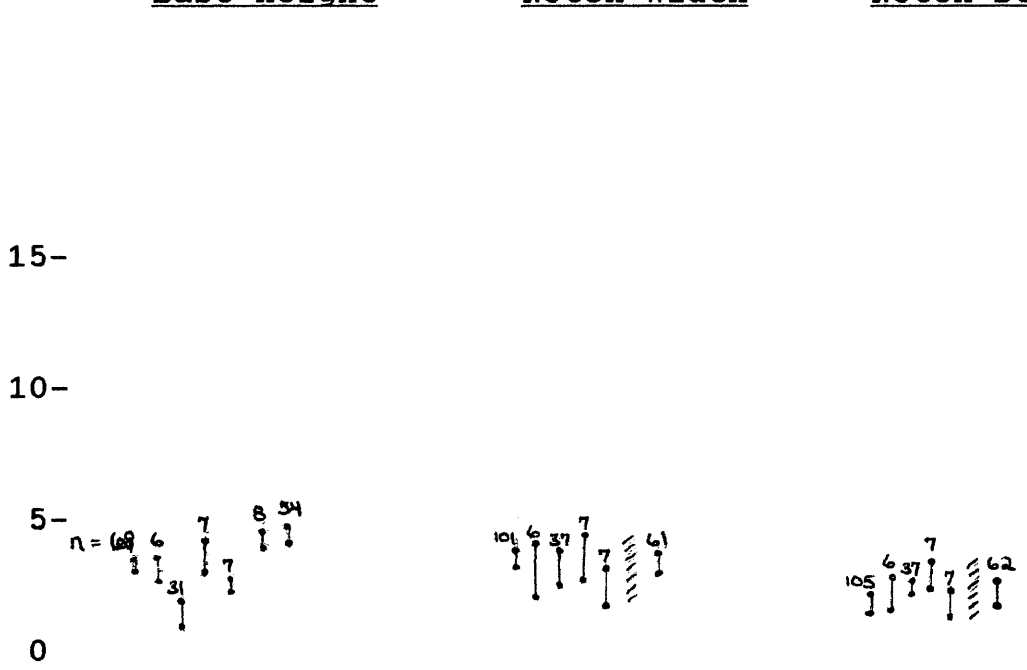
Table IV. Comparison of 95% Confidence Intervals with Gull Lake Classic Variety Attribute Means

Attribute	Significant Variance		No Significant Variance	
T. Length (21.4)	Fantasy	24.5-26.3	Wortham GL	20.6-23.4
	LAURD	15.3-18.5	Wortham TR	20.0-32.4
	Fantasy-6	27.0-32.6	Manyfingers	20.8-24.5
			Lost Terrace	16.5-28.1
Width (12.9)	Fantasy	13.6-14.8	Wortham TR	7.9-20.5
	Wortham GL	13.2-14.2	Manyfingers	11.7-13.7
	Fantasy-6	13.7-15.5	Lost Terrace	11.6-13.1
			LAURD	11.4-14.6
Thickness (2.6)	Fantasy	2.9- 3.1	Wortham TR	2.5- 3.1
	Wortham GL	2.3- 2.5	Manyfingers	2.5- 3.0
	LAURD	2.3- 2.3	Lost Terrace	2.3- 2.3
			Fantasy-6	2.6- 3.0
Neck Width (10.4)	Fantasy	10.5-11.2	Wortham GL	9.7-10.7
	LAURD	8.9- 9.5	Manyfingers	9.5-11.7
			Lost Terrace	8.6-10.8
			Fantasy-6	9.5-11.9
Base Height (2.4)	Fantasy	3.3- 3.4		
	Wortham GL	1.9- 2.3		
	Wortham TR	3.1- 4.6		
	Manyfingers	2.5- 3.0		
	Lost Terrace	4.1- 4.7		
	LAURD	4.2- 4.8		
	Fantasy-6	2.9- 3.3		
Notch Width (2.7)	Fantasy	3.0- 3.2	Wortham GL	2.7- 3.3
			Wortham TR	2.7- 4.0
			LAURD	2.5- 3.0
			Manyfingers	2.3- 3.0
			Fantasy-6	2.6- 3.7
Notch Depth (1.3)	Fantasy	1.5- 1.7	Manyfingers	1.2- 1.6
	Wortham GL	1.8- 2.1		
	Wortham TR	1.8- 2.4		
	LAURD	1.4- 1.6		
	Fantasy-6	1.5- 2.0		



Key: Order from left to right:
Fantasy, Fantasy-6, Wortham Shelter Gull Lake, Wortham Shelter Timber Ridge, Manyfingers, Lost Terrace, LAURD

Figure 8. 95% Confidence Interval Ranges (mm)



Key: Order from left to right:
Fantasy, Fantasy-6, Wortham Shelter Gull Lake,
Wortham Shelter Timber Ridge, Manyfingers,
Lost Terrace, LAURD

Figure 8. 95% Confidence Interval Ranges (mm)

different sites. This variation may indicate cultural differences and/or similarities between the social groups from the various sites.

95% confidence intervals were constructed for the seven attributes from the sample sites for which the necessary data were available. The standard values, based on the Gull Lake Classic variety means, were then compared to the confidence intervals. If the standard values were within the range of a given confidence interval, then the variation was deemed insignificant; if not, then the variation was significant. Table IV lists the mean values for the Gull Lake Classic variety, the confidence intervals for each attribute by site, and indicates degree of variation for each site by attribute. Figure 8 presents the information in graphic form.

The Gull Lake Classic variety standard values are outside the confidence interval for the Fantasy site in seven out of seven attributes; for the LAURD sites, in five of seven; and for the Wortham Shelter Gull Lake Classic variety, in four of seven. The Manyfingers site was most compatible with Gull Lake having similar standard values in six of the seven attributes; next is the Wortham Shelter Timber Lake Ridge variety in five of the seven attributes. Lost Terrace was similar to Manyfingers and Wortham Shelter Timber Ridge in all categories for which data was available, but cannot be fully analyzed without data regarding notch

attributes.

Interestingly, the Wortham Shelter Gull Lake Classic differs significantly from the Gull Lake site Gull Lake Classic in width, thickness, base height, and notch depth. The Wortham Shelter points are wider, thinner, smaller-based, and deeper-notched than the Gull Lake Classic points. This indicates that designation of these particular Wortham Shelter points as "Classic" may be misleading and/or erroneous.

Because of the seemingly low number of "beautiful" points identified in the Fantasy collection and the fact that all seven attributes varied significantly from the Gull Lake Classic mean values, I postulated that the point "style" at Fantasy varies significantly from that of the Gull Lake Classic and that it would probably not be considered "beautiful" according to the standards by which a point style is judged beautiful for this paper, i.e. a majority of the points exhibit the qualities associated with beautiful phenomena. The "beautiful" points from the Fantasy collection, the Fantasy-6 points, differ significantly from the Gull Lake points in total length, width, base height, and notch depth. There was no significant variation in thickness, neck width, or notch width. So, the six "beautiful" points vary less from the standard than the collection as a whole, but they were not as close a match to Gull Lake as were the Manyfingers points.

Site Data

Because the projectile point data indicated that significant variation exists between certain point collections, I investigated site attributes in order to determine whether or not the sites differ significantly from one another. Because the Classic projectile points from the Gull Lake site were used as the "standard" against which the other sites were measured and because the Fantasy and Manyfingers sites displayed, respectively, the most and least significant variation from the Gull Lake site, those three sites were selected for comparative analysis. Table V presents the site attributes that were selected for comparison and the available information for each attribute by site.

Attribute Comparison

1. Dates: the Manyfingers and Fantasy sites are separated by approximately 50 to 150 years; both sites are approximately seven hundred years later than the Gull Lake site. Time, therefore, is probably not a significant variable.
2. Location: the Fantasy site is closer to the Gull Lake site than is the Manyfingers site. Since Fantasy points are most dissimilar to Gull Lake, geographic distance alone does not account for the variation.
3. Type of Site: the significant aspect of this variable would appear to be the fact that the

Table V. Site Attributes for the Gull Lake, Manyfingers, and Fantasy Sites

	Gull Lake	Manyfingers	Fantasy
Dates:	A.D. 210±60 Lyr. 31a A.D. 660±60 Lyr. 26 A.D. 730±80 Lyr. 24	A.D. 860: meat proc. area	A.D. 910±100
Location:	S.W. Sask. deep coulee Cypress Hills grasslands to No.; hummocky moraine to So.	S.W. Alberta fescue prairie transition zone river terrace Avonlea and 2 Old Women's occupations	No.cent. MT Beaver Cr. Valley & adjoining prairie grasslands
Type of Site :	kill, occupation, processing area deeply stratified	occupation, processing area possible series of events but not strati-graphically isolated	kill, processing area stratified
Strati-graphy:	(See end of Table)	*	xu1: 4 units 1:med.dark gray, silty clay, colluvial deposit 2:lt. gray silty clay, some bone, colluv. dep. 3:red-br. silty shale, artifact-bearing 4:bluish-gr. Bearpaw shale xu2:dense clay colluvium
Tools:	large number;wide variety stone: quartzite= teshoa, choppers; knives, flakes; non-quartzite: end-scrapers, sidescrapers; knives (1=pet.wood);	stone: choppers, endscrapers, bifaces, uni-faces bone: fleshers scrapers,awls, perforators	stone: cores= coarse-grained; flakes, side-scrapers, re-touched flakes; coarse in xu1 fine in xu2 lithics:

Table V. cont.

	drills, perforators, gravers, hammerstones, bell-shaped pestles (A.D.50 and 700) greatest # & variety in Layer 24	lithics not specified	endscrapers: 1=E-1 3=E-4 1=E-16 bifaces: 1=C 1=E-3 2=E-4 1=F-1
Pottery:	Layer 24: Gull Lake Cord-impressed maggot impressions on lip fabric impressions on body and base very end of Avonlea occupation	deep knotted cord impressions, sometimes parallel	parallel-grooved: rare for the area
Faunal Remains:	(See Below)	33 bison 2 dogs 1 coyote 1 rabbit all long bones smashed cut marks little burned/ calcined bone	bison & 1 small carnivore analysis incomplete
Features:	bone beds	1: concentration of bone 2: bone-lined pit basin-shaped 70cm in diam. no charcoal or discoloration use=unknown	xu1: rectangular depression w/ culturally placed stones no charcoal or ash, heavily burned bone possible hearth xu2: 2 basin hearths
Season:	*	summer or fall	mid-winter - mid-spring
Projectile Point Lithics:	32.2%=pet. wd. 20.3%=chert 10.6%=KRF 10.6%=other	notched: non-local unnotched: local	22%=opaque yellow chert (E-4) 20%=porcell.

Table V. cont.

	chalced. 0 = obsid.		(F-1) 14%=green arg. (A-2)
Debitage:	*	primarily local green argillate primary and secondary decortication flakes	mostly coarse-grained (B-1) some fine-grained (E-4-8) mostly in xu2
Other:	*	FCR:lots, wide-spread	FCR:xu2, mostly

Stratigraphy for Gull Lake Site:

Natural (cultural material-bearing layers in top 15'):
Surface to 15 feet depth - the upper drift layer: glacial till consisting of silt overlaid by fine sand or silt (this till is designated Layer 52 in the excavation);
15 feet to 30 feet - the lower drift layer: pale yellow, poorly stratifed sand and oxidized sand containing numerous selenite crystals;
30 feet to 50 feet - below the drift-shale contact: carbonaceous dark gray to black shale containing abundant selenite crystals;
50 feet to 60 feet - pale yellow cross-bedded sandstone with no inclusions;
60 to 70 feet - pale olive, unconsolidated cross-bedded sand;
70 to 100 feet - dark gray shale with no inclusions or mineral crystallites (Kehoe 1973:31)

Cultural - Avonlea-bearing layers = 32-24
"A pattern of unburned whole bison bones overlying charcoal and heavily butchered bone scraps repeats itself through the Gull Lake Site" (Kehoe 1973:39). "...six black charcoal lenses each overlain by a bone layer for a total of six bone layers" (Ibid:192).

Layer 32: carbonized; suggestion of wet period with lush, thick vegetation; "burnt off before the first bison drive at the site;" "surface of...old humus layer was occupied by the first Avonlea people" (Kehoe 1973:22)
Layer 31c: .2' layer of bone; dark, charred occupation layer
Layer 31a: butchered, burned bone; bone scarp, and charcoal flecks; C-14 date: A.D. 210±60
Layer 31: well-preserved, little butchered bone
Layer 30: evidence of possible flash flood; yellow,

Table V. cont.

sterile; well-sorted sand and gravel
Layer 29a: black charcoal
Layer 28: charcoal, a living floor; large bison bones
Layer 27: mostly complete, fairly articulated bone; olive-colored clay slopewash
Layer 26: complete and nearly complete butchered bone atop bone scraps and charcoal; mostly disarticulated; many Avonlea points - especially Timber Ridge Sharp-Eared; C-14 date: A.D. 660±60

Faunal Remains - primarily bison; other species very minimal
Layer 32: minimal amount
Layer 31c: 3 MNI; all limbs except one broken, cut, and scraped"presumably for marrow" (Kehoe 1973:149)
Layer 31a: 13 MNI; broken skulls - marrow extraction; articulated portions of spinal columns - other skeletal material scattered; 2 mature males, 1 yearling bull
Layer 31: 13 MNI; more articulated, less scattered; evidence for smashed skulls
Layer 29: 9 MNI; no burned bone; broken, cut, and scraped bone
Layer 28: (no MNI recorded); cut, scraped, burned bone
Layer 27: 26 MNI; many unbutchered, articulated units; mostly mature females, some large males, a few 2-4 year-olds, no fetal
Layer 26: 32 MNI; some burned bone; articulated vertebral columns; long bones: cut/broken and scraped; 6 mature females, 3 2-4 year-olds, 1 6-month-old calf, no fetal material
Layer 24: 28 MNI; intact bone; few are scraped; distal metatarsals and metacarpals and rear lower limb bones = most numerous

Fantasy site lacks evidence for an "occupation."

4. Stratigraphy: the earliest Avonlea occupation at the Gull Lake site is recorded in Layer 32: a carbonized layer containing a minimal amount of faunal material and one projectile point that has been associated with a wet period of lush vegetation; the presence of well-sorted sand and gravel in Layer 30 has been associated with flash flooding which would indicate lack of vegetation due, perhaps, to a previous drought period; Manyfingers is stratigraphically obscure; the stratigraphy at the Fantasy site consists of various types of silty clay, silty shale, and shale which may indicate that environmental conditions differed from those at Gull Lake in the early Avonlea period.
5. Tools: the greatest variety of tools appears at Gull Lake and indicates a wide range of activities; the tool assemblage from the Manyfingers site includes both bone and stone implements and was apparently used in conjunction with meat and hide processing; the lithic tool assemblage at Fantasy, as analyzed at the time of this writing, would have been associated with meat processing and, possibly, hide processing; analysis of bone implements has not yet been completed.
6. Pottery: pottery appeared at all three sites: the

Manyfingers sherds, based only on information contained in the site report, appear similar to those from both the Gull Lake and Fantasy sites; the Fantasy sherds bear very little resemblance to those at Gull Lake. These differences may indicate that the group of people who occupied the Fantasy site showed a greater degree of cultural distinction from the inhabitants of the Gull Lake site than did the inhabitants of the Manyfingers site.

7. Faunal Remains: the faunal assemblage at all three sites was dominated by bison; all long bones were smashed at the Manyfingers site and there was little evidence of burning which may indicate grease-extracting activity; bone at the Gull Lake site was cut, scraped and burned and more completely butchered in Avonlea layers than in successive ones; analysis is incomplete for the faunal remains at the Fantasy site.
8. Features: all sites had bone beds; both Fantasy and Manyfingers had hearths - each with a distinctive form, i.e. bone-lined at Manyfingers and stone inlaid at Fantasy.
9. Season: mid-winter to mid-spring at Fantasy; summer or fall at Manyfingers; not noted for Gull Lake.
10. Projectile point lithics: Fantasy points were produced from locally-available materials;

Manyfingers were not. If unnotched triangular-shaped items are projectile points, then some were. The Gull Lake report did not indicate whether or not the lithics were locally available.

11. Debitage: at both the Manyfingers and Fantasy sites debitage materials were of a different type than the material from which the projectile points were made.
12. Other: fire-cracked rock was present at both the Fantasy and Manyfingers sites; stone-boiling was probably an activity at both sites (presence of fire-cracked-rock not noted for Gull Lake site).

Analysis

Comparison of these twelve attributes indicates that there were cultural differences between the groups of people who were using the three sites. Because the data are incomplete, it is not possible to fully compare all three sites for every attribute. However, according to the available data, the most distinct differences among the sites, apart from projectile point metrics, appear to be in the attributes of pottery, features, seasonality, and lithic materials.

Differences in the attributes of seasonality and projectile point lithics are less informative than the other attributes. Culturally-related people could certainly use different sites at different times of the year. However, the fact that the Manyfingers people were producing projec-

tile points from non-local material and the Fantasy people were utilizing local material suggests that the Manyfingers people had a trade relationship and/or cultural preference for certain lithics that the Fantasy people did not. It also suggests that desirable knapping material may have been near-at-hand for occupants of the Fantasy site and not for those at the Manyfingers site.

The distinctions in pottery and hearth structure could be cultural markers. If the joint appearance of specific forms of pottery and hearth styles could be documented for a large number of sites, a meaningful pattern of cultural affiliations might unfold for the Avonlea distribution area. Unfortunately, information regarding sediment deposits is incomplete for Fantasy and Manyfingers. In order to decipher environmental conditions from the stratigraphy of these sites, more information is required. The record at Gull Lake indicates that the Avonlea occupation began during, or shortly after, a wet period. There are three occupation layers between this layer and a sterile layer associated with flash-flooding. There are 1, 4, and 55 projectile points per layer, respectively, and a bison MNI of 3, 13, and 13, respectively. Most of the bone is broken and scraped indicating marrow-extraction. Six additional Avonlea occupation layers lie above the sterile layer. These layers contain large numbers of projectile points and bison MNI figures or 13 or greater except for one layer

which has only 4 projectile points and an MNI of 9.

Without direct examination of the projectile points, it is difficult to ascertain whether or not there are aesthetic differences between the points that are apparently associated with a more lush environmental period and those that appear after what may have been a drought. The faunal remains indicate varying degrees of butchering both above and below the sterile layer.

Although the association of the earliest Avonlea deposits with an apparently favorable climatic situation suggests that part of my thesis may be unsupportable, it could be that the Avonlea materials were produced originally under different environmental circumstances and the Gull Lake deposits are the remains of a people who came into the area from a drought-stricken locale. It may also be that the interpretation of carbonized material as evidence of a lush climate is erroneous. Once again additional information is necessary in order to make an accurate assesesment.

Faunal remains, though incompletely reported, indicate that the people at all three sites relied heavily and almost exclusively on bison throughout these occupations. It is impossible to determine whether or not the animals were being processed to the same extent at all sites. Very thorough carcass processing appears to have taken place at Manyfingers, indicating either great need for nourishment, heavy production of substances that require bone grease,

e.g. pemmican, tanned hides, pottery, etc., or both. If the site was utilized in the fall, the people may have been stockpiling provisions for a harsh winter. If this was the case, then there *could* be a link between projectile point morphology/aesthetics and environment. Up to a point, harsh environmental conditions should stimulate social cohesion; society has a better chance of survival when united than when fragmented. Adherence to a specific projectile point template, i.e. a "cultural signature" (Smith 1973:73), would be expected under such conditions (Wiessner 1990:109).

The data suggest that there are at least two culturally-differentiated groups represented by the three sites: one, the people at the Gull Lake and Manyfingers sites and the other, the people at the Fantasy site. For the people at the Manyfingers site, adherence to a particular point style appears to have been more important than for those at the Fantasy site. The uniform style of projectile points may have been an expression of social cohesion at the Manyfingers while the greater variety in the Fantasy projectile points may have reflected an emphasis on individual expression (Wiessner 1990:109). Whether or not the groups were functioning in different environmental situations is not clear. However, the data suggest that the socio-cultural climates were different.

Comparison to Solutrean and Folsom Point Styles

There are intriguing similarities among the Solutrean,

Folsom and Avonlea situations. Very briefly, all three projectile point styles are regarded by many investigators as beautifully-crafted and delicately made (Bordes 1968:217; Warburton and Duke 1995:212; Willey 1966). Each of the three styles appeared at a time of climatic change: the Solutrean appeared approximately 20,000 years ago during severe glacial conditions (Fagan 1992:180; Bryson and Murray 1977:128); the Folsom, approximately 10,500 years ago, during the Valderian glacial advance and the waning Two Creeks interstadial. During this time almost a dozen faunal species became extinct in North America, including the mammoth (Butzer 1971:506). The archaeological record indicates that Avonlea points appeared in conjunction with a period of increased dryness. Each of the three styles is associated with a big game hunting cultural adaptation. One investigator has postulated that the "smaller shouldered points in the Upper Solutrean may reflect a shift in emphasis in hunting techniques as a new missile system (the bow?) was adopted" (Smith 1973:72). The Avonlea point has been widely recognized as the first arrowpoint style in the northern Plains. Upper Solutrean points may have been a response to hunting a "different variety of animal" (Smith 1973:72). The Folsom hunters probably had to make various technological and social adjustments when mammoths and other mammals became extinct.

The parallels among the three projectile point styles

indicate that the production of "beautiful" projectile point styles, environmental conditions, and stress are interrelated. Although a comparison of metrics and other attributes associated with the three styles is beyond the scope of this paper, the available information indicates that the similarities are more than coincidental.

Summary

From data obtained from selected site reports and a collection of projectile points, I was able to establish a standard by which projectile point aesthetics can be measured. The qualities universally associated with beauty can be quantitatively assessed in terms of projectile point morphology. Even though an element of subjectivity remains, the procedure provides a method by which the most aesthetically-pleasing points may be separated from more ordinary ones on an objective basis.

I designed a method by which the significance and meaning of projectile point aesthetics in prehistoric society can be inferred. The method involves establishing morphological parameters, calculating ranges of variation, and defining confidence intervals for projectile point attributes for a given projectile point style. The resulting figures are compared to values derived from a normative point collection in order to ascertain the range of variation from the norm and the nature of the variation for particular sites. This information combined with information

about site characteristics, provided a more complete picture of the social and environmental milieu in which the points were used. Application of this method to a set of Avonlea sites indicates that it is possible to determine whether or not distinct groups are represented in the archaeological record and whether or not they experienced conditions conducive to social cohesion or individual competition.

Due to the lack of pertinent data, I was unable to determine whether or not the creation of the Avonlea projectile point style was associated with environmental and/or cultural stress. It appears that the "classic" Avonlea points from the Gull Lake site and the points from the Manyfingers site are very similar to one another, while those from the Fantasy site are significantly different from the other two. The Classic points were deposited in conjunction with a carbonized sediment layer at approximately A.D. 210; possibly a period of lush vegetation. The stratigraphic layer beneath some of the Avonlea-bearing deposits at the Gull Lake site consists of well-sorted sand and gravel. Such sediment is indicative of free-running water that may be the result of poor vegetative cover which, in turn, could be associated with a period of drought. The implications of the associations are not clear at this point.

Faunal remains in the Avonlea strata are more completely butchered than in the succeeding Prairie cultural layers

(Kehoe 1973). The people associated with the Avonlea deposits were apparently interested in retrieving as much of the animal resource as possible. The reason is not known. However, if they were experiencing a drought, they may also have been suffering from nutritional and psychological stress. If these conditions prevailed at both the Gull Lake and Manyfingers sites and not at the Fantasy site, then support would exist for the thesis that beautiful projectile points are associated with conditions of environmental stress.

VII. Summary and Conclusion

"It is perhaps not overly hyperbolic to state that projectile points are both the most studied and the least understood of all artifacts found on the Plains."

- Warburton and Duke 1995:223

"The Plains can only contribute fully to general debate when Plains archaeological data are explored in all their specificity."

- Hodder 1995:239

"In point of fact the mapping of every trait in Aboriginal culture is needed to clarify our understanding of regional cultures, trait distributions and associations, and the interrelationships of the social, ethnographic and archaeological aspects of culture as a whole."

- McCarthy 1977:261

The purpose of my investigation was to examine the meaning of the aesthetic dimension of projectile point morphology in terms of the thesis that beautifully-made projectile point styles are produced by big game hunting societies that are heavily dependent upon projectile point technology and who are experiencing stress related to the procurement of their primary resource. I postulated that stress related to resource procurement uncertainty would result in increased spiritual activity and that this activity would stimulate the development of ritual involving beautifully-made projectile points.

In order to support or refute my hypothesis, I investigated aesthetic expression, the concept of beauty, style, stress, magical thinking, and the paleoclimate and ecology of the Great Plains. By employing ethnographic analogy and

investigation to the Avonlea projectile point style. I developed a set of ten working hypotheses, two general objectives, and four objectives directed specifically at the analysis of the Avonlea cultural system to guide my research. Briefly, these hypotheses, objectives, and the results of my investigation are as follows:

Hypotheses:

Hypothesis 1: The concept of beauty is based on universally-perceived, biologically-based, culturally-filtered qualities of symmetry, order, balance, harmony, and mastery of a medium.

Hypothesis 2: Stress may result in increased spiritual activity in humans.

Hypothesis 3: Stress-related spiritual activity often involves ritual and beautifully-crafted, symbolic objects associated with the source of stress.

Hypothesis 4: Stress can be detected in the archaeological record.

Hypothesis 5: Detrimental climatic conditions and technological innovation can produce stress.

Hypothesis 6: Ceremonialism can be detected in the archaeological record.

Hypothesis 7: Lithic materials selected for ceremonial projectile points are the finest available and differ from materials used in the production of non-ceremonial tools.

Hypothesis 8: The range in variation of morphological attributes for ceremonial points would be limited and well-defined.

Hypothesis 9: Ceremonial points are beautifully-crafted, i.e. characterized by regular, well-ordered flaking patterns; symmetry; quality lithic materials; balanced proportions; and mastery of the medium.

Hypothesis 10: A high percentage of the most outstanding points would be found in close proximity to possible ceremonial features.

All the hypotheses were supported by the literature; only Hypotheses 4 and 6 were also supported by data taken from the Avonlea archaeological record. Lack of consistent data made it impossible to determine whether or not the other hypotheses were supportable.

Objectives:

General:

1. Develop a standard by which projectile point aesthetics can be measured.

Results: I established a method based on quantitative evaluation of symmetry, balance, lithic material, and mastery of the medium. These qualities are quantified by: 1) measuring total length, total width, thickness,

neck width, base height, notch width, and notch depth;

2) assessing flake scar pattern for symmetry and regularity;

3) determining quality of lithic material.

2. Develop a method for ascertaining whether or not projectile points were used in a ritual context, prehistorically.

Results: I developed a method based on classifying projectile points according to aesthetic attributes, identification of provenience, and distinctions between provenience and distribution - both geographic and chronologic. Although I was unable to apply my method to the issue of ceremonial use of projectile points, I demonstrated that this method can reveal whether or not points with particular aesthetic characteristics are used in particular contexts.

Avonlea-specific:

1. Determine the aesthetic nature of Avonlea points according to objective as well as subjective criteria.

Results: The aesthetic nature is variable - some are beautifully-crafted; others are not.

2. Determine the existence of a ceremonial context

for Avonlea projectile points.

Results: Not possible - lack of data.

3. Determine the presence or absence of strict adherence to a specific mental template by measuring the range of variation in Avonlea points both within and among sites.

   Results: There does not appear to have been strict adherence to one template. Variation occured both within and among sites.

4. Determine the existence of environmental and/or cultural stress in conjunction with the appearance, and throughout the existence, of Avonlea points.

   Results: Indications of stress existed at several sites, primarily in the form of skeletal anomolies and heavy butchering of faunal material.

My research indicates that aesthetic expression is a universal phenomenon associated with comprehending the meaning of existence and ordering the environment. The concept of beauty appears to be defined by the quantitative qualities of balance, order, harmony, symmetry, mastery of a medium, and by a qualitative, spiritual component that is manifested in a sense of awe, wonder, and inner peace. Even though beauty has a culturlaly-determined component, the principles underlying the concept are universal and biolo-

gical.

Aesthetic expression articulates with the archaeological record via the concept of "style." Projectile point morphology illuminates cognitive, emotional, and psychological characteristics as well as geographic and chronologic distribution.

Uncertainty and lack of control result in stress. Both technological change and environmental conditions can create uncertainty. Human beings attempt to maintain or establish order when faced with stressful situations. Such attempts are often characterized by magical thinking expressed in ritual. In ritual, objects associated with the source of stress are embued with supernatural power. Objects exemplifying the definitive qualities of beauty: order, balance, symmetry, harmony, and mastery of a medium are physical manifestations of a cognitive attempt by and emotional desire of human beings to maintain or restore order in their lives. Such objects invoke a sense of wonder.

My investigation of paleoclimate and ecology revealed that vegetation is affected both qualitatively and quantitatively by adverse environmental conditions. Because bison are dependent for survival upon vegetation, adverse environmental conditions impact the condition of the herds. Detrimental environmental conditions create a stressful situation for human groups who depend upon bison for existence.

I applied the information I obtained from my research to the Avonlea cultural system. Unfortunately, consistent data are not available from all Avonlea sites. Therefore, definitive descriptions for certain salient aspects of Avonlea "culture," e.g. point style parameters, lithic materials, point aesthetics and provenience, and sediments, were not always available.

Through comparison of metric data obtained from the measurement of seven morphological attributes, I was able to determine that significant differences existed between collections of projectile points from various Avonlea sites. The earliest known collection of Avonlea points, the Gull Lake Classic points, was established as the standard against which the other collections were measured. Although it was not possible to analyze this collection first-hand, in the literature the points are referred to repeatedly as beautifully-crafted and delicately made. Point collections that were similar to the standard collection in the most variables were considered "beautiful" and those that differed in the most variables were not. A measurement of significant variation was obtained by establishing 95% confidence intervals for all collections in the study and utilizing the mean values from the Gull Lake Classic attribute measurements as the standard values against which variation significance was measured.

The points from the Manyfingers site were most similar

to the Gull Lake Classic points; the points from the Fantasy site were significantly different. Attributes from the three sites were compared: dates, location, type of site, stratigraphy, tools, pottery, faunal remains, features, seasonality, projecile point lithics, debitage, and data regarding fire-cracked rock.

Based on the available data, I offer the following interpretation of the Avonlea situation. The well-sorted sand and gravel in the stratigraphic layer directly below the layers containing the Gull Lake Classic points at the Gull Lake site indicates that there may have been a period of drought prior to and possibly extending throughout the occupation of the Gull Lake site by the people who produced the Classic points. Information regarding faunal remains is too sketchy to determine whether bison procurement was impaired during this occupation. The bone is butchered and burned, but the extent of the butchering is not noted in the site report. Because the metric and non-metric attributes of the Manyfingers and Gull Lake sites are similar, I infer that there were similar activities conducted at the two sites under similar circumstances. Without access to aesthetic information, it is impossible to assess the aesthetic nature of the two point styles. Metrically, however, they are extremely close. Based on the same information, people at the Fantasy site were probably engaged in similar activities, but perhaps under different circumstances, either cultur-

ally, environmentally, or both. Until a larger, consistent body of data is available it will not be possible to address this issue in a satisfactory manner.

The primary objective of this study - to determine whether or not the production of "beautiful" projectile point styles is associated with environmentally-induced cultural stress in big game hunting societies - was achieved only to the extent that my working hypotheses were supported or refuted by the Avonlea situation. As stated above, Hypotheses 4 and 6 were the only hypotheses that were supported by data. However, examination of the cultural, environmental, and stratigraphic information regarding the Avonlea projectile point style and a cursory comparison of Avonlea with two other "beautiful" projectile point styles - Solutrean and Folsom - revealed provocative similarities which suggest that such an association is feasible.

The study of aesthetics is the study of the human soul. Projectile point morphology is more than the physical arrangement of notches and flake scars: it is style, and style is communication. An understanding of projectile point aesthetics can provide the archaeologist with an avenue into the prehistoric mind.

"(I)t is imperative that Plains archaeologists begin to debate the symbolic content of the archaeological record" (Warburton and Duke 1995:228). Avoidance of intangibles promotes the caricaturization of prehistoric people as "mere

automata moving across the landscape, figuring out more efficient ways to feed themselves" (Warburton and Duke 1995: 228). "Life for all of us includes beauty, myth, pain, creativity, birth, sickness, fear of the unknown, joy, laughter, sadness, thoughts of an afterlife, and all the emotions that make us uniquely human" (Warburton and Duke 1995:227). This is as true for populations that existed in the past as it is for those of the present.

Human beings are distinguished from other species by their use of symbols. Through symbolic use of language, behavior, and materials, they communicate with one another and with their environment. Culture is built upon symbolism. Anthropology is based on the interpretation of culture. Attempts to interpret the ideologic aspects of the material record are essential for a complete reconstruction of prehistoric culture.

In this study, I have attempted to demonstrate that a beautifully-made projectile point style played a symbolic role in human adaptation on the Plains. Although my thesis could not be fully supported, I believe that insights regarding both the adaptive nature of beauty and the Avonlea cultural system can be obtained from the "structure of inferences" I developed in my work. Hopefully, Plains archaeologists will someday accumulate, in a consistent manner, the type of data that would allow me to fully test the hypotheses upon which my thesis rests.

APPENDIX

Data from Fantasy Site Projectile Point Collection

Spec. #	CMU #	Fig. #	Type	MPL	MBL	M BaW	MB1W	Mth	NW	BaSh	X-sect	RNH	LNH	RND	LND	RNS	LNS	BaH	Both	S1	S2	Lithic	Overall Desc.
1	2						10	3			2									7	8	B-2	5
2	2					12	13		10	2		3	3	2	1.5	2	1	2.75				F-1	4
3	2						15	3			3								3	3	3	E-15	6
4	2			15	13	11	11	2	9	1	2	2.5	3	1	1	4	3	2	8	8	8	E-11	2
5	2			25	21		14	3	9.5	2	1	3		2		1		3		9	8	E-10	7
6	2			29.5	24	17	16	3	13	2	2	3	3	2	2	1	1	3	6			E-10	1
7	2					12	12	3	10	3	2	3	3	1	1	1	1	2	6			E-4	4
8	2					12	13	3	10	3	2	3	3	1	1	1	1	2	7			F-1	2
9	2						11	2			1								6			F-1	6
10	2			28	21	14	16	3	11	1	1	4	4	2	2	1	1	3		7	8	E-4	2
11	1			24	18		15	3			1	3		2		1		3	8			E-15	7
12	2			26	22	11	14	3	9	1	2	4	4	2	2	1	1	3		6	10	F-2	2
13	2					15	15	3.5	12	2	2	4	4	2	1.5	1	1	4				E-11	4
14	2			27	21	14	14	3	11	2	3	3.5	3.5	1.5	1.5	1	1	4	6			E-4	1
15	2						15	2.5			1								3			F-2	6
16	2						14	3			2									6	8	E-11	6
17	2						16.5	3	13		1											F-1	6
18	2			18	14	16	16	3	12	1	1	3	3	2	2	1	4	3.5	7			E-4	1
19	2			29	21		20.5	6			3	6		3		4		6	8			E-7	7
20	2			24	19		14.5	4	11	1	2	4	3.5	2	2	1	1	4	10			E-7	7
21	2			22	18		15	3	11	3	1	3		1		4		3	5	5	5	E-4	7
22	2					13	13	2.5	10	2	3	2.5	2.5	1.5	1	1	1	3.5				F-1	4
23	2					12			10	2		2.5	2.5	1.5	1.5	4	4	3				F-1	4
24	2			27	22	13.5	13.5	3	10	2	1	3	3	2	2	2	2	3		6	3	E-17	1
25	2			27	22.5	15	15	3	11	2	3	4	3.5	2	1.5	1	1	4		6	2	E-4	1
26	2							3		3	1	2.5		1.5		2		3	11			E-11	7
27	2			17	12	15	14	2.5	11.5	2	3	2.5	2.5	1.5	1.5	1	1	3		8	1	F-1	7
28	2						15	3		1	1	2.5		2		1		3		1	7	E-7	7

Spec. #	CMU #	Fig. #	Type	MPL	MBL	M BaW	MB1W	Mth	NW	BaSh	X-sect	RNH	LNH	RND	LND	RNS	LNS	BaH	Both	S1	S2	Lithic	Overall Desc.
29	2					15	13.5	2	11	1	2	3	3	1.5	1.5	3	3	3	7			E-4	4
30	2			29	25		14	2.5			3								3			E-17	7
31	2			33	30			3			2	3		2		1		3	11			E-4	7
32	2							3			3	3		2		1		3		2	8	A-2	7
33	2					11	12	2.5	9.5	2	1	2.5	5	1.5	2	1	4	3	8			E-17	4
34	2			30	26		14	3	10	4	2	4		2		3		3.5	6			E-4	7
35	2						14	3			1									10	8	E-15	6
36	2							2.5			3									11	2	E-17	6
37	2					15.5	14	3	12.5	3	3	3	3	1.5	1.5	1	1	3.5	1			E-10	4
38	2			28	23	14	14	3	11	2	3	2.5	2.5	1.5	1.5	1	1	3		6	2	A-2	1
39	2					14	15.5	2	12	1	1	3	3	1.5	1.5	1	2	3		7	6	E-4	2
40	2						12.5	3			3									7	8	A-2	6
41	2						12.5	2.5	9.5		1	3		1.5		1		3	8			F-1	6
42	2				20.5		14	3	9		3			2	2				8			E-7	7
43	1			20		21.5	20.5	5	20		3							6	2			A-2	1
44	1					15	15	3	12.5	2	1	3	3	1	1	1	4	3.75	8			F-1	4
45	1			33	27.5	14	15	2.5	10.5	4	1	3	3	2	2	1	1	3	11			E-4	1
46	2					13	13		10.5	3		3	3.5	1	1	1	2	3				E-4	4
47	1					14.5			10.5	1		4	3	2	1	2	1	2.75				F-1	4
48	1					15	15.5	3	13	1	1	3	3	1	1	1	1	3.5		8	2	A-2	7
49	1							2.5														E-17	8
50	1			47	43		28	5	22		1	5		3		4			10			E-7	7
51	3			22	18.5		13	4	11	2	2	2.5		1		1		3.5	10			F-1	7
52	1			22			13	3			3									7	8	A-2	7
53	1			14	12	11	10	2.5	9	3	3	2.5	2.5	1	1	1	1	3		8	2	E-17	1
54	1					16	15	3	13	4	1	4	3	1.5	1	1	1	4		7	3	E-4	7
55	1					14	13	2	13	3		1.5	2	0.5	0.5	1	1	3.5				E-10	4
56	1			24	18	14	13	3.5	11	4	2	5	4	1.5	1.5	3	4	4.5		9	8	F-2	7

Spec. #	CMU #	Fig. #	Type	MPL	MBL	M BaW	MB1W	Mth	NW	BaSh	X-sect	RNH	LNH	RND	LND	RNS	LNS	BaH	Both	S1	S2	Lithic	Overall Desc.
57	1			23	18	16		4	12	1	2	4		2		2		4		6	10	E-7	7
58	1			19	15	14	14	4	11	4	2	3		1		1		3	10			E-17	7
59	1							3		1		3		1		4		3				F-1	4
60	1						13	4														F-1	6
61	1			18	14	14	13	3	11	3	1	2.5	2.5	1	1	1	1	3.5	8			E-17	2
62	1						16	3.5		3	1	3		1.5		4		3	8			A-2	4
63	1			17	12	11	11	3	8	1	3	4		2		4		4	8			F-1	7
64	1			16	13	14	14	3	11	1	3	3	2.5	2	2	1	1	3	8			E-5	1
65	1						14	3	12	3		4		2		3		4				F-1	6
66	1			28			15	3	12	3	2									6	11	E-7	6
67	1						14	3	11	3	2	3.5		1.5		3		3.5	10			F-1	4
68	1						13	3	9	1	3	4		2		3		4	10			E-1	4
69	1			16	14	13		3	10	1	3	2.5		2	2	2		2	10			F-1	7
70	1			18	14	13.5	14.5	3	8	5	3	4	5	3	3	2	2	4.5		3	8	E-1	1
71	1			30	26	10	12	3	8	1	2	2.5	3	2.5	2	1	2	3		8	10	F-1	1
72	1						12	3	9	3	3	3	2	1.5	1	1	1	3		2		E-10	4
73	1						13	2	10		3	3.5	3	2	2	2	2	3		8		F-1	4
74	1			27	23	14	15	3	11	3	3	3.5		2		2		4		2	8	F-1	7
75	1			18			15	3			2								2			A-2	1
76	1			27	22	13	14	2.5	10	2	1	3	3	1.5	1.5	1	1	3		6	9	E-10	1
77	1						17	3	11.5	3	3	3		2	2	1	1	3		2	3	J-2	4
78	1					13	15	3	10	3	1	3	4	2	2	1	1	3.25		8	2	F-1	4
79	1							2			1								6			F-2	6
80	1						15	3	11	1	3	5		2	1.5	4		4.5		2	3	A-2	7
81	1			25	20	13	14	3	10	3	3	3.5	3.5	2	2	3	3	3.5	6			E-17	1
82	1			26	21	14	14	2.5	10	2	2	2.5	2.5	1.5	1.5	2	2	3		6	3	E-11	2
83	1							2.5			3									11	10	E-7	6
84	1				31.5			3			2									6	6	E-17	6

Spec. #	CMU #	Fig. #	Type	MPL	MBL	M BaW	MB1W	Mth	NW	BaSh	X-sect	RNH	LNH	RND	LND	RNS	LNS	BaH	Both	S1	S2	Lithic	Overall Desc.
85	1			31	26		11	3.5	14	2	2	3		1.5	1.5	1		3.5		8	7	F-1	7
86	1					14	14	3	11	3	3	3		1		1		3.75		6	8	E-4	7
87	1						16	3	12		2	3.5		2		1		4		3	2	F-2	4

References Cited

Adams, Marie Jeanne
1973 Structural aspects of a village art. American Anthropologist 75:265-79.

Alland, A.
1989 Affect and aesthetics in human evolution. The Journal of Aesthetics and Art Criticism 47:1-14.

Antevs, Ernst
1955 Geologic climatic dating in the west. American Antiquity 20(4):317-335.

Arnheim, Rudolf
1949 The gestalt theory of expression. Psychological Review 56:156-71.
1974 Art and visual perception: a psychology of the creative eye. University of California Press, Berkeley.

Arthur, George W.
1974 An introduction to the ecology of early historic communal bison hunting among the northern plains indians. Unpublished doctoral dissertation. Department of Anthropology, University of Calgary, Alberta, Canada.

Baker, Richard G. and Kirk A. Waln
1985 Quaternary pollen records from the great plains and central united states. Pollen records of late-quaternary north american sediments, edited by Vaughn M. Bryant, Jr. and Richard G. Holloway. American Association of Stratigraphic Palynologists Foundation, Austin, Texas.

Bamforth, Douglas B.
1991 Ecology and human organization on the great plains. Plenum Press, New York.

Barnett, H.G.
1953 Innovation: the basis of cultural change. McGraw-Hill, New York.

Barnosky, Cathy W. et al.
1987 The northwestern u.s. during deglaciation: vegetational history and paleoclimatic implications. In The geology of north america (vol. K-3), edited by W.F. Ruddiman and H.E. Wright, Jr. Geological Society of America, Boulder, Colorado.

Binford, Lewis R.
1962 Archaeology as anthropology. American Antiquity 28(2): 217-225.

Bleed, Peter
1969 The archaeology of petaga point: the preceramic component. Minnesota Prehistoric Archaeology Series. Minnesota Historical Society, St. Paul.

Boas, Franz
1955 Primitive art. Dover Publications, New York.
Borchert, John R.
1950 The climate of the central north american grassland. Annals of the Association of American Geographers 40(1):1-39.
Bordes, Francois and Denise de Sonneville-Bordes
1970 The significance of variability in palaeolithic assemblage. World Archaeology 2:61-73.
Breznitz, Shlomo
1994 Stress in the prison of success. Social Research 61(1): 167-179.
Brumley, John H.
1990 Investigations at herdegen's birdtail butte site (24BL1152). Archaeology in Montana 31(1):17-86.
Brumley, John H. and Barry J. Dau
1988 Historical research investigations within the forty-mile creek resevoir project. Archaeological Survey of Alberta Manuscript Series #13.
Brumley, John H. and Patrick J. Rennie
1993 The results of investigations at the king site along the east margins of the little rocky mountains. Ethos Consultants Inc., Havre, Montana.
Bryson, Reid A.
1974 A perspective on climatic change. Science 184(4138):753-760.
Bryson, Reid and Thomas J. Murray
1977 Climates of hunger: mankind and the world's changing weather. The University of Wisconsin Press, Madison.
Burkhardt, M.E. and D.J. Brass
1990 Changing patterns or patterns of change: the effects of a change in technology on social network structure and power. Administrative Science Quarterly 35:104-127.
Butzer, Karl W.
1971 Environment and archaeology: an ecological approach to prehistory (second ed.). Aldine Publishing Co., Chicago.
Clayton, Les; W.B. Bickley, Jr.; and W.J. Stone
1970 Knife river flint. Plains Anthropologist 15(50):282-290.
Conkey, Margaret
1992 Experimenting with style in archaeology: some historical and theoretical issues. In The uses of style in archaeology, edited by Margaret Conkey and Christine Hastorf. Cambridge University Press, Cambridge.
Coupland, Robert T.
1958 The effects of fluctuations in weather upon the grasslands of the great plains. The Botanical Review 24(5):274-317.

Cowgill, George L.
1975 Population pressure as a non-explanation. In Population studies in archaeology and biological anthropology: a symposium, edited by Alan C. Swedlund.

Crowther, Paul
1993 Art and embodiment: from aesthetics to self-consciousness. Clarendon Press, Oxford.

Cupchik, Gerald C. and R. Walter Heinrichs
1981 Toward an integrated theory of aesthetic perception in the visual arts. In Advances in intrinsic motivation and aesthetics, edited by Hy I. Day. Plenum Press, New York.

Davis, Leslie B.
1966 Avonlea point occurrence in northern Montana and Canada. Plains Anthropologist 11(32):110-116.

Davis, Leslie B. and Jack Fisher
1988 Avonlea predation on wintering plains pronghorn. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Dissanayake, Ellen
1992 Homo aesthetics: where art comes from and why. The Free Press, New York.

Duke, P.G.
1988 Models of cultural process during the avonlea phase. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Eibl-Eibesfeldt, I.
1988 The biological foundation of aesthetics. In Beauty and the brain: biological aspects of aesthetics, edited by Ingo Rentschler, Barbara Herzberger, and David Epstein. Bickhauser Verlag, Basel.

Fagan, Brian M.
1991 In the beginning: an introduction to archaeology (seventh ed.). Harper Collins, New York.

Fisher, John W. Jr. et al.
1994 The koepke bison kill site (24GF270), montana. Unpublished manuscript.

Fraley, David C.
1988 Avonlea and besant in eastern montana: archaeological distributions in the lower yellowstone region. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Fredlund, Lynn B.
1981 Southeast montana in the late prehistoric period: human adaptation and projectile point chronology. Unpublished Ph.D. dissertation. Simon Fraser University.

1988 Distribution and characteristics of avonlea south of the yellowstone river in montana. In Avonlea yesterday and today:archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Frison, George
1972 The role of bison procurement in post-altithermal populations on the northwestern plains. University of Michigan Museum of Anthropology Anthropological Papers 46.
1991 Prehistoric hunters of the high plains (second ed.). Academic Press, San Diego.

Gero, Joan M.
1991 Genderlithics: women's roles in stone tool production. In Engendering archaeology, edited by J.M. Gero and M.W. Conkey. Basil Blackwell, Cambridge.

Gombrich, E.H.
1984 The sense of order: a study in the psychology of decorative art. Cornell University Press, Ithaca.

Greiser, Sally T.
1988 Lost terrace avonlea material culture. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Griffin, James B.
1960 Climatic change: a contributory cause of the growth and decline of northern hopewellian culture. The Wisconsin Archaeologist 41(2):21-33.

Hannas, L. Adrien and Timothy R. Nowak
1988 Avonlea: a point industry surfaces in south dakota, or archers on the march. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Hayden, Brian
1981 Research and development in the stone age: technological transitions among hunter-gatherers. Current Anthropology 22:519-548.

Hodder, Ian
1979 Economic and social stress and material cultural patterning. American Antiquity 44:446-454.

Hoffman, Robert S. nd J. Knox Jones Jr.
1970 Influences of late-glacial and post-glacial events on the distribution of recent mammals on the northern great plains. In Pleistocene and recent environmnts on the central great plains, edited by W. Dort and J.K. Jones. University of Kansas Publications, Lawrence.

Hudecek-Cuffe, Caroline R.
1992 Aspects of culture change in the late prehistoric period on the northwestern plains. North American

Archaeology 13(4):317-332.

Husted, Wilfred
1969 Bighorn canyon archaeology. Smithsonian Institution River Basin Survey, Publications in Salvage Archaeology, No. 12. Lincoln.

Johnson, Ann M.
1970 Montana projectile point types: avonlea. Archaeology in Montana 11(1):45-57.

Jones, Rhys
1990 Hunters of the dreaming: some ideational, economic and ecological parameters of the Australian aboriginal productive system. In Pacific production systems: approaches to economic prehistory, edited by D. Yon and J. Mummery. Australian National University, Canberra.

Joyes, Dennis C.
1988 A summary and evaluation of avonlea in manitoba. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Kehoe, Thomas F.
1961 The avonlea projectile point. The Blue Jay 19:137-139.
1966 The small side-notched point system of the northern plains. American Antiquity 31(6):827-841.
1973 The gull lake site: a prehistoric bison drive site in southwestern saskatchewan. Publications in Anthropology and History, No. 1. Milwaukee Public Museum.
1988 The avonlea point: a history of the concept. In Avonle yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Kehoe, Thomas F. and Bruce McCorquodale
1961 The avonlea point: horizon marker for the northwestern plains. Plains Anthropologist 6(13):179-188.

Keinan, G.
1994 Effects of stress and tolerance of ambiguity on magical thinking. Journal of Personality and Social Psychology 67:48-55.

Klimko, Olga
1985 New perspectives on avonlea: a view from the saskatchewan forest. Contributions to Plains Prehistory: the 1984 Victoria Symposium, edited by David V. Burley. Archaeological Survey of Alberta, Occasional Paper No. 26. Alberta Culture Historical Resources Division.

Klimko, Olga and Margaret G. Hanna
1988 The avonlea type site revisited: a report on excavations and ceramic analysis. In Avonlea

yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Kroeber, Alfred L.
1969 Relations of environmental and cultural factors. In Environment and cultural behavior: ecological studies in cultural anthropology, edited by Andrew P. Vayda. Natural History Press, Garden City.

Lee, Vernon and C. Anstruther-Thomson
1912 Beauty and ugliness and other studies in psychological aesthetics. John Lane, The Bodley Head, London.

Maquet, Jacques
1971 Introduction to aesthetic anthropology. Addison-Wesley Module in Anthropology. Reading, Massachusetts.

Malinowski, Bronislaw
1954 Magic, science, and religion and other essays. Doubleday, Garden City.

McCarthy, Frederick D.
1977 The use of stone tools to map patterns of diffusion. In Stone tools as cultural markers. Humanities Press, New Jersey.

Meyer, David
1983 Saskatchewan laurel: an overview. Saskatchewan Archaeology 4:3-24.

Meyer, David, Olga Klimko and James Finnigan
1988 Northernmost avonlea in saskatchewan. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Milne, Laurie Ann
1988 The larson site (D10n-3) and the avonlea phase in southeastern Alberta. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis, Saskatchewan Archaeological Society, Saskatoon.

Minai, Arghar Talaye
1993 Aesthetics, mind, and nature: a communication approach to the unity of matter and consciousness. Praeger Publishers, Westport, Connecticut.

Moodie, D.W. and Arthur J. Ray
1976 Buffalo migrations in the canadian plains. Plains Anthropologist 21(71):45-52.

Morgan, R.G.
1979 An ecological study of the northern plains as seen through the garratt site. Occasional Papers in Anthropology, No. 1. Department of Anthropology, University of Regina, Regina, Saskatchewan.

Morris, Desmond
1962 The biology of art: a study of the picture-making behavior of the great apes and its relationship to

human art. Alfred A. Knopf, New York.

Munson, Gene
1991 Archaeological investigations at 24RB1145 for peabody coal company's big sky mine, area b, rosebud county, montana. GCM Services, Inc. Butte, Montana.

Ottaway, Harold
1970 A possible origin for the cheyenne sacred arrow complex. Plains Anthropologist 15(48):94-98.

Paul, Gregor
1988 Philosophical theories of beauty and scientific research on the brain. In Beauty and the brain: biological aspects of aesthetics, edited by I. Rentschler, B. Herzberger, and D. Epstein. Birkhauser Verlag, Basel.

Quigg, Michael
1978 Winter bison procurement in southwestern alberta. Plains Anthropologist Memoir 14, edited by L.B. Davis and M. Wilson.

Rappaport, Roy A.
1969 Ritual regulation of environmental relations among a new guinea people. In Environment and cultural behavior: ecological studies in cultural anthropology, edited by Andrew P. Vayda. Natural History Press, Garden City.
1971 The sacred in human evolution. Annual Review of Ecology and Systematics 2:23-44.

Reeves, Brian O.K.
1983 Culture change in the northern plains: 1000 B.C.-A.D. 1000. Archaeological Survey of Alberta, Occasional Papers, No. 20 Edmonton.

Rehrer, Charles
1978 Buffalo population and other deterministic factors in a model of adaptive process on the shortgrass plains. Plains Anthropologist Memoir 14, edited by L.B. Davis and M. Wilson.

Renfrew, Colin
1994 The ancient mind: elements of cognitive archaeology. Cambridge University Press, Cambridge.

Rhoades, Robert E.
1978 Archaeological use and abuse of ecological concepts and studies: the ecotone example. American Antiquity 43:608-614.

Roll, Tom E.
1979 Additional archaeological assessment of the fisher river site (24LN10), northwestern montana. Archaeology in Montana 20(2):79-106.
1988 Focus on a phase: expanded geographical distributions and resultant taxonomic implications for avonlea. In Avonlea yesterday and today: archaeology and prehistory, edited by

Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Roll, Tom E. and Smith
1982 Kootenai canyon archaeology: the 1979 laurd project final mitigation report. Report to the Seattle District, U.S. Army Corps of Engineers.

Ruebelman, George N.
1980 The henry smith archaeological site protection project, phillips county, montana. Manuscript on file, Bureau of Land Management, Lewistown.
1988 The henry smith site: an avonlea bison procurement and ceremonial complex in northern montana. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Sackett, James R.
1977 The meaning of style in archaeology: a general model. American Antiquity 42:369-380.
1992 Style and ethnicity in archaeology: the case for isochrestism. In The uses of style in archaeology, edited by Margaret Conkey and Christine Hastorf. Cambridge University Press, Cambridge.

Schaeffer, Claude E.
1978 The bison drive of the blackfeet indians. Plains Anthropologist Memoir 14, edited by L.B. Davis and M. Wilson.

Smith, Brian J. and Ernest G. Walker
1988 Evidence for diverse subsistence strategies in an avonlea component. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Smith, Philip E.
1973 Some thoughts on variations among certain solutrean artifacts. In Estudies dedicados al profesor dr. luis pericot.

Smoliak, S.
1956 Influence of climatic conditions on forage production of shortgrass rangeland. Journal of Range Management 9:89-91.

Soper, Dewey J.
1941 History, range and home life of the northern bison. Ecological Monographs 2(4):347-412.

Stanfill, Alan L.
1988 Avonlea projectile point manufacture: a testable model. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Syms, E. Leigh
1977 Cultural ecology and ecological dynamics of the ceramic period in southwestern manitoba. Plains Anthropologist Memoir 12, Vol. 22(76), Pt.2.

Lincoln.
Tacon, Paul S.C.
1991 The power of stone: symbolic aspects of stone use and tool development in western arnheim land, australia. Antiquity 65:192-207.
Thornhill, Randy
1993 The allure of symmetry. Natural History 102(9):30-36.
Tratebas, Alice and Ann M. Johnson
1988 Three avonlea bison kill sites in the milk river drainage of northeastern montana. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.
Tuan, Yi-fu
1993 Passing strange and wonderful: aesthetics, nature and culture. Island Press/Shearwater Books.
Warburton, Miranda and Philip Duke
1995 Projectile points as cultural symbols: ethnography and archaeology. In Beyond subsistence: plains archaeology and the postprocessual critique, edited by Philip Duke and Michael C. Wilison. University of Alabama Press, Tuscaloosa.
Washburn, D. (Editor)
1984 Structure and cognition in art. Cambridge University Press, Cambridge.
Wettlaufer, B.N. and W.J. Mayer-Oakes
1960 The long creek site. Anthropological Series No. 2. Saskatchewan Museum of Natural History, Department of Natural Resources, Regina, Saskatchewan.
White, J. Peter; Nicholas Modjeska; and Irari Hipua
1977 Group definitions and mental templates. In Stone tools as cultural markers. Humanities Press, New Jersey.
Whybrow, Peter
1984 Contributions from endocrinology. In Approaches to emotion, edited by Klaus Scherer and Paul Ekman. Lawrence Erlbaum Associates, Hillsdale, New Jersey.
Wiessner, Polly
1983 Style and social information in kalahari san projectile points. American Antiquity 48:253-276.
1989 Style and changing relations between the individual and society. In The meaning of things: material culture and symbolic expression, edited by Ian Hodder. Unwin Hyman, London.
1990 Is there a unity to style? In The uses of style in archaeology, edited by Margaret Conkey and Christine Hastorf. Cambridge University Press, Cambridge.
Wilson, Michael Clayton
1988 Bison dentitions from the henry smith site, montana: evidence for seasonality and

paleoenvironments at an avonlea bison kill. In Avonlea yesterday and today: archaeology and prehistory, edited by Leslie B. Davis. Saskatchewan Archaeological Society, Saskatoon.

Wobst, H. Martin
1974 Boundary conditions for paleolithic social systems. American Antiquity 79:147-178.

Wolfe, Alvin W.
1969 Social structural bases of art. Current Anthropology 10:3-44.