Romancing the Debitage:
The Lithic Debitage and Projectile Points at Bernard Creek Rockshelter, Idaho County, Idaho

A Thesis

Presented in Partial Fulfillment of the Requirements for the

Master of Arts

with a

Major in Anthropology

in the

College of Graduate Studies

University of Idaho

by

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May 2015

Authorization to Submit Thesis

This Thesis of Shaun Dinubilo, submitted for the degree of Master of Arts with a Major in Anthropology and titled "Romancing the Debitage: The Lithic Debitage and Projectile Points at Bernard Creek Rockshelter, Idaho County, Idaho," has been reviewed in final form. Permission, as indicated by the signatures and dates below, is now granted to submit final copies to the College of Graduate Studies for approval.

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Abstract

In 1976, two archaeologists from University of Idaho went to Bernard Creek Rockshelter in Hells Canyon National Recreational Area, Idaho to survey the damage done by people who were illegally mining the site for artifacts. Since the original excavation in 1976, very little academic work has been done on the site's collection that was recovered at a time pivotal to the understanding of lithic debitage. My main research questions are: is there any correlation between lithic typology and environmental changes, what was the function of the site, did site function change over time, and is there a change in lithic raw material that suggests a more curated or expedient behavior? The importance of the findings will be to help archaeologists better understand behavior of the Cascade archaeological phase and realize the importance environment had on a lithic system through the use of correlations.

Acknowledgements

I would like to thank Robert Lee Sappington for suffering through my grammar and spelling on my thesis drafts and for giving me some guidance on stone tool reduction. Additional thanks to the Don Crabtree Scholarship committee for bestowing me 1000 dollars for research which gave a better understanding of time within the site. I would also like to thank Washington State University's geoarchaeology lab for allowing me to use their nested sieves. I would like to acknowledge Stacey Camp, Joseph Randolph, William Andrefsky, and James Chatters. Recognition is due to the Alfred Bowers Laboratory of Anthropology for gathering the original site data. Lastly, recognition is due to AMS Direct for obtaining radiocarbon dates for Bernard Creek Rockshelter.

Thanks is due to Steve Hackenberger for helping establish a thesis topic and sharing important information regarding Hells Canyon and Bernard Creek Rockshelter. Without his assistance the project would have been too much to bear. Also his networking skills allowed me to navigate the legality of radiocarbon dating for the site and the ability to contact the lead excavator of the site Joseph Randolph. Lastly, the culture resource management reports he was able to give me helped drastically in the process of understanding Hells Canyon prehistory.

Dedication

I would like to dedicate this thesis to David and Peggy Dinubilo. Without their encouragement and support I would have lost hope in this project a long time ago and the aliens would have won!

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Chapter I: Introduction

The importance of Bernard Creek Rockshelter is the knowledge about the Cascade Archaeological phase. This could give legitimacy to the Nez Perce tribe's argument of being here for 7,500 BP. The Bernard Creek Rockshelter archaeological site was excavated in 1976 by the archaeologists Max Dahlstrom and Joseph Randolph as part of an Archaeological Resource Protection Act project (Randolph and Dahlstrom 1977). Data that were gathered from the excavation has remained unstudied to this day. Since the 1970s, there have been major refinements in history, theories, and methods available for archaeologists to use for studying old data. The main issue that I am proposing to research is whether lithic reduction correlates to paleoenvironmental changes at Bernard Creek Rockshelter, Hells Canyon National Recreation Area, Idaho. There are several research questions that are driving my main issue of environmental correlation: Is there any correlation between lithic typology and environmental change? What was the function of the site? Did site function change over time? Is there a change in lithic raw material that suggests curated to expedient technologies? Methodologies that I want to use are lithic debitage analysis, establishment of a projectile point chronology, projectile point breakage, projectile point length and thickness measurements, radiocarbon date, and obsidian sourcing (see methods section).

Bernard Creek Rockshelter's importance to the archaeological record and to the general public is twofold. First, there is a currently a crisis of curation (Marquardt et al. 1972). This crisis has its roots in the 1970s when one of the first studies was performed by the United States government (Marquardt et al. 1972). The curation crisis is simply the fact that artifact repositories do not have the funding to maintain adequate conditions for long term artifact storage, lack available space, and cannot fund projects to restore stored archaeological materials (Marquardt et al. 1972). Instead of trying to waste tax payer money by conducting a project that requires a place to store new archaeological materials, such, as lithics, I chose to work on an unstudied site. This study of Bernard Creek Rockshelter will cost no extra fee to the tax payer. Using modern methods on old archaeological materials will ultimately save money over time due to the minimal cost associated with the research of the archaeological site.

The second reason Bernard Creek Rockshelter is important is because the old data from the site require an update. Updating data and providing new insights about human functionality and behavior is why the United States government funds archaeological projects. In order to be a steward to the archaeological record and to meet my obligation to the general public, I need to reveal that old data still have a place in the modern world. I can accomplish this by using a more modern cultural ecology paradigm (see theory section).

The significance of the research I will be performing on the Bernard Creek Rockshelter artifact assemblage will help to establish an understanding of the importance of stone tools and their use by Archaic peoples. I hope to show correlations between stone tool waste amounts and environmental pressures, which will allow for an understanding that the native peoples that lived at the archaeological site were more environmentally aware than previously thought. Correlation will either be a statistical number or a visible change in lithic debitage that matches up with known paleoenvironmental pressures. Lithic debitage is essentially stone tool waste. I hope to allow for reproducibility of my results through the use of empirically based perspectives. Reproducibility is reaching the same conclusion through using different methods. It also allows for my research to foster new ideas about archaeological information from previous data. There is an assumption within archaeology that old data are useless. This ties in to the crisis of curation because it leads to archaeological material becoming ignored and even orphaned.

Good science is the ability to come to the same conclusion through a different methodological approach. There is a red herring in lithic studies which is the want or desire to copy exactly what a previous study has done. Science is not about being able to clone experiments or research methods, but rather trying to assert that the results of research can lead to some form of truth about the world. My research question of lithic reduction correlating to environmental changes at Bernard Creek Rockshelter, Idaho, is not intended for exact replication, but should be counter tested against other sites and methods to determine if my answers hold true or not.

Another major issue with regards to lithic studies and research is the lack of standard terminology. The full range of the archaeological record cannot be standardized. Stone tools are fundamentally variable to an individual tool maker's needs or wants, however, they are all made in stages (Schiffer 1972, Schiffer 1987, Thomas 1981). Within lithic studies, the concept of secondary flakes is used, however, it is never rarely defined. At times when secondary flakes are defined they are not universal across different methodological approaches (Andrefsky 2009). Stone tools are fundamentally variable, but certain aspects like flake stages should have a common terminology. In order for research to be shared and understood by different researchers, there needs to be a common terminology. One of the biggest flaws in all of the approaches to lithic research is how different people define common words. This causes major problems when trying to compare data from different companies and universities. Lithic studies have a tendency to be a very niche field of study which should allow for easy standardization of terminology.

Archaeological Culture Region of Bernard Creek Rockshelter

Bernard Creek Rockshelter is located in the culture area labeled as the Columbia Plateau (Chatters et al. 2003; Roll and Hackenberger 1998; Walker 1998). The culture area extends from eastern Washington to central Idaho and from northeastern Oregon to the Northern Rocky Mountain Range which is a huge geographical area (Walker 1998). Bernard Creek Rockshelter is also very close to the northern edge of the Great Basin Culture Area.

Bernard Creek Rockshelter is located at the confluence of the Snake River and one of its tributaries known as Bernard Creek. This portion of the Snake River has been labeled as the Hells Canyon District and is known to be the deepest portion of the entire Hells Canyon Recreational District (Chatters et al. 2003). The Hells Canyon District is further broken down into three distinct geographical zones: Upper Canyon, Inner Gorge, and the Lower Canyon (Chatters et al. 2003). Inner Gorge is where the Bernard Creek Archaeological site is located, which is the deepest gorge in North America (Chatters et al. 2003, Hackenberger et al. 1991, Idaho Chamber of Commerce n.d.;). The geographical boundary is from Pittsburg Landing to Imnaha River (Chatters et al. 2003). Lower Canyon's Elucian distance is 30 kilometers in length (Chatters et al. 2003).

This portion of the Hells Canyon District contains the two oldest archaeological sites on the Snake River, Hells Canyon Creek Rockshelter and Bernard Creek Rockshelter. Both of these sites have potential to go back in time to at least 8000 BC (Hackenberger et al. 1991, Randolph and Dahlstrom 1977, Roll and Hackenberger 1998). This portion of the Snake River is known for steep canyon walls and many rapids (Roll and Hackenberger 1998). The Inner Gorge was only accessible by a combination of horse and river boat transportation during early 19^{th} century (Chatters et al. 2003). This geographic barrier was not an issue for the Native Americans who would have originally occupied the site (Chatters et al. 2003). However, after the Native people started to use horses as a main source of mobility and transportation the Inner Gorge of the Hells Canyon District became a geographical boundary to them (Hackenberger et al.1991; Roll and Hackenberger 1998). Due to the narrow ledges of the canyon walls, horse travel was near impossible. The current concept is that when Native Americans in the Columbia Plateau adapted the horse, the trails leading to Bernard Creek became too narrow for them to travel on (Hackenberger et al. 1991).

The artifact assemblage at Bernard Creek Rockshelter can potentially tie into a theoretical and metaphysical understanding of how Native people used their surroundings based off the remaining lithics. Unstudied artifacts can bring to light new ideas and test old theories with newer methods, thus allowing for validation of ideas. This validation of ideas is the cycle of science and allows to further progress of humanity's understanding of the site's use and eventual abandonment. Currently, the United States government views that all archaeological data are for the betterment of its citizens (King 2012). The validation of ideas or concepts, meets the federal government's agenda concerning historic preservation (King 2012).

Inner Gorge and Lower Canyon Areas of the Hells Canyon Archaeological District

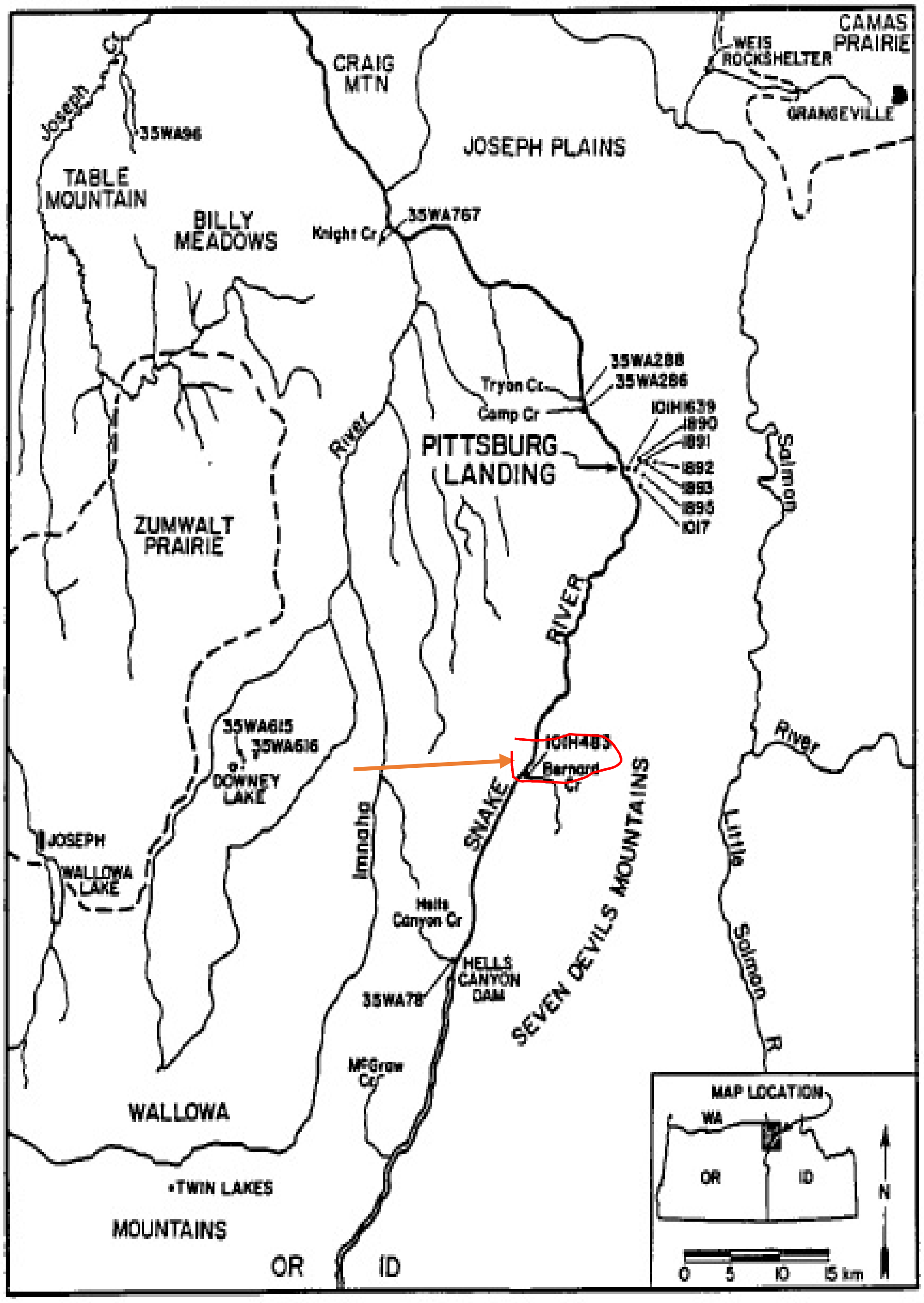

Figure 1: Adapted from Hackenberger et al. 1991. Arrow and circle indicate site location.

History of Ownership of Bernard Creek Rockshelter

The goal of this section is to cover the very brief history of Bernard Creek Rockshelter, the area surrounding the site, and its ownership. Bernard Creek Rockshelter has been under the ownership of different National Forests (Bitterroot, Weiser, Nez Perce, Nez Perce-Clearwater, and Wallowa-Whitman), but has remained under the control of the United States government for over a century (Nez Perce-Clearwater National Forest n.d.). There was an excavation carried out at the archaeological site in 1976 and as of today the site gets a decent amount of tourism from visitors to the Hells Canyon National Recreational Area, but no further study from social scientists.

The area surrounding Bernard Creek Rockshelter during the contact period have historically been managed by the Nez Perce Tribe until the creation of the Bitterroot and Weiser National Forests around 1908 (Nez Perce-Clearwater National Forest n.d). This is when the president of the United States at the time, Theodore Roosevelt, signed into law Executive Order 842 which established the Nez Perce and Clearwater National Forests, and gave the government control of Bernard Creek Rockshelter (Nez Perce-Clearwater National Forest n.d). In 2012 the Nez Perce and Clearwater National Forests merged into the Nez Perce-Clearwater National Forest (Nez Perce-Clearwater National Forest n.d). During the 1950s, the United States government determined that the Hells Canyon Area had both archaeological and historical importance (Torgeson 1983). However, it was not until 1975 that the Hells Canyon National Recreational Area was established in order to allow a place for tourists to visit. The United States Government strived to protect the archaeological and historical sites under a federal agency (Torgeson 1983). With the establishment of the Hells Canyon Archaeological District (HCAD), the United States government wanted to preserve the importance of the archaeological sites. At the same time, the federal government also acknowledged the importance that the HCAD had when it came to tourism, and in 1985 the Hells Canyon Archaeological District was formed (Chatters et al. 2003).

The historical importance of the HCAD ranges in time from about 8,000 years ago to the mid-20^{th} century with the remains of mining equipment, agricultural items, and dam shafts on the ground level (Torgeson 1983). The results of Bernard Creek Rockshelter excavation of 1976 have played a major role in determining the significance of the HCAD because of the geological and faunal data acquired (Torgeson 1983). The age of the site was determined to be 7200 years before present (BP), one of the oldest in the HCAD.

Chapter II: History of Excavation of Bernard Creek Rockshelter

Excavations were carried out by Max Dahlstrom and Joseph Randolph as part of an Archaeological Resource Protection Act investigation to determine the extent of damage caused by illegal relic collectors (Randolph and Dahlstrom 1977). During the excavations at Bernard Creek Rockshelter, three test pits were dug to various depths: Test pit 1/Block 1 was excavated to 370 centimeters and was designed to determine the significance of the site. Test pit 2/Block 2 was excavated near Block 1 to a depth of 140 centimeters, and Test pit 3/Block 3 was excavated to a level of 260 centimeters (Randolph and Dahlstrom 1977). Test pits 2 and 3 were designed to determine the level of disturbance from illegal relic collectors (Randolph and Dahlstrom 1977). From the three test pits, it was concluded that Bernard Creek Rockshelter had been extensively damaged by illegal excavation. Approximately 62% of the horizontal layer, and 17% of the vertical deposits were negatively impacted by illegal artifact mining (Randolph and Dahlstrom 1977: 46). Looting of the archaeological site possibly increased due to one main cause: the search for quartz for radio right after World War II (Chatter et al. 2003). It should be noted that Bernard Creek Rockshelter is located along a hiking trail and the site has been known for looting, despite its location in the Nez Perce-Clearwater National Forest (Randolph and Dahlstrom 1976). The United States government was buying quartz from any source due to a shortage (Chatters et al. 2003). Idaho as a state, is rich in quartz which is probably due to the formation of gold deposits. However, near the site, there are no known quartz deposits in the area. It has been reported that the original looting of the archaeological site destroyed the topmost cultural horizons due to the site having quartz material artifacts (Chatters et al. 2003).

Dahlstrom and Randolph concluded that about 6700 years of pre-contact history was destroyed, however, older deposits were considered to be culturally and stratigraphically intact (Randolph and Dahlstrom 1977). The disturbance was determined by excavating a control Test Pit (Block 1), and then excavating another test pit to determine the extent of disturbance. Bernard Creek Rockshelter has enough undisturbed data to provide further research to a better understanding of the Cascade archaeological phase. Its artifact assemblage has been boxed up in the University of Idaho Alfred Bowers Laboratory of Anthropology and remained unstudied by academics until 2013 when Dr. Steven Hackenberger from Central Washington University started having a few of his students perform faunal analyses on the artifacts from site (Day 2014, personal communication Steven Hackenberger 201;).

A radiocarbon date determined that Bernard Creek Rockshelter's oldest occupation level is 7139 years ago. The date obtained was at the bottom of the block 1 (370 cm). Block 1 was not a sterile layer within the site, it was the middle of a lithic feature (Randolph and Dahlstrom 1977). This is the only radiocarbon date obtained because the archaeologists did not have funding to gather more samples for testing (Randolph and Dahlstrom 1977). The latest form of projectile point discovered at the archaeological site is the Elko Corner Notched that dates between 3500 and 1500 BP years ago (Randolph and Dahlstrom 1977). Dahlstrom and Randolph never did an in-depth projectile point chronology. There is one historic period artifact that was lying on the surface of the site which is a 22 caliber rifle shell that was not dated during the study (Randolph and Dahlstrom 1977). The total age range of the site remains radio-metrically undetermined as of 2015 (Randolph and Dahlstrom 1977). Bernard Creek Rockshelter is known to have an occupation period beginning in the early Cascade phase and possibly going into the later Harder phase (Randolph and Dahlstrom 1977). After their investigation, a study came out about the subsistence use at the archaeological site (Regan and Womack 1982).

There is currently an interest in the archaeological site for tourists due to the pictographs at Bernard Creek Rockshelter that were mapped out by Google during their creation of Google Earth. Pittsburg Landing in the Hells Canyon National Recreation Area offers a trail head for backpackers that goes right by the site (Idaho Department of Commerce n.d.). There are also a couple of boat docks located at Pittsburg Landing that permit the use of jet boats and other privately owned aquatic vessels to enter the Snake River.

Bernard Creek Rockshelter has the most prehistoric importance in the Cascade phase due to it being significant enough to help establish the HCAD, when compared to the majority of sites in Hells Canyon (Chatters et al. 2003; Hackenberger et al. 1991; Torgeson 1983; Walker 1998). During the Cascade phase, Mount Mazama ash appears at the 150 cm level along with the introduction of a side-notched projectile point, but the authors did not give an explanation (Randolph and Dahlstrom 1977). During the original site report, not much time was spent building a sufficient cultural projectile chronology of Bernard Creek Rockshelter. Dahlstrom and Randolph listed the projectile points that were found in the strata and determined if they were lanceolate, dart, and arrow points (Randolph and Dahlstrom 1977). However, considering that some of the artifacts were incorrectly identified, it seems most likely that these lists were based off current 1960s academic articles and morphology. During their excavation one of the main questions being addressed was if Cascade points were common throughout the Columbia Plateau. It was assumed that they were lanceolate points, however, it was not until the later 1970s and 1980s that these assumptions were challenged due to better data (Thomas 1981).

More recently a few studies have been performed to try to get a slightly better understanding of Bernard Creek Rockshelter. A pedestrian survey was carried out near the site to try to locate any known raw material sources such as chert and jasper (Chatters et al. 2003). The pictographs found during the excavation have been radiocarbon dated to 7000 years ago (Chatters et al. 2003). A refined radiocarbon date was taken from the soil recovered from test pit/block 1 (Chatters et al. 2003). Any modern study on Bernard Creek Rockshelter directly reflects the original reports from 1977, and it remains the metanarrative on the archaeological site. This seems problematic because for about 40 years no academics have attempted to use modern theoretical ideology on this significant site.

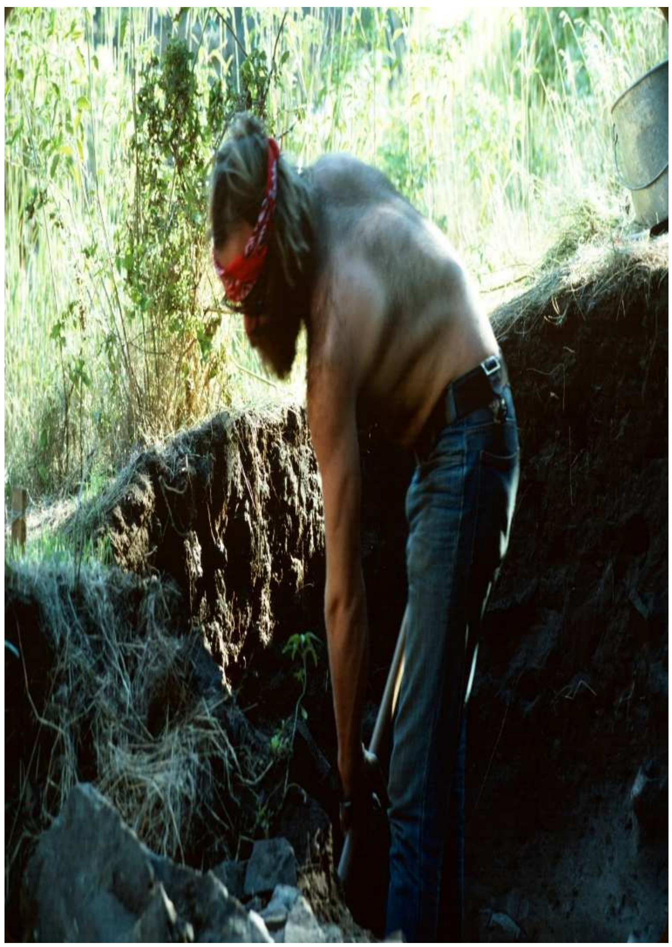

Figure 2: Joseph Randolph excavating the site. (Photo by Joseph Randolph 1976).

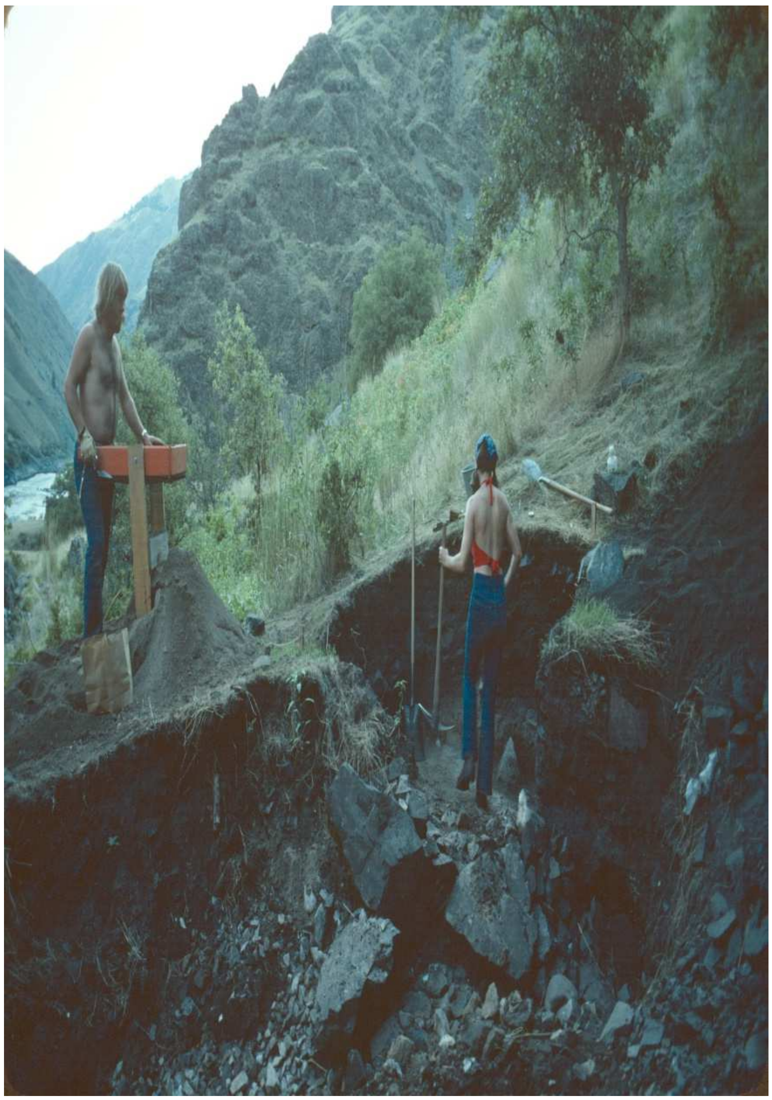

Figure 3: Excavation of the site by Keo Boresen and Norris Randolph. View of Bernard Creek Rockshelter's Northeast test pit. (Photo by Joseph Randolph 1976).

Figure 4: John Mitchell excavating a test pit. (Photo by Joseph Randolph 1976).

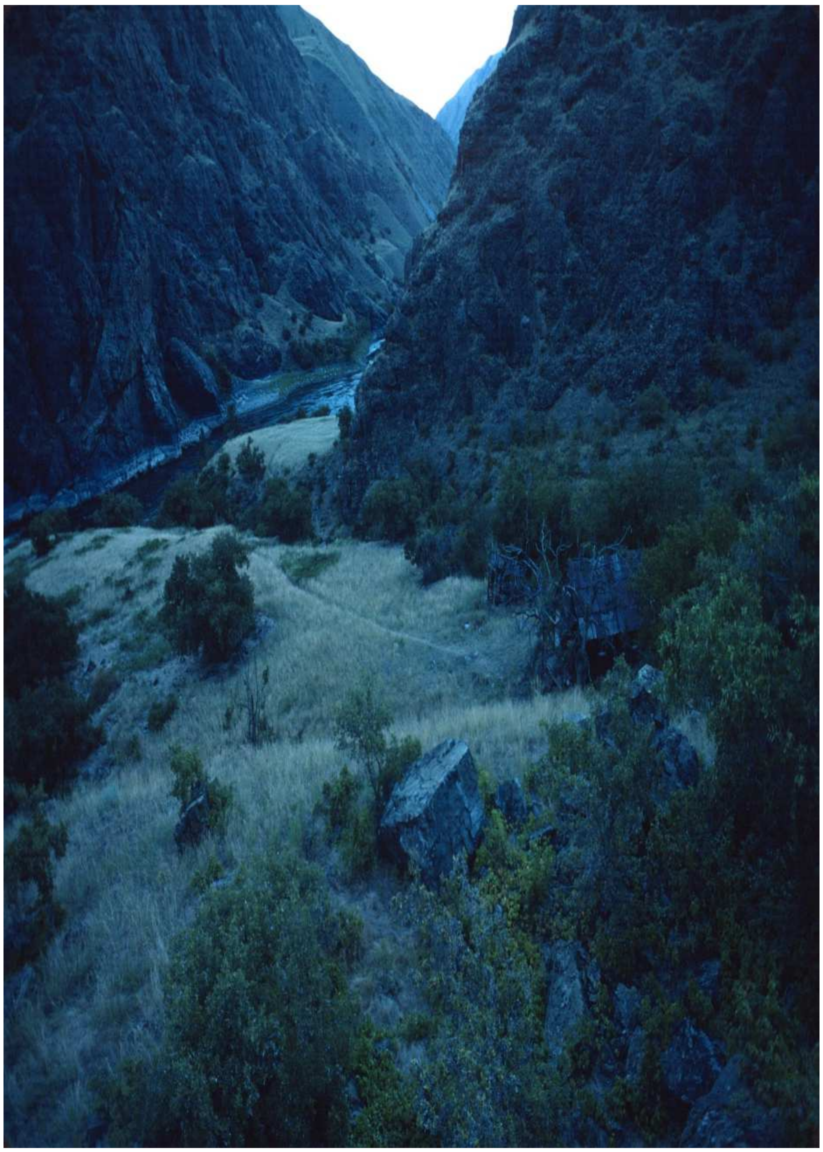

Figure 5: View facing Bernard Creek form the Northeast. Site is behind the photographer. (Photo by Joseph Randolph 1976).

Figure 6: Bird's eye view of Bernard Creek Rockshelter's 370 cm of stratigraphy. This is test pit (block 1) and was stopped at 370 cm. (Photo by Joseph Randolph 1976).

Figure 7: Stratigraphy of test pit (Block) 1. The white band is the Mount Mazama ash layer (6800 to 7000 BP). (Photo by Joseph Randolph 1976).

Figure 8: Projectile Points that were 0-20 cm below datum. (Photo by Joseph Randolph 1976)

Figure 9: Projectile point fragments from 280-290 cm below datum. (Photo by Joseph Randolph 1976).

Figure 10: Cascade projectile points at 360-370 cm below datum. (Photo by Joseph Randolph 1976).

Chapter III: The Convergence of Theory, Method, and Research Questions

The questions I hope to address using the various methods declared in this proposal are:

1. Is there any correlation between lithic typology and environmental changes?

2. What was the function of the site?

3. Is there a change in lithic raw material that suggest curated to expedient behavior? (see theory section)

4. Did site function change over time?

These questions put my research under the positivist paradigm of the 1960s and 1970s. However, I realize that not all features of the archaeological record are due to material causation alone. Material causation is the concept that physically measurable events, like environment changes, cause changes in cultural systems. Objectivity comes from the artifacts in the ground and the ways they were discarded.

Very little has been written about the combination of flake debitage amounts and types being related to environmental changes. Current knowledge about lithic reduction assumes that stones are reduced in typological stages in a cultural system (Schiffer 1987). This cultural system of stone reduction has created types of stone debitage, and has been implied to create mutually exclusive categories (Alan and Sullivan 1995). When I perform my methodologies, there will be a separation of lithic debitage being broken into either a primary flake, secondary flake, tertiary flake, or microlithic. I put the stone debitage and formed tools into a "type" but for a systematic approach to lithics, they are all related to each other in some way and not truly mutually exclusive. Lithic types, I believe, are actually more ranges of measurements and are not fundamentally exclusive to each other. Little is known about flake types determined by mass analysis within the Columbia Plateau, except for what has been found in the gray literature.

Since the 1980s, the archaeological literature has been steadily increasing about lithic methodologies and their use (Andrefsky 2001). From the 1980s to the early 2000s, published arguments between archaeologists have occurred in journal articles and books on lithic methodologies (Andrefsky 2001, Morrow 1997, Shott 1994). More recently, two major lithic debitage methods have come under critical review because of problems of replication, subjectivity, and lack of standardization (Andrefsky 2001). The two major methods are attribute analysis and technological analysis. Attribute analysis is a typology based off of one or two lithic attributes, such as cortex amounts. Technological analysis is the process of looking at individual lithic variation on a single piece of lithic debitage.

During the 1990s, another type of lithic methodology came about because of the time constraints in using attribute and technological analysis (Andrefsky 2001). This new method is called aggregate analysis or mass analysis. During the 1990s and early 2000s, mass analysis was tested and revealed that the flaws of the methodological approach did not outweigh the benefits (Andrefsky 2001, Shott 1994). This is because mass analysis cannot determine the type of reduction (Andrefsky 2009). Instead the method assumes that all reduction is coming from a core (Andrefsky 2009). In more recent times, mass analysis has started to replace technological analysis (Andrefsky 2009). Sieve mass analysis has several flaws, but the major issue is not being able to identify individual technological variation on flakes. The problems concerning flake variation for sieve mass analysis is addressed with the increased amount of sieves used (personal communication with Bill Andrefsky 2014). A huge benefit to using mass analysis is the ability to quantify lithic size classes, which allows for the use of statistics. Statistics can used to see if there is a relationship between different types of archaeological material. A numeric correlation can give a valuable line of evidence.

In 2009, an article by Willam Andrefsky challenged the use of stone tool studies involving lithic analysis and argued against sieve mass analysis (Andrefsky 2009). The article challenged the notion that mass analysis is replicable and has major issues involving debitage size and the mesh being used (Andrefsky 2009). The argument being made is that sieve mesh size does not control debitage shape (Andrefsky 2009). Lastly, it has been argued that making assumptions about behavior without tying it into debitage technological differences is not useful (Andrefsky 2009).

I respectfully disagree with Bill Andrefsky and argue that the size class of lithic debitage can be important depending on the research questions being addressed. The scale of research, scope of research, research design, reproducibility, and theoretical assumptions for any major questions being asked are dependent on the method a person uses. The scale of my research is currently macroscopic and is concerned only with descriptive systemic correlation with known environmental pressures. If my research was addressing technological variation of lithics to infer individual or possibly group behavior, then I would use a different methodology. Fundamentally, there is a limit to how much lithic debitage and tools can reveal about human behavior. The scope of my research could be applicable to a large area and sieve mass analysis allows for data to be acquired at a faster rate (because it allows for debitage to be sorted through sieving), which will reduce error. Due to the issues associated with technological analysis, mass analysis allows for a standardized method for archaeological materials.

Research design comes down to analyzing two forms of data: quantitative and qualitative (Erickson and Murphy 2008). The question of lithic correlation and environmental pressures requires the use of both types of data. The analysis of lithic debitage being used to address my questions requires the use of mass data. Mass data can ultimately be turned into statistical numbers that can show a correlation using the Pearson R statistic for testing purposes. The only use for the Pearson's R test is to show statistically that there is a relationship occurring between two elements such as lithic debitage amounts and environmental change.

Qualitative data for my research design will come from two different methodologies: cultural chronology and radiocarbon dating. Usually archaeological sites do not contain large amounts of projectile point data, but the stone points do allow for a sense of time depth. Projectile points can also be useful for arguing about possible human landscape trends due to how and when they appear in archaeological strata (Andrefsky 2001, Dunnell 1978, Shott 1994, Thomas 1978). Radiocarbon dates are expensive to obtain, but allow for a relatively precise understanding of time depth that is able to be correlated with the data from my mass analysis.

Quantitative data acquired for my research design from the site include debitage analysis, microdebitage, projectile point breakage patterns, and identifying raw material types of lithic debitage. Sieve mass analysis is fundamentally a method that creates statistical multivariate data (Andrefsky 2001, Andrefsky 2009). Multivariate data have several operational and quantifiable (numeric) measurements that are mathematical in nature. This type of data can then be applied to the statistical measures of Pearson's R test and Chi-Square tests to observe independence and significance of variables (Rumsey 2001). The employed statistical methods are fundamental to testing hypotheses that require multivariate types of data. A side benefit of mass analysis is the typing of microdebitage. Projectile point breakage patterns can also reveal data about the use of projectile points. Breakage is also fundamental to understanding site function through time by establishing a variable typology of breaks. Variable typologies are not truly mutually exclusive, yet allow the frequency of breaks through time to be quantified. Lastly, having a decent sample size of debitage and projectile point hafting elements allows for raw material types to be quantified. Raw material of stone tools allows for some insight, through time, on what Native Americans were imprinting on. Imprinting is the ability to map on to lithic raw materials sources over time.

Ultimately, the ability to use two different types of data, quantitative and qualitative, can be useful to create a narrative about the site. This narrative can be used to form generalizations about site function, while at the same time become more precise with the qualitative data. Numeric information from statistics can be useful to determine group behavior, while using qualitative data to understand when events occurred.

It is impossible to completely replicate research. The reason for the lack of replication is because individuals bring in biases, such as enculturation and experience, from many different sources that will cause some skew of results. We as an archaeological/anthropological community need to start adapting the term reproducibility. In order to perform science, there needs to be acknowledgment that our biases will alter data either intentionally or unintentionally. Reproducibility is a term that realizes that replication is possible, and shows that coming to the same conclusions allows archaeologist to control their own biases. This is applicable to my own research because lithic studies lack standardized terms. Mass analysis has the same problem, but is workable because it allows for broad categories to be used scientifically while allowing my own biases to be controlled. The subjectivity in sieve mass analysis is in choosing the sieve mesh size to determine flake size in a lithic system. This subjectivity is easily able to be controlled because if anyone wants to reproduce my results, it is simple to grab the same sieve mesh size or test results against a different methodological approach. Mass analysis is easy to reproduce because there is no undefined word used like bipolar flake scarring.

Lithic Debitage Analysis

I will consider sieve mass analysis because it is a more scientifically neutral method, and the ability to reproduce my study and results are possible (Andrefsky 2001). The concept behind sieve mass analysis is to establish a set of sieves that overlap each other in an effort to distribute lithic debitage into a size class (Andrefsky 2001). The size class determines what type the lithic flake is and where in the reduction sequence the majority of the lithic assemblage occurs (Andrefsky 2001, Larson 2004, Larson and Finley 2004). The use of sieve mass analysis allows for whole populations to be quickly analyzed. It also allows archaeologists to look at whole lithic debitage parameters throughout the archaeological collection to better understand site function (Andrefsky 2001, Larson 2004, Larson and Finley 2004). Sieve mass analysis allows archaeologists to work with statistics, allowing them to easily quantify their findings. This eventually allows for interpretation of site function without being subjected to our own biases or researcher errors. Caution must be used when applying this method to not allow for ecological fallacies of data (Andrefsky 2001). The ecological fallacy is the concept of assuming that characteristics of a group apply to all individuals within that group (Rumsey 2011).

Sieve mass analysis is the better of the lithic debitage analysis methods, however, the method has some flaws with its implication and use. The first flaw of the method is that the macroscopic approach I'm using is only assigning flakes based off of four nested sieves. Sieve mass analysis does not account for all variation of flake types, but for my research questions it is applicable (Andrefsky 2001).

I am testing to see if there are any correlations between lithic typologies, or an increase or decrease of lithic type amounts and environmental changes. The use of macroscopic observation is needed to see is if there is a gradual or dramatic increase that matches up with the literature and current knowledge about environmental changes in the paleo-environmental record (Prentiss et al. 2006). The second flaw in using sieve mass analysis is that the data recovered cannot be used to determine the type of tool reduction occurring (Andrefsky 2001, Morrow 1997). Variation on individual lithics are too subjective and too open for interpretation, thus causing flaws and issues of reproducibility. The flaws in using sieve mass analysis are minor compared to the other two types of lithic analysis known as technological analysis and attribute analysis (Andrefsky 2001). It has been noted that sieve mass analysis has been greatly used as a "…general analysis..." of lithic debitage (Franklin and Simek 2008: 13)

Projectile Point Breakage Patterns

One way to address site function and change through time is by visually observing the types of breakage on projectile points. Breakage on projectile points is a major indicator of human behavior and how the stone tools were being used (Frison 1974). There are two broad categories of projectile point breakage: manufacture errors and use break errors (Frison 1974). Those broad categories can be further broken down into bend breaks, burin breaks, basal breaks, and crushed breaks. These categories can exhibit a mixture of these different breaks as well.

Different breakage patterns have certain assumptions behind them and have been replicated out in the field (Frison 1974). One of the assumptions is that bend breaks are indicators of hunting. This is based off of the work by George Frison and his replicative study in 1974. During his replicative study, Frison noticed that projectile points hafted to a foreshaft were more likely to break at a projectile point hafting element. Points used with a main shaft were more likely to shatter. Lastly, he observed that the physics of a projectile point entering into an animal hide caused it to break at the haft (Frison 1974). The break that occurs on the projectile point is hinged and can happen anywhere above the hafting element (Frison 1974). Sometimes, the bend break causes a small flake to be dislodged from the point causing a small impact fracture on the projectile point.

The second assumption I will make about breakage patterns is that any damage to a projectile point's hafting element is from manufacture and not use (Frison 1974). This assumption plays directly into the third assumption that points that are split down the center are from manufacture error. This usually occurs when the conchoidal cone of fracture travels further than the thin stone tool causing it to split in half at a ridge. Both of these assumptions come from my own experience as a novice flintknapper, who has broken more flakes than made successfully completed points.

The final assumption I will make about stone tool breakage is that crushed breaks are from stone tool use. Breakage of this type is commonly caused by the projectile point being used as either a scraping or cutting tool (Frison 1974). Stone tools are fundamentally able to be rejuvenated, which makes them economically important.

These assumptions are intertwined with my research questions because I am curious to determine if site function has changed through time. Projectile point breakage allows for a descriptive statistical measure of frequency between the types of breaks and the assumptions that follow them. The diachronic view that breakage patterns offer me will allow for a testing of function through time and observe if there were indeed group behavioral changes at the site. Due to the site's location, I hypothesize that most of the breaks will be hunting-related or bending fractures. My null hypothesis is that the breaks will be random, suggesting that behavior was random.

Cultural Chronology

The original site report for Bernard Creek Rockshelter suggests several things about the cultural chronology of the archaeological site. The first suggestion is that the Cascade Phase (8000 to 4000BP) projectile points are beyond the scope of Washington State, which is already known. The second assumption is that Bernard Creek Rockshelter had lanceolate projectile points used throughout the 7139 years of occupation (Randolph and Dahlstrom 1977). The current literature about the Columbia Plateau doesn't seem to support this assumption of contact period use of lanceolate points (Ames et al. 2010, Davis 2001, Prentiss et al. 2006). The assumption that lanceolate points were used until historic period (1830 to present), suggests that I should revise the projectile point chronology for Bernard Creek Rockshelter based off one of the many methods available. During the revision of the Bernard Creek Rockshelter projectile point chronology, I will need to define both style and function in order to conceptualize the work I will be doing. I will also attempt to tie it together with my overall questions of curation and environmental pressures (Dunnell 1978).

The bases of the projectile points do not interact with the environment and thus allow for similarity (Dunnell 1978). This similarity with projectile points allows a relative method to date archaeological sites that have been used by the cultural historians and their serration methods from the 1930s (Dunnell 1978). Basal styles of projectile points will allow me to reconstruct the Bernard Creek Rockshelter cultural chronology. I define function as environmentally altered projections that are present on the artifacts. This means that a portion of the stone tools will have an end that is altered by the environment and not temporally and spatially constant between sites and cultures. I break down all projectile points into the function and style adaption in a system. This is not the typical Darwinian archaeology view of stone projectile points, but fits under my theoretical framework of describing past systems.

The third assumption about projectile points at Bernard Creek Rockshelter is that there was a major influence from both the Great Plains and Great Basin in terms of style and function (Randolph and Dahlstrom 1977). Archaeologists have relied upon the assumption of Great Basin and Great Plains influence since major projects occurred in the Columbia Plateau from the 1960s to modern times (Ames et al. 2010, Browman and Munsell 1969).

During my re-analysis of the projectile points at Bernard Creek Rockshelter, I will try to compare the models of the Columbia Plateau projectile chronology and a Great Basin projectile point chronology to attempt to determine if there is in fact overlap between the two types of cultural chronologies. There is already a known type of projectile point that shows up in the archaeological record for both the Columbia Plateau and the Great Basin which is the Elko series of projectile points. My assumption is that there is a cross over, but my null hypothesis is that all of the lanceolate points (except for Clovis and Folsom), dart points, and arrow points are in situ developments.

Several archaeologists have been critical about inferring behavioral function and have questioned if it is possible (Dunnell 1978, Shott 1994, Thomas 1978). I argue that projectile points are useful to understanding past population trends with regards to site function. Projectile points offer one more sets of data to use in an argument for population migration, in situ development, or diffusion. Since the Native peoples of the Columbia Plateau used projectile points and did not make pottery, it is one of the more important data sets available for archaeologists to study in the northwestern United States. The only cultural remnants that preserve well are lithic tools. Archaeology at best can only view a total of about one percent of a total culture, which makes any data set useful when trying to understand past human behavior. Some of the earliest debates in the Columbia Plateau were over projectile point chronologies and associated inferred behavior (Browman and Munsell 1969, Davis 2001, Leonhardy and Rice 1970).

Understanding the projectile point chronology is critical to Bernard Creek Rockshelter because there is only one radiocarbon date, and the archaeological site lacks a temporal range. My research questions need, at the very least, a relative date to compare the lithic debitage to in order to understand past human behavior. Projectile point chronologies are considered a decent method for adding an understanding of time depth to archaeological sites. The original excavators of the site did not document a chronology. Bernard Creek Rockshelter is considered critical to a lot of studies in the Hells Canyon Archaeological District (Torgeson 1983). Including a sense of time depth is necessary for the archaeological site because currently it lacks any understanding of when change occurred in either geologic site formation processes, when human dietary practices changed, and when different resources were heavily stored/exploited.

Projectile Point Thickness Length Ratios

A 2006 article *Projectile Point Shape and Durability: The Effect of Thickness: Length* has suggested that projectile points may have been made to be reused and to purposely shatter inside an animal (Cheshier and Kelly 2006). The reason for a projectile point to purposely shatter is to cause game to bleed more allowing for easy tracking (Cheshier and Kelly 2006). The authors set a determined ratio measure of less than .121 cm for this type of point. Obtaining the measurement requires taking the length of a projectile point and dividing it by the thickness (Cheshier and Kelly 2006). The authors of the article only suggest that the flintknapping strategy was used. The study was experimental and was performed to test breakage patterns with projectile points. No case study was conducted as a follow up.

Chapter IV: Theory, a Foundation of Research

Usefulness of theory in the field of anthropology can be fundamental to the work being done. Theory is strongly tied into most, if not all, research and methods used. Bernard Creek Rockshelter, I believe, has great potential to reveal a lot research questions involving past behavior, site functionality, and environmental pressures. The research questions that I am asking are:

1. Is there any correlation between lithic topology and environmental changes?
2. What was the site's function?
3. Is there a change in lithic raw material that suggests curated to expedient technologies?
4. Did site functionality change over time?

All of the research questions that are being asked are based on some application of archaeological theory. For the research being conducted on the Bernard Creek Rockshelter artifact assemblage, I need to use theory as a way to explain past behaviors based on material factors such as lithic debitage. The theories I plan on using are systems theory, systematic approach to lithic reduction, and site abandonment (Binford 1978, Binford 1980, Schiffer 1987). All the theories listed are historically rooted in each other in some way. During my research I will have to form a hypothesis that will attempt to explain how I foresee that these theoretical assumptions will be noticed in the artifact assemblage for Bernard Creek Rockshelter.

Lewis Binford, the very first American archaeologist that tried to theorize about behavior in the archaeological record, came up with some ideas in the 1970s and 1980s that are still used in modern archaeology. The first of his theories that I'm applying to the Bernard Creek Rockshelter artifact assemblage are the concepts of curated and expedient technologies (Binford 1978). Binford defined curated technologies as "…personal gear" that had large time investments in the items, they had many functions, and were rarely discarded before making it to the end of their use life (Binford 1978: 343). Lewis Binford came up with this concept when he went and observed the Nunamiut in North Central Alaska, and realized that certain items were constantly checked before leaving residential base camps before hunting game animals (Binford 1978).

The other concept that Lewis Binford came up with while observing the Nunamiut, is the concept of expedient technologies (Binford 1978). Expedient technologies, were observed and loosely defined as "…de facto garbage" and stated that "…are the items that are apt to appear most commonly in the archaeological record" (Binford 1978: 342). Lastly, it should be noted that Lewis Binford noticed that all the items that were abandoned on the Nunamiut hunting stand were done so at a distance from the main occupation area of the hunting stand (Binford 1978).

The concepts of expedient and curated technologies are too subjective because they are defined too intuitively (Binford 1978). Lewis Binford's definitions are problematic because they create a scenario where curation and expedience of technologies are not measurable in the archaeological record. They have also created problems of replication due to the lack of standardization of terms and methodologies because of how intuitive his definitions are defined. More recently, the issues concerning the definition of stone tool curation and its presence only in collector subsistence systems has been brought up (Andrefsky 2009). Several studies have concluded that foraging societies in modern times heavily curate tools before going out to gather nearby resources (Andrefsky 2009). These studies have called into question what curation actually is, and if it can be observed in the archaeological record (Andrefsky 2009). Curation and expediency have been shown as attempts to show cultural laws which may not exist (Odell 2001). Personally, I believe that cultural laws exist, but currently no single theoretical paradigm can explain all of the complexity. A better way to define curation in the archaeological record is "…a tool's actual use relative to its maximum potential use" (Andrefsky 2009: 71). This means that lithic debitage that is classified as terminal or retouch flakes, and were used meet their full use life or were curated. This measurement is based on individual flakes and stone tools.

Collector and forager behavior has been observed in the ethnographic record and they are still current in modern research (Binford 1980, Steward 1955). Julian Steward in the 1950s came up with a model for cultural evolution called multi-linear evolutionism (Erickson and Murphy 2008). This work by Julian Steward influenced Lewis Binford and his work in archaeology. Lewis Binford agreed with Julian Steward and in his 1980 article "*Willow Smoke and Dogs Tails*," where Steward argued that certain cultures gathered and stored surpluses of food and other items when the resource availability became very limited due to environmental constraints (Binford 1980, Steward 1955). Some cultures had no need to gather resources because they were readily available at all times of the year (Binford, 1980).

During the time Lewis Binford spent with the Nunamiut of central Alaska, he came up with the ideas of collector and forager behaviors that he believed are observable in the archaeological record. Binford defined collector cultures as having two noticeable qualities to their living strategies "…collectors are characterized by the storage of food for at least part of the year and logistically organized food-procurement parties" (Binford 1980:10). Foragers "…generally have high residential mobility, low-bulk inputs, and regular daily food procurement strategies" (Binford 1980:9). Lewis Binford's assumptions were based off environmental pressures that in turn determine the subsistence strategies that a culture can adapt to better maintain itself. When applied to the archaeological record, certain artifacts can reveal the subsistence pattern used in the past which can also determine behavior (Binford 1980).

Due to how the Columbia Plateau drastically changes seasons in both the past and modern times, an understanding of collector and forager societies are key to any underlining theoretical assumption. This continuum of collectors and foragers in archaeological sites offers a key understanding of how hunter and gatherer societies vary (Prentiss et al. 2006). This continuum allows for cultural variation between two extremes, however, it doesn't offer a straight path to direct archaeological site understanding.

This continuum offers a theoretical framework to determine onsite functionality. Basing the research that the Native peoples in the Columbia Plateau were more on the collector continuum then forager allows for some insight into how people could have mapped on to their resources. There is even an argument that there is a switch from a forager to collector (Prentiss et al. 2006). Logistically, collectors have a systemic approach that works best within their environmental framework for the Columbia Plateau. Looking at individual site functionality helps archaeologists determine spatially how behavioral systems are spread out in the landscape when applied to a broader scale. Behavioral systems can also be revealed through determining site functionality depending on the types of resources being used and the tools used to process those resources. I argue that Bernard Creek

Rockshelter is part of a behavioral system mapped out in the landscape and that the function of the site is either a hunting stand or resource procurement site. A food procurement site would hypothetically contain small amounts of artifacts, have time depth, and contain small pieces of ground stone. My sample size is not an appropriate size to show the occurrence of collecting or foraging.

It should be noted that collectors will use and exploit resources much like foragers if given the opportunity. Since the forager and collector paradigm is based on a continuum the amount of variation can be great. Collectors and foragers could potentially switch roles during a season or year depending on mircoenviromental changes. Putting a culture into a typology can be problematic. For the sake of my research, I will take the concepts of collectors and foragers as a background theory though there are several issues that need to be sorted out regarding this assumption. Collector and forager social organizations are based around the concept of ecological systems theory (Binford 1964; Prentiss et al. 2006).

Behavioral systems attempt to reach a homeostasis and will try to maintain the status quo. This does not mean that systems will not breech homeostasis when there is a drastic environmental change. Usually, behavioral systems will attempt to adapt to a new environment and as such will create new technology, make new rituals, or map on to new or different resources. This is observable in the archaeological record through the changes in projectile point types and lithic. I hypothesize that this homeostasis will also be noticeable in lithic debitage and changes in raw material types. Stone tools and their waste are some of the few preserved archaeological materials still observable in the pre contact archaeological record that will give a glimpse of a larger subsistence system and its many subsystems.

There are many variables to consider when determining if a technology was a causal change to a rapidly changing environment. Systems theory is only best used as a descriptive theory or when applied used as a theoretical background or framework (Hall and Chase-Dunn 1993). I fundamentally believe that there is no one theory that can explain the full variability of human behavior at archaeological sites or landscapes.

In 1972, Michael Schiffer came up with a systemic theoretical approach to lithic reduction and argued about site abandonment depending on amounts of artifacts left behind. The systemic approach that Schiffer created involves lithic reduction being a cultural process that stone artifacts eventually have to pass through, and are then discarded as debitage later on (Schiffer 1972). This system of lithic reduction reveals how sites become abandoned because the amounts of artifacts left behind can also suggest how rapidly the people occupying the site left (Schiffer 1972). The assumption I am making about Bernard Creek Rockshelter is that all of the lithic debitage and stone tools were part of a reduction system that would change depending on environmental pressures. Environment was not the only influence that would completely change a system, but was a stronger driver of the change and is scientifically observable in the archaeological record through the study of lithic debitage and projectile points. The application of this theoretical lens does not mean that I will be searching for success or system failure.

The lithic reduction system did not collapse until the historic period when Euro-Americans brought in diseases and new technology. Therefore, I will not address systemic collapse because it did not happen during the occupation history of Bernard Creek Rockshelter. My hypothesis is that lithic debitage change or stagnation correlates to an environment that was shifting. This environmental alteration will be either dramatic or gradual and thus a relative pattern for lithic debitage should emerge or statistically show correlation with the use of a Pearson's R. The null hypothesis is that lithic debitage homeostasis and adaption, as I have defined them, will not follow a pattern of known paleoenvironmental change or will show no correlation on a chi-square test. This means that other factors (social, individual, resource availability) outside of the environment are influencing the lithic reduction sequence.

The issue of Bernard Creek Rockshelter abandonment can give archaeologists insights to how quickly or gradually Native Americans left archaeological sites. Using the paleoenvironmental record will allow for observable correlation between abandonment and a changing environment. The hypothesis I will be making is that abandonment of the Bernard Creek Rockshelter was gradual. The null hypothesis is that site abandonment was dramatic.

With my research, I plan on only making descriptive observations while using several theoretical concepts as background for my own bias. I claim to be a cultural ecologist with an interest in systems and subsystems theory. Since I am only attempting to look for descriptive correlations between lithic debitage and environment, the need for a strong theoretical background is useful, but not completely needed. In a lot of regards, theory blinds archaeology and in turn closes down new methodological approaches that can possibly provide insight to behavior and functionality. As of right now, no theoretical framework can give us a theory of everything (Schiffer 1999). When used together with an understanding of their weaknesses and strengths theories can reveal a hint of truth about the past. It is also an ethical obligation to the public to demonstrate the importance of archaeology and theory.

The broader implications of the research I'm going to perform on Bernard Creek Rockshelter will reveal that looted archaeological sites still have great theoretical and research potential. Also, the research being performed will shed to light on how modern interpretation of theory can work to try to answer questions from old excavations. My thesis research will also help with the problem of curation because it is not required to go to the archaeological site to excavate a new test pit. Instead, I will be working with data gathered from the 1970s that have remained unstudied until this year. I hope that the assumptions I am making about the artifact assemblage for Bernard Creek Rockshelter will be able to influence others about the importance of theory and how data and theoretical assumptions can reveal a lot about the past.

The goal I hope to accomplish through doing this research is to gain an understanding of how to conduct scientific research. The theories that I have chosen are all based in the paradigm of the 1960s and 1970s, and the methodologies are based in the cultural ecology movement from the 1960s. The methodological approaches that I am using have been refined over time, but are still based off the assumption of positivism. Fundamentally, I believe that there is truth through using the lenses of modernity.

I hope my research on Bernard Creek Rockshelter will teach me how to apply the scientific method, and give me the ability to hone those skills later in life. From learning these skills of scientific methodologies, I plan on trying to help teach people that humans have always been somewhat influenced by their environment. Current climate change is expected to have devastating effects on people around the world. The Native people that lived at Bernard Creek Rockshelter experienced firsthand how a changing world can completely alter life through natural means. Modern climate change is manmade and nonreversible, but sites like Bernard Creek Rockshelter can reveal that humans can adapt and overcome massive environmental challenges. As the course of humanity is constantly struggling to deal with massive changes, so were the ancestors of the people at Bernard Creek Rockshelter. This is just one of the many archaeological stories that can teach humanity how to survive in uncertain times.

Chapter V: Results and Discussion

Lithic Debitage

Lithic debitage from the site forms a bimodal distribution based off of total amounts. This is supported by histograms only showing primary, secondary, tertiary, microlithic, and core amounts. Binomial distributions strongly suggest periods of increased stone tool making periods. The two largest debitage distribution levels are: layer 7 and layer 3/4. At layer 7 the amount of debitage present equals 745 pieces. At layer 3/4 debitage is only 659 pieces. Debitage amounts at layer 7 have a gradual increase through time. After layer 7, there is a drastic drop in the amount of debitage. This gradual increase is probably heavily influenced by the environment because conditions were stable (Chatters et al. 2003). Since the environment was relatively stable in climate, game was likely to thrive causing an increase in site use. Another reason for the increase of debitage could be from the intended manufacture of basalt tools due to their durability. It could also be that the Native Americans at Bernard Creek Rockshelter were heavily increasing their dependence on riverine resources and in turn intensifying their use of basalt river cobbles (Davis 2001). During this increase in stone tool production and the presence of a stable environment, obsidian enters into the lithic system. Quartz, which is in the deepest levels of the site (370 cm) eventually gets replaced by obsidian. This replacement happens during a period of stone tool manufacturing seven years after the oldest known sediment.

Site Stratigraphy	
Arbitrary Levels	Geologic Layers
0-20 cm	Layer 1
20-85 cm	Layer 2
85-120 cm	Layer 3/4
120-150 cm	Layer 5
150-280 cm	Layer 6
280-300 cm	Layer 7
300-310 cm	Layer 8
320-360 cm	Layer 9
360-370 cm	Layer 10

Figure 11: Bernard Creek Rockshelter's site stratigraphy. Adapted from Randolph and Dahlstrom 1977.

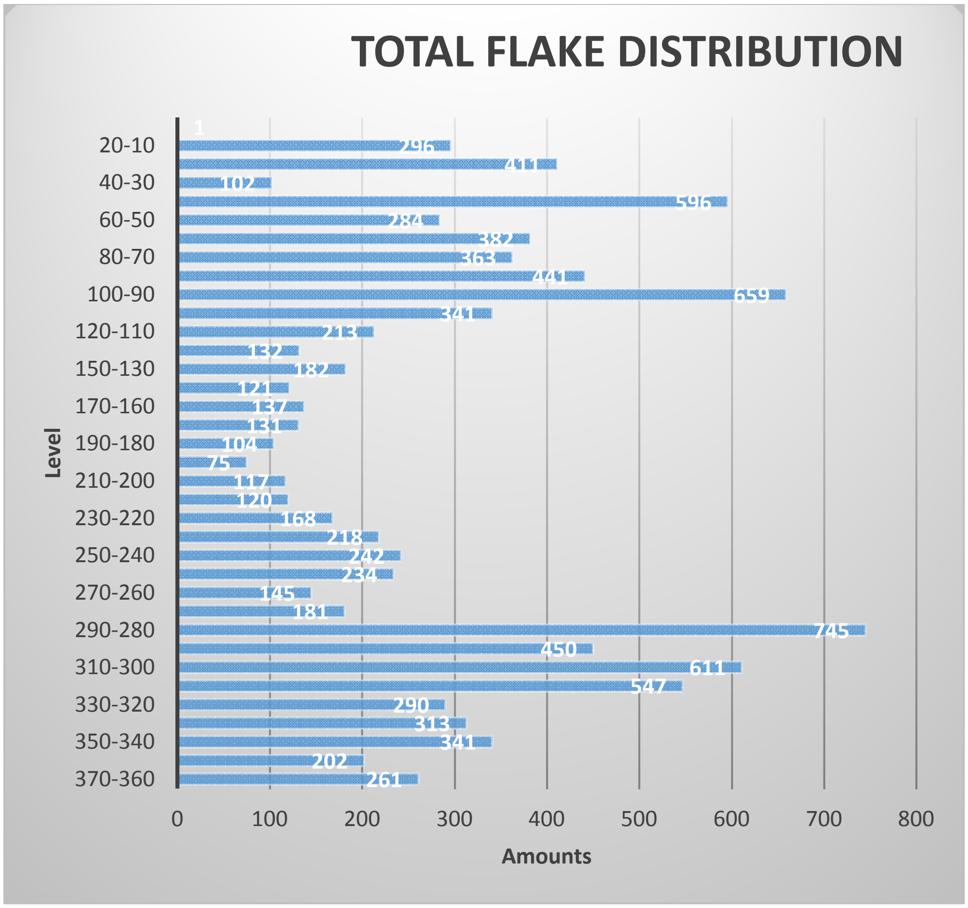

Figure 12: Debitage distribution frequency by level.

Mass analysis can reveal the type of percussion style used for stone tool making (Andrefsky 2001). From the data gathered from the lithic debitage, it is clear that the most abundant type is secondary flakes followed by primary flakes. Following those, the most frequent types are microlithics and tertiary flakes. The smallest amount of lithic debitage consists of exhausted cores. Based off of the following data, it appears that the main type of percussion being used is direct percussion. This is indicative from both secondary and primary flakes being the largest amounts. Microdebitage is also suggestive of direct percussion occurring at the site. It should also be noted that soft hammer percussion was also being used due to the presence of tertiary flakes. The count for each flake type is 2600 for primary flakes, 4744 for secondary flakes, 1093 for tertiary flakes, 1592 for microlithics, and 113 core fragments. Total flake amounts from both test pits 1 and 3 are 10,142. The amount of total debitage from the site suggests that it was never heavily used for anything other than a hunting stand (Binford 1980).

When the lithic debitage amounts are broken down into percentiles per level, an interesting trend is revealed. There appears to be a general inverse relationship between primary and secondary flakes through time. There is also a trend that happens twice when secondary and primary flake frequencies almost match each other. For layers 9 and 5 these frequencies meet again. During these levels of strata, both primary and secondary flakes are equally represented in the lithic system. The reason for the frequency of secondary and primary flakes at layers 10 and 9 is not explainable by environmental constraints. However, it appears more stone tools were produced at this level because the amount of debitage outweighs the number of bone fragments. The layer 5 is during the Mount Mazama ash layer. The overall amounts of debitage are increasing from an all-time low and site activity is increasing because of a stabilizing environment following the eruption. This stabilizing environment made it ideal for the Native Americans to start manufacturing stone tools for tasks such as hunting.

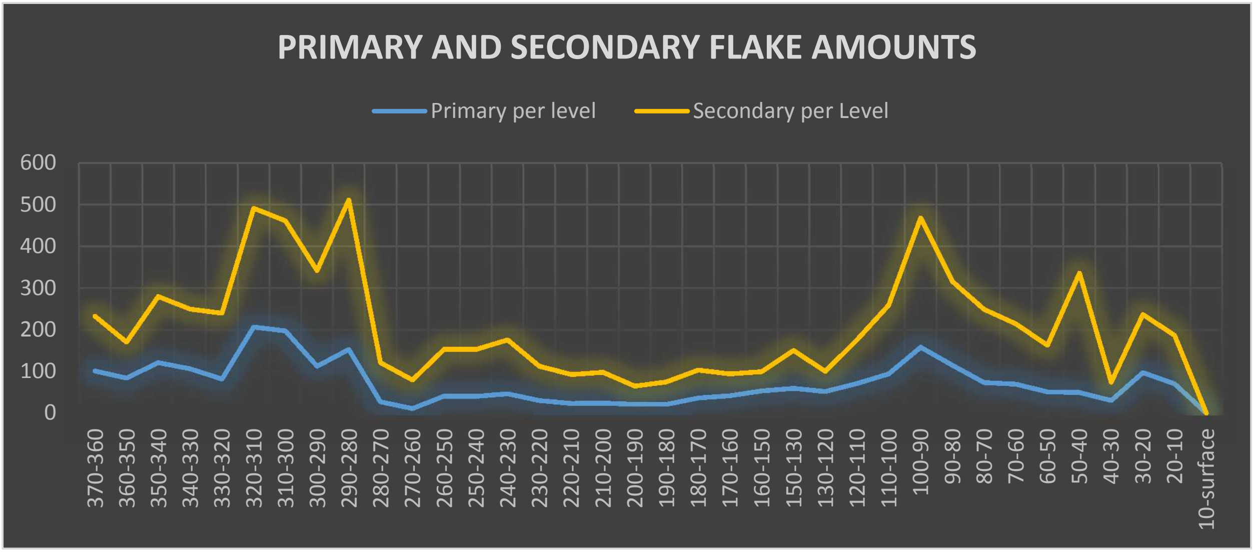

Figure 13: Frequency distribution of secondary and primary flake amounts.

The most unique deposits of strata for primary and secondary flake frequencies are later in layer 6 and early layer 5. Primary flake amounts supersede secondary flakes, and it is possible that this could have been caused by the eruption of Mount Mazama. With the environment being altered by the eruption, it would make economic sense to produce more primary flakes. The reasoning for this assumption is that primary flakes could have served as blanks in an unstable environment. Since the environment changed so rapidly, game would have become harder to find. Debitage amounts suggest that lithic production activity at the site during early layer 5 decreased. All rare raw material sources decrease including obsidian. The best way to adapt to a drastically changing environment is to make an equally adaptable tool such as a blank. A blank would have allowed for more margin of error in stone tool making for the off chance that a Native American came across game. Secondary flakes can be still be used as blanks, however, their general size limits the amount of error and utility. This could have drastically hindered mobility during a harsh environment. When the Native Americans at the site became more familiar with the dramatic changes to the environment, there was an individual choice to start using secondary flakes. With the re-stabilization of the environment after the eruption the on-site knapping was increased. This is the last time that primary flakes supersede secondary flake frequencies.

Statistical methods were used to try and determine if there was a numeric relationship between primary and secondary flake frequencies. To test this correlation, a Pearson's R correlation test was conducted (Vogt 2005). The null hypothesis was set to zero as a no correlation with a confidence interval of positive to negative point 1 (Vogt 2005). The alternative hypothesis was set to any number above or below positive or negative point 1 (Vogt 2005). With statistics, all numbers normally are between 0 and 1. However, since the Pearson's R correlation test measures negative and positive relationships there could be numbers between negative 1 and 0 (Vogt 2005). The results are:

	PRIMARYFREQ	SECONDARYFR
PRIMARYFREQ	1.000	
SECONDARYFR	-0.216	1.000

Figure 14: Pearson's R results for primary and secondary Flake Frequencies.

There appears to be a negative correlation between secondary and primary flake frequencies which makes sense because stone tools are not an additive technology. Even though there is a negative relationship between the variables, it is only a weak correlation. As with all information this relationship should be taken with caution. Lastly, all this relationship is actually suggesting is that secondary flake frequencies are related to those of primary flakes. This can be summed up as common sense and it might be even possible for outliers to have skewed the data.

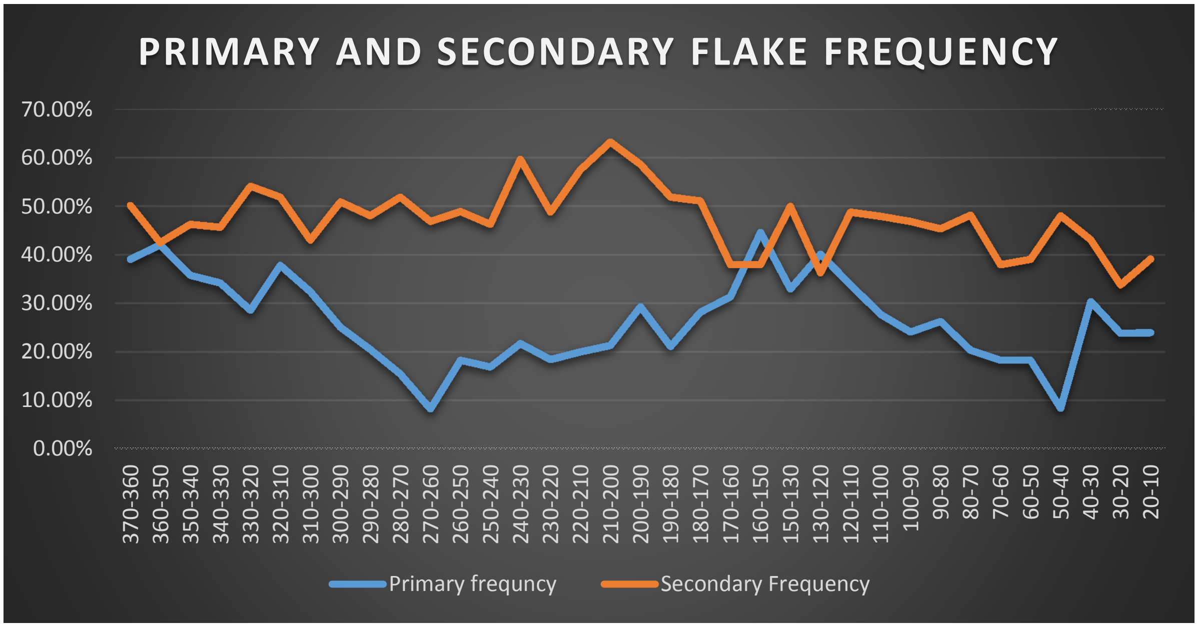

Figure 15: Primary and secondary flake frequencies.

Between the frequency amount of primary and secondary flakes, there is an inverse pattern occurring. Two large gaps are suggestive of lithic reduction not occurring at Bernard Creek Rockshelter. When basalt frequencies are added to the graph as another variant, reduction of lithic types become clear. Basalt makes up the majority of primary flakes within the site and closely mirrors primary flake types. There are a few outliers, however, the majority of raw material types are not basalt. It should be noted that basalt becomes less common during drastic events such as the Mount Mazama eruption. During the eruption, and possibly several years after it, the most common type of percussion occurring is soft hammer. When climatic periods are non-dramatic, the most common type of percussion is hard hammer. Soft hammer percussion involves using bone or antler to break rocks while hard hammer involves striking a stone against another stone. It should be noted that basalt is very typical for Cascade phase archaeological sites in the Columbia Plateau (Chatters et al. 2003).

Between the periods of layers 10 and 7 there was an intensification of on-site knapping. Within about a couple of hundred (7193) of years from the oldest date of 7439 BP, basalt hits its maximum use at Bernard Creek Rockshelter. This date was obtained from a recently acquired radiocarbon date. This suggests that the use of local stones were extremely important for flintknapping. After the start of layer 6 basalt use takes a drastic decline and almost drops out of the lithic assemblage. Later in layer 6 basalt starts to drastically incline. The basalt use increases at the level of 160 to 150 cm, and comprises 50 percent of the lithic assemblage. Native American flintknappers at the site chose to start using basalt heavily, however, after the Mazama eruption, basalt's use as raw material gradually declines. This decline could be from a gradually changing environment, which could lead to an individual's choice to use different materials or the introduction of a new technology.

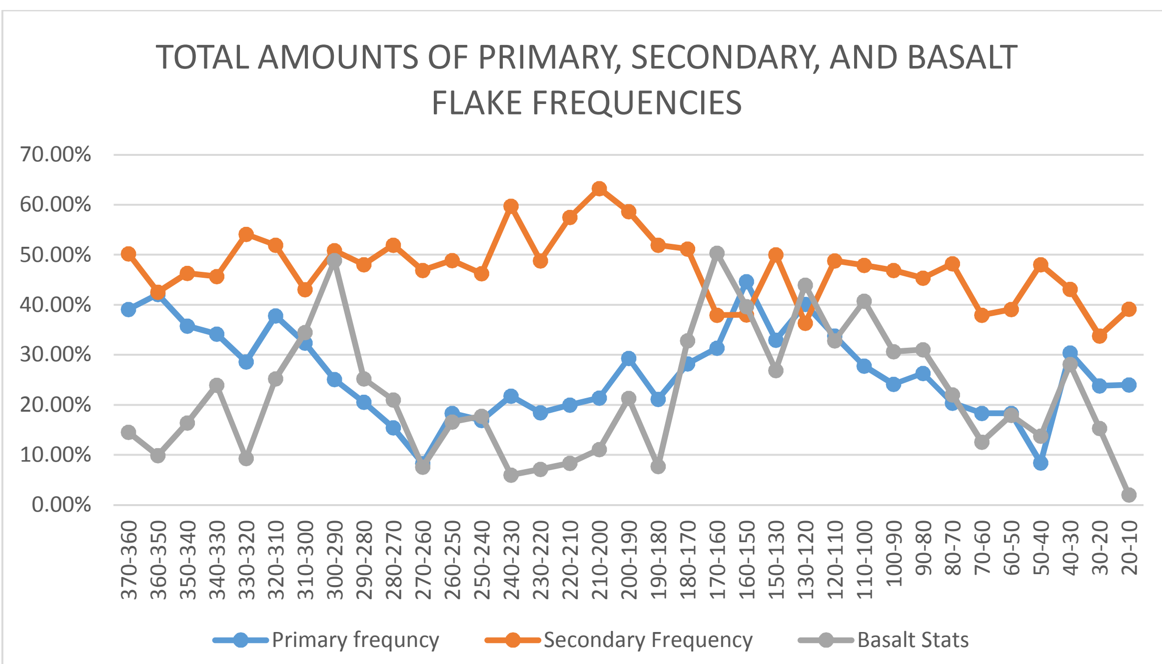

Figure 16: Frequencies of primary and secondary flakes with the frequency of basalt at the top.

Tertiary and microlithic amounts reveal the same binomial pattern as the secondary and primary flakes, and suggest a possible relationship later in the site's history. Early on the amounts per level between microlithics and tertiary flakes appear to be random and not related. During the layer 3/4 the two types tend to mimic each other. I hypothesize that this is when technology changed and the flintknapping activity went from an expedient to more curated focus (Binford 1979). By "curated" I mean a focus on maintaining tools (Binford 1979, Binford 1980). This does not suggest different subsistence patterns as mentioned by Lewis Binford in 1980. This level is correlated to a period of decreased basalt use, the introduction of side notch points besides cold springs, and a close mirroring between tertiary and microlithic amounts. This change occurs after the Mount Mazama eruption when the environment stabilized allowing game to return to the area. This cultural transformation was influenced by a natural transformation due to environmental stabilization (Schiffer 1987).

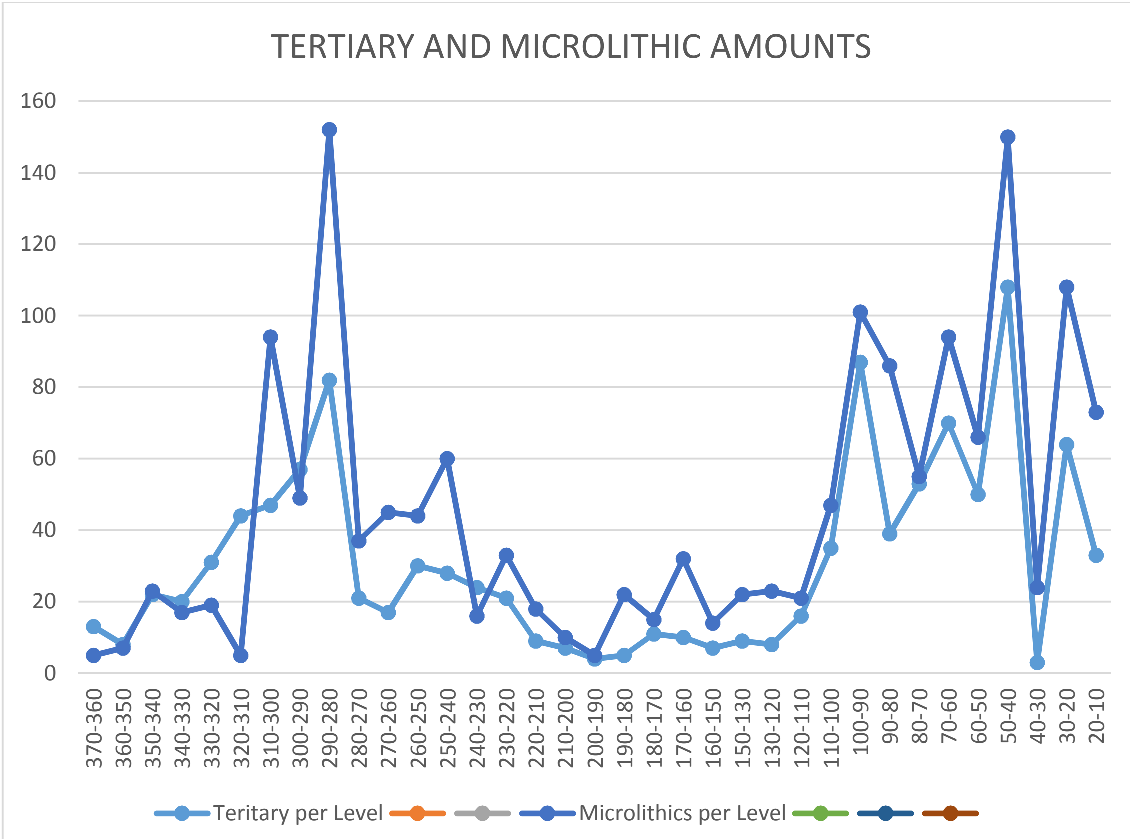

Figure 17: Amounts of tertiary and microlithics.

The most notable relationship is the frequency per level between tertiary flakes and microlithics. Besides the increase in overall amounts, the actual frequencies appear to be random through time. Generally, there is a period of increased production per level of tertiary flakes at layer 2. This creates a generally skewed left distribution. The skewedness of the tertiary distribution could be from different styles of tool production and possibly even the curation and maintenance of bifaces. This meshes with the general decrease in basalt use over time.

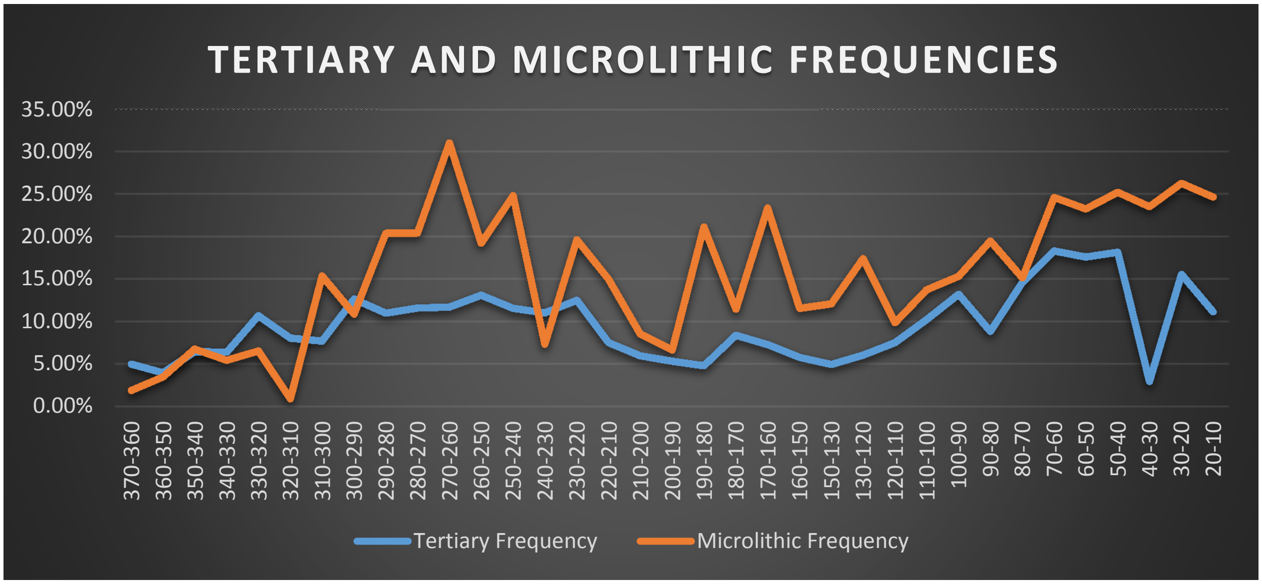

Figure 18: Tertiary and microlithic frequencies across time.

As for microlithics, there are periods of randomness with a general increase in the end. The height of microlithics occurs at 270 to 260 cm level, however, this level is only representative of Block 1. The amount of microlithics could suggest that there was a preference to the use of local materials and hard hammer percussion. When flintknapping with another cobble small flakes fly off due to the amount of force and the cone of percussion breaking the rock (Whittaker 1994). During layer 6 microlithic reduction appears to be almost random. There could be a number of reasons for this, however, it could simply be a lack of data from the two test pits used in this study. Not all of the microlithic data seems to follow a random pattern. From levels 120 cm to the end of the site’s history, there is a general increase in microlithics which could possibly be from the increased curation of stone tools.

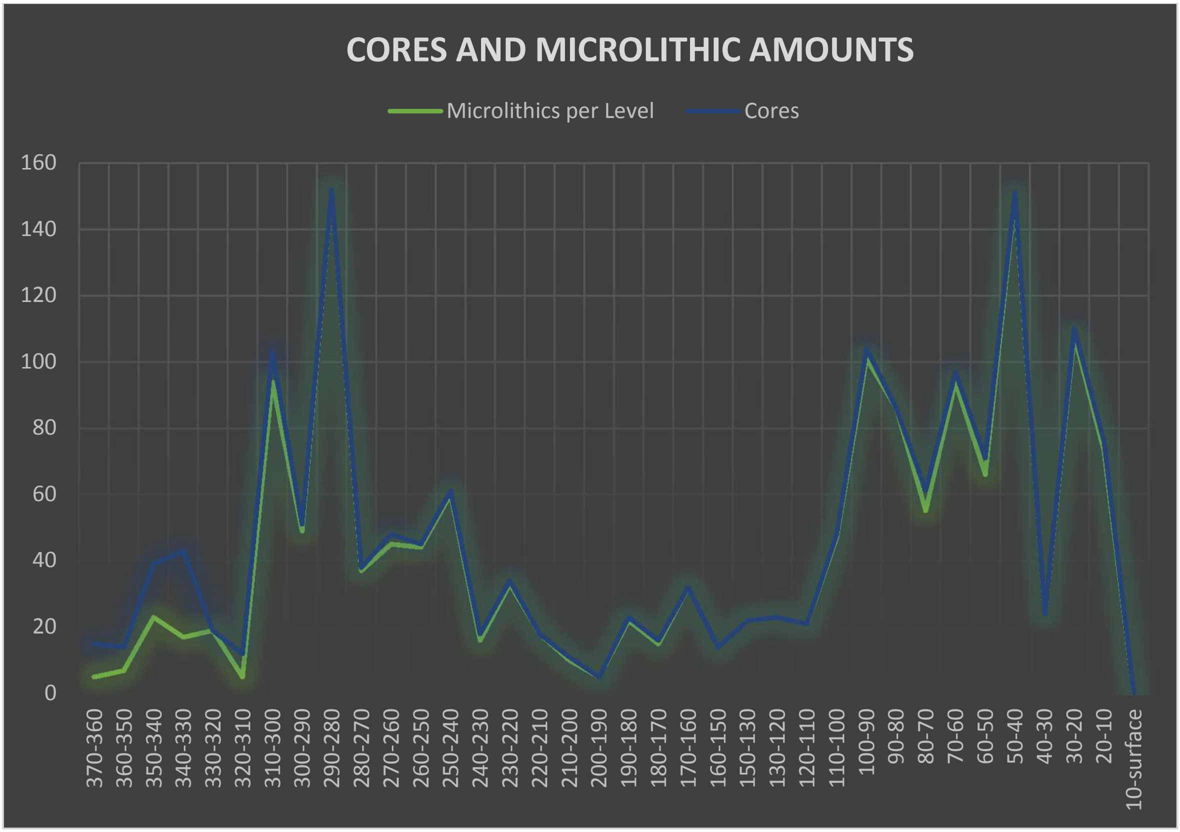

Figure 19: Core and microlithic amounts across time.

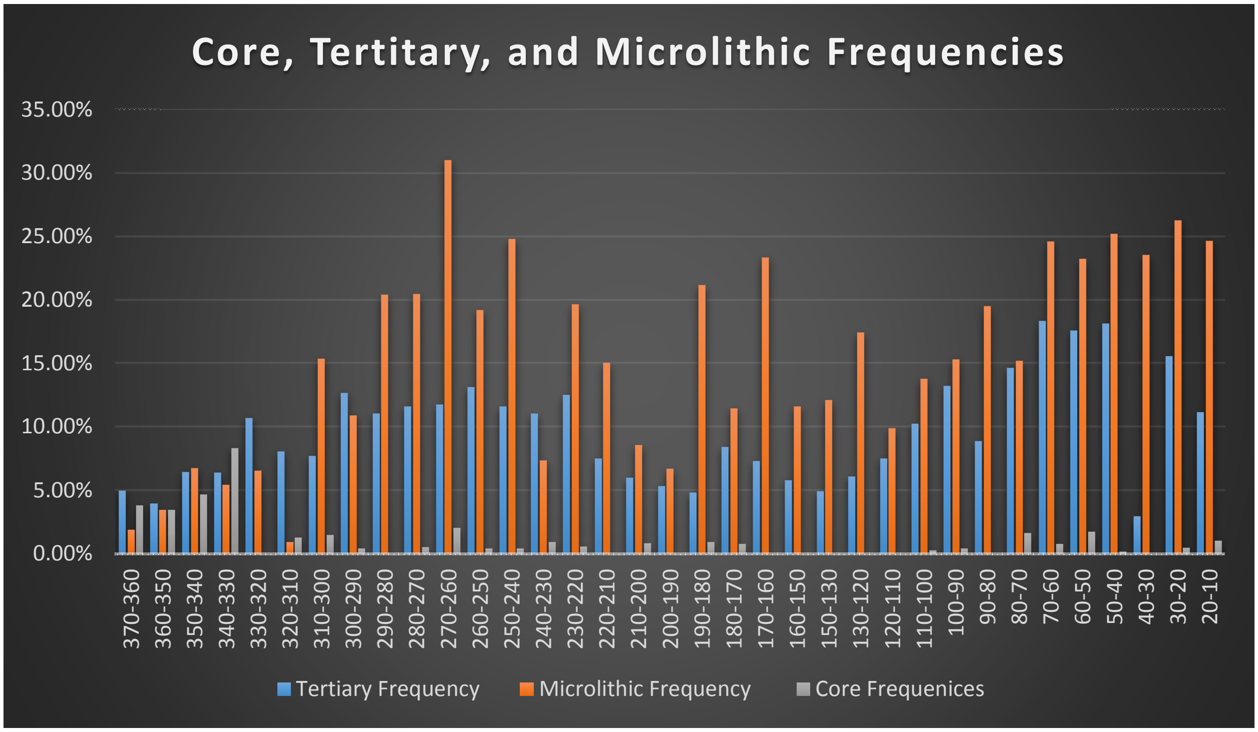

Figure 20: Tertiary, core, and microlithic frequencies.

The core and microlithic amounts are almost identical, however, there is a difference between the amounts at the lowest levels of the site (layers 10 and 9). At these levels, cores are more frequent than microlithics. The reason for this is unknown because that time period only covers seven years. It is possible that individual flintknappers chose to not use pressure flaking techniques.

When exhausted cores, tertiary flakes, and microlithic frequencies are compared a clearer pattern seems to appear. It appears that early on in the site's history microlithics and tertiary flakes were more closely related to each other than cores. This is further evidence that early on the Native Americans at Bernard Creek Rockshelter were making and utilizing raw materials from the Snake River and Bernard Creek. Core frequencies are the highest during layer 9. Throughout most levels of the site, core frequencies stay relatively constant, which is evidence for the use of direct percussion being the most common type of reduction strategy being employed.

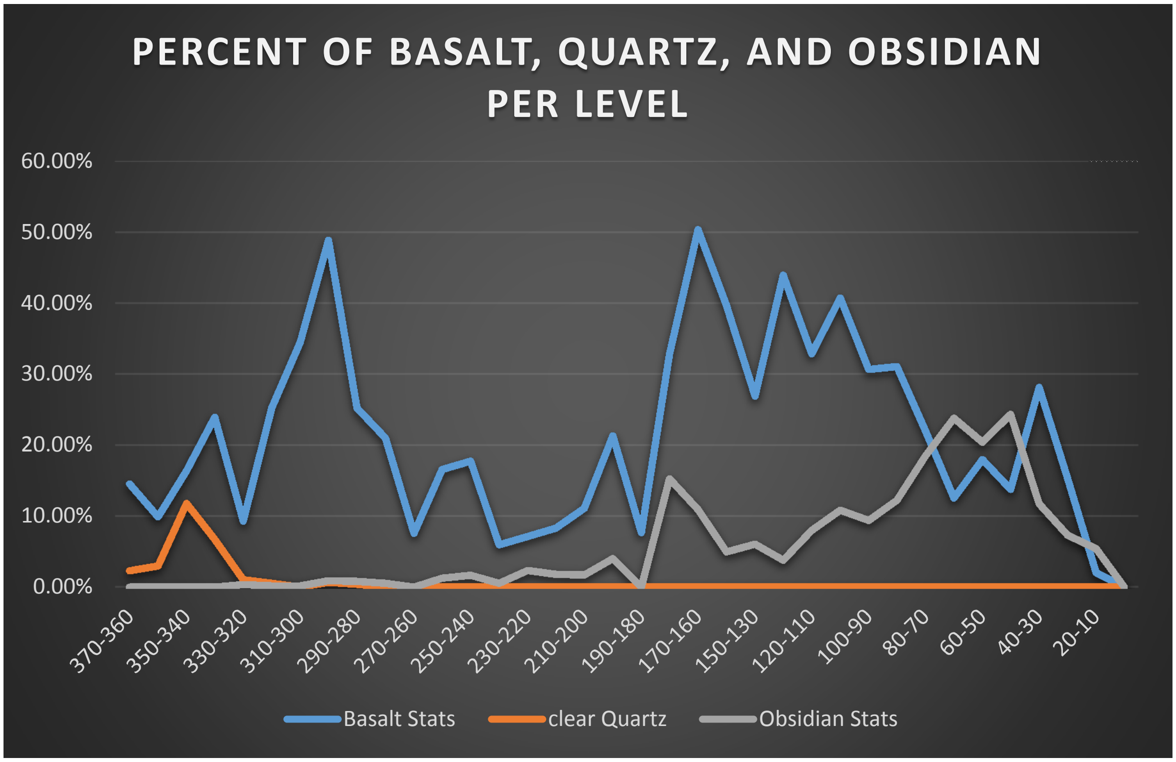

Figure 21: Percentiles of basalt, quartz, and obsidian per level.

Debitage amounts after 280 to 290 cm take a drastic decrease from 745 pieces to 181 pieces at level 280 to 270 cm. There are two possible reasons for this drastic decrease: flooding, and/or change in lithic raw material sources. The time difference between the levels of 370 cm to 150 cm is only 200 years. Sediment data from the site and from other sites in Hells Canyon, suggest periods of massive flooding along the Snake River (Chatters et al. 2003; Randolph and Dahlstrom 1977). This flooding could have caused game to move upland causing the site to be less utilized for lithic activity. The use of different lithic sources and the introduction of complex trade systems could have possibly caused Native

Americans to decrease stone tool production at the site. When obsidian, basalt, and quartz are compared with each other across the site, there is a general decrease in the use of basalt but an increase in obsidian. Based off of the histogram that shows the distribution between all three, the frequencies per level appear to have a possible relationship between each other. Early on within the debitage assemblage a very clear quartz material was being utilized, and within 50 cm above the bottom of the site obsidian enters into the assemblage. At the levels of 290 to 280 cm clear quartz completely drops out, but obsidian remains constant. This appears to be a systemic change in raw material choice. It should be noted that a greyish quartz remains constant throughout all levels of the site. A possible reason for the switch is that obsidian is more constant in breakage than quartz (Personal communication Sappington 2014). Also, obsidian is a better stone to use because of its sharpness, and ease of stone tool shaping (Whittaker 1994).

To test this relationship, I used a statistical software packet. Statistics are a good starting point for mathematically testing relations. The variables that were used were all of the 370 cm basalt and obsidian frequencies. The correlation test used was Pearson's R, which tests levels of correlation (Vogt 2005). The closer the numbers are to positive or negative 1, the stronger the relation. The null hypothesis was less than positive or negative 1. The results of the test revealed that there is no mathematical relationship occurring. Numerically, the number is too close to zero to reveal any significance (Vogt 2005). I argue that even though the numbers are not mathematically comparable, the original histogram still reveals a switch between basalt and obsidian frequencies. This brings up one of the flaws with the method I was using. Mass analysis assumes that all lithic reduction is occurring directly from a core (Andrefsky 2009). Collectors are more likely to curate stone tools, thus causing flakes which occurred from a biface or tool. Statistical methods will not necessarily be able to distinguish the differences between biface and tool reduction. The two variables clearly reveal that there are periods of the assemblage that contain more primary or more secondary flakes.

	BASALTSTATS	OBSIDIANSTA
BASALTSTATS	1.000	
OBSIDIANSTA	0.149	1.000

Figure 22: Pearson's R results for basalt and obsidian frequencies.

Obsidian enters into the site during a period of increased stone tool production. It is possible that trade was being established and sites like Bernard Creek Rockshelter could be the peripherals of the trade, which would explain part of it. However, when obsidian is introduced to the site, it becomes a selective choice (Hall and Chase-Dunn 1993). It is possible that an individual flintknapper could have access to it because obsidian has a few periods where it drops out of the lithic assemblage. The fact that obsidian is rare within the site suggests an economic advantage to having it, however, more data will be needed to test this hypothesis. Eventually it seems that obsidian becomes more common and accessible until the Mazama eruption. During the Mount Mazama eruption, obsidian exhibits a decline in frequency within the site's assemblage. After the eruption, obsidian steadily increases and is possibly more accessible until the site becomes abandoned.

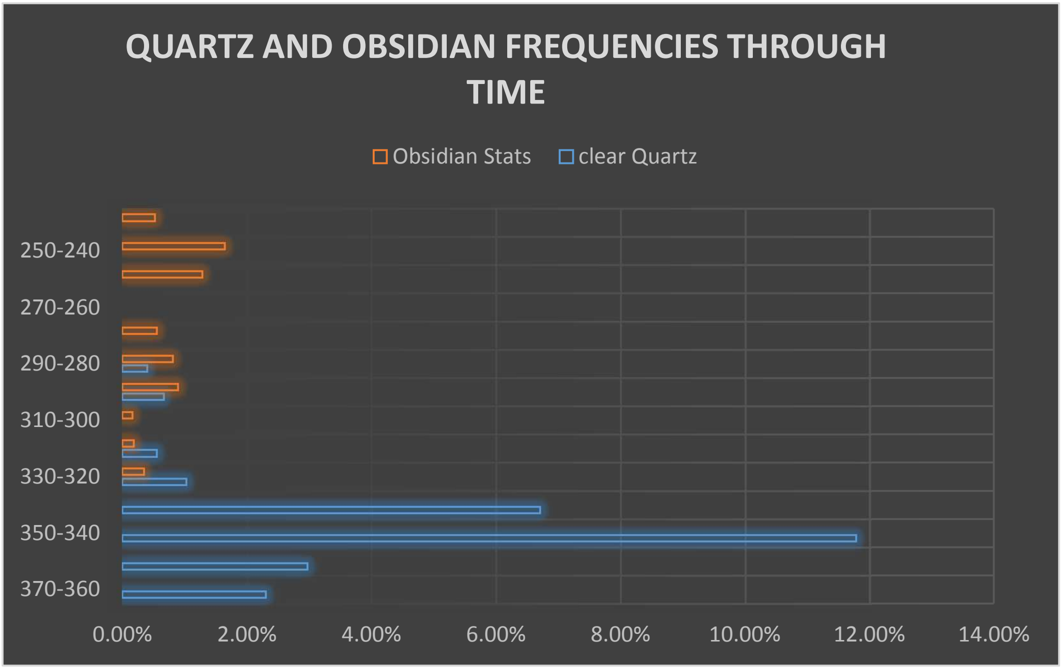

Figure 23: Quartz and obsidian frequencies through time.

I hypothesize that obsidian replaces clear quartz for flintknapping. The maximum use of clear quartz is during layer 9. Quartz has a tendency to shatter when hard hammer percussion is used which makes the raw material hard to knap (Personal Communication with Robert Sappington). However, the clear quartz at Bernard Creek Rockshelter appears to have been utilized, with most of them appearing at the terminal flake level. This suggests that the Native Americans were potentially placing some value in quartz due to its transparent like appearance. Also, Native Americans could have placed some ritualistic and economic value on quartz due to the difficulty of knapping the stone. It should be noted that the switch between clear quartz and obsidian happens about a couple hundred years (7193+-23) later than the oldest excavated level (7439+-23). This change is due to massive flooding along the Snake River (Personal Communication with Dr. Jim Chatters). Assumptions about this transition should be taken with a grain of metaphorical salt.

Bone and Debitage Weights

One of the ways to address function change in Bernard Creek Rockshelter is to compare the weights of bone and debitage. This helps reveal when there were periods of increased lithic activity and periods of increased hunting. The debitage data and the small amount of bone weight data obtained already suggest that Bernard Creek Rockshelter was generally a hunting stand, however, this micro-change in behavior can reveal more of the site's complexity.

During the original excavation, the archaeologists never specified the actual weight of the bones (Randolph and Dahlstrom 1977). Instead, they created a bar chart revealing the relative amounts of weights. The graph uses increments of 10 grams, making it difficult to determine the exact amounts. I made a graph of the total weights that closely resembles what the original archaeologists created. For the debitage weights, I chose certain groups of levels to reveal if is there is a visible relationship between the variables. The first group is from layers 10 to 9 and a second group from layers 3 to 1. Group 1 was chosen due to its being when the amounts of debitage are the highest. There is an introduction of obsidian, clear quartz drops out of the lithic assemblage, and microlithic frequencies are the highest at this level. Group 2 was chosen because it contains the highest frequency of obsidian, an inverse between obsidian and basalt, decreasing amounts of basalt, a generally declining trend in the frequency of secondary flakes, and the second highest frequency of primary flakes.

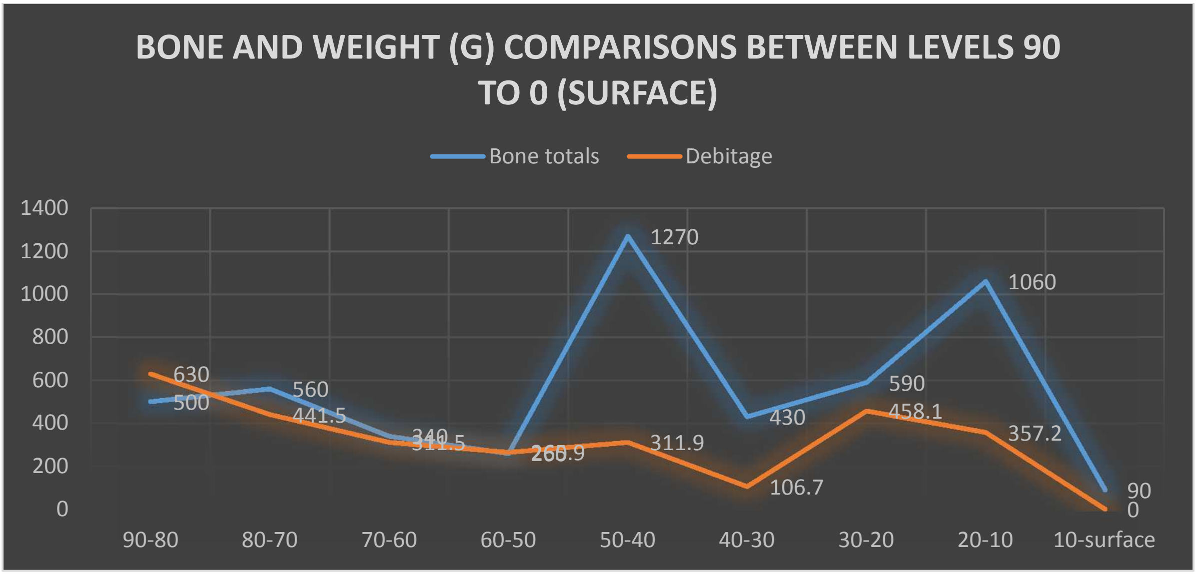

Figure 24: Bone and weight comparisons between layers 1 to 3.

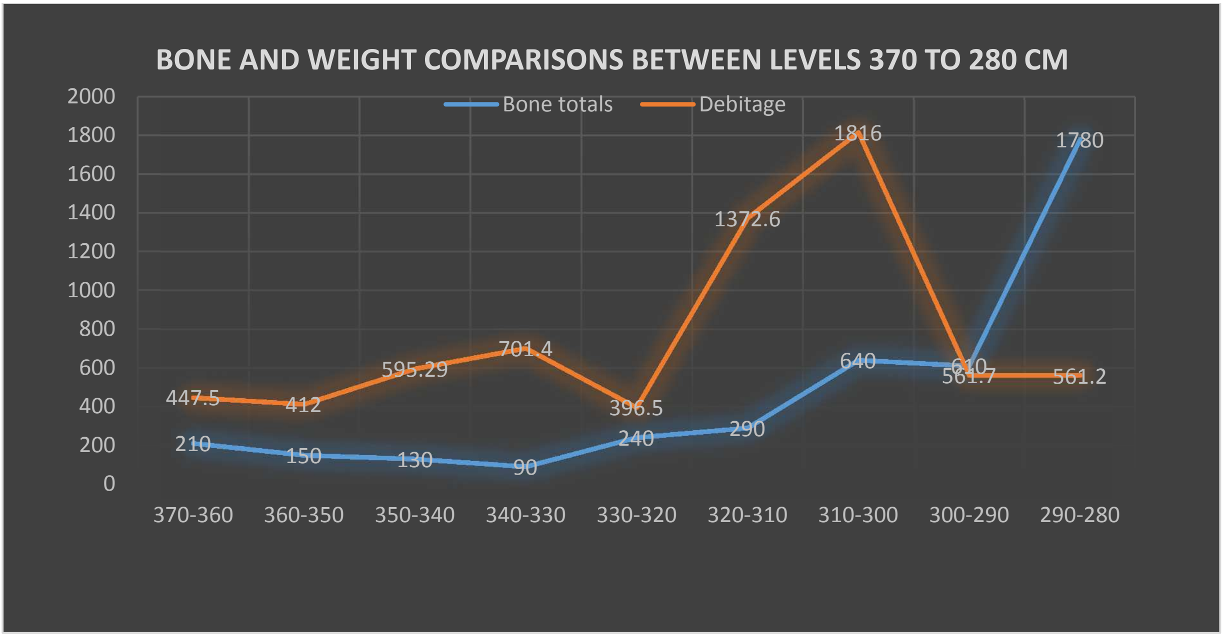

Figure 25: Bone and weight comparisons between layers 10 to 7.

In the 370 to 280 cm line graph, there appears to be higher weights of debitage as a total assemblage than bone weights possibly suggesting that the site was used as a normal hunting stand starting at 7200 years ago (Randolph and Dahlstrom 1977). Weights at the 370 cm level are relatively close in total grams. Bone weights are 210g and debitage weights are 447.4g. It is possible that Native Americans at the site were using local basalt to make projectile points and utilizing flakes to butcher game. However, the weights of both debitage and bone are small, meaning that there was not a lot of activity. This pattern stays constant until 340 cm, where debitage weights drastically increase in comparison to to bone weights. I hypothesize that Bernard Creek Rockshelter's function changed from a hunting stand to a minor quarry site due to the increase debitage weights, increased frequency of secondary flakes, general increase in debitage amounts, and the apex of quartz flake intensification. Near the end of the sample, bone weights surpass debitage weights suggesting that the site's function possibly changed to more a resource procurement site for gathering game animals.

From the levels 90 cm and the surface, there seems to be slightly increased debitage weights when compared to bone weights at the 90 cm level, however, debitage weights and bone weights are inclined to have descending trends. This information suggests that from 90 to 60 cm the site was used as a hunting stand (Binford 1980). At the levels of 60 cm to 0 cm, bone weights drastically increase compared to the weights of debitage. This suggests that the site's function changed to resource procurement, and an increase in animal butchering behavior occurred. Other evidence such as an intensification of obsidian use and a decrease of basalt use suggests resource procurement at Bernard Creek Rockshelter.

Chronology

The application of a projectile point chronology allows me to have a sense of time within the archaeological site. Projectile point chronologies allow for an understanding of when critical changes in lithic activity occurred. They also allow for an understanding of climatic conditions that may have effected flintknapping activities. By assigning relative date ranges to increases or decreases of lithic debitage amounts the importance of the environment with regards to the archaeological site can be revealed. Another major benefit that a projectile point chronology can add to my research is that it reveals when functional changes happened. This then can be correlated to environmental, fauna, and sediment changes to build a better understanding of how this site fits into the larger concepts of Hells Canyon. Lastly, there has been a history of publications briefly mentioning Bernard Creek Rockshelter (Chatters et al. 2003, Osterkamp 2014, Regan and Womack 1981).

Knowing this information, I am ethically bound to establish a lithic profile of the site and at the same time to try to understand how the site's function changed throughout time. This will not only help academic archaeologists but will also help the CRM sectors perform better stewardship for the site. Adding to the already existing knowledge about the Hells Canyon Archaeological District can help CRM mangers reinforce the importance to the general public about the oldest site that they manage.

The establishment of a projectile point chronology originally required me to take measurements on all completed points. A completed projectile point is any stone tool that has both a hafting element (base/bottom with a stylistic element) and a triangular shaped tip. An issue occurred when attempting this because out of the original 49 completed points only 11 remain in the University of Idaho's archaeological repository. The other 38 completed points are currently unable to be located. Since there is a lack of completed points, I did other research on point breakage patterns and determined that all projectile points at Bernard Creek were at one time hafted to a foreshaft (Figure 26). A foreshaft when stuck in an animal would cause the hide to bunch up thus snapping the point at the haft, and protecting the hafting element (Frison 1974). Since the hafting element of a stone tool was preserved, it was possible to measure and look at the projectile point bases to determine stylistic trends through time (Thomas 1981).

Figure 26: Example of foreshaft from waa.basketmakeratlatl.com.

For each level I counted up all the projectile point parts then separated them into three mutually exclusive categories: bases/hafting elements, midsections, and tips. It should be noted that in lithic reduction, mutually exclusive categories only exist for the sake of quantifying information. From personal experience in flintknapping, I know that there is a limit to the use of a stone tool before it is discarded (Schiffer 1972, Thomas 1981). These discarded hafting elements, corner notch and basal notch, have periods of increase and decrease. Statistically, these styles make a unimodal curve through time. This type of curve is also known as normal distribution or a bell shaped curve. Ideally, this is what archaeologists want to observe with the diffusion of point types.

To acquire more data for the chronology, I followed the example of David Thomas (1981) and decided to use remnants of hafting elements. On each hafting element I took basal widths, thicknesses, and neck widths. Length measurements were not taken because stone tools were constantly being rejuvenated before they were discarded (Thomas 1981). The only measurements that will remain the most stable through time are basal width and thickness. Neck widths were gathered to try and determine point function as a lanceolate, dart, or arrow point.

Hafting elements were chosen from all of the Test Pits excavated at Bernard Creek Rockshelter. Block 2 was used despite it being excavated as a measure of damage that occurred from illegal relic hunting in the 1970s. However, test pits 1 and 3 were not disrupted by illegal looting of artifacts and will correct any sampling bias of Block 2. Using test pits 1 and 3 allows for an accurate measure of stylistic elements on the projectile points through time. Lastly, most of the projectile points were excavated from Block 1, and can add a slight bias to the sample. The reason for block 1 biasing the sample is due to three features being excavated and two of those are lithic reduction related (Randolph and Dahlstrom 1977). As with most data in the archaeology, there is going to be a slight sampling bias due to unknown numbers of artifacts in the ground as well.

When each projectile point was measured, it was also recorded into a notebook stating where it was discovered in the provenience of the site. Once the location of the projectile point's position in the strata was recorded, I then input the data into a database. This allowed for a visual patterning of projectile point distributions based off morphological grouping. An example of this is round convex bases being typed as cascade points. The sample of projectile points recovered from the site was too small to use statistical methods to determine category. The largest group of any type of point within each category was 32, however, as a total group, statistical methods were used.

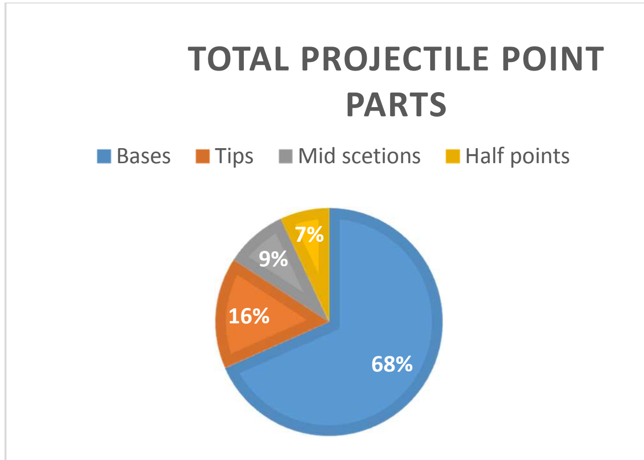

Figure 27: Total projectile fragments in Bernard Creek Rockshelter's assemblage.

From all of the data gathered for the projectile point chronology, 108 hafting elements were present that had varying degrees of breakage patterns. This represents 68% of the entire projectile point assemblage recovered from the site. Statistical parameters can be further broken down into three precise categories: Pre-Mazama (7439 to 6900 BP), Mazama (6900 to 6800 BP), and Post Mazama (6600 to site abandonment 1800 BP). These subdivisions allow for a broad understanding of time. Most of the sample came from the Post Mazama layers while the latter came from Pre-Mazama layers, however, all of the Pre-Mazama layer projectile points are mostly cascade style hafts. During the Mazama layer, all of the projectile points except for one do not show up.

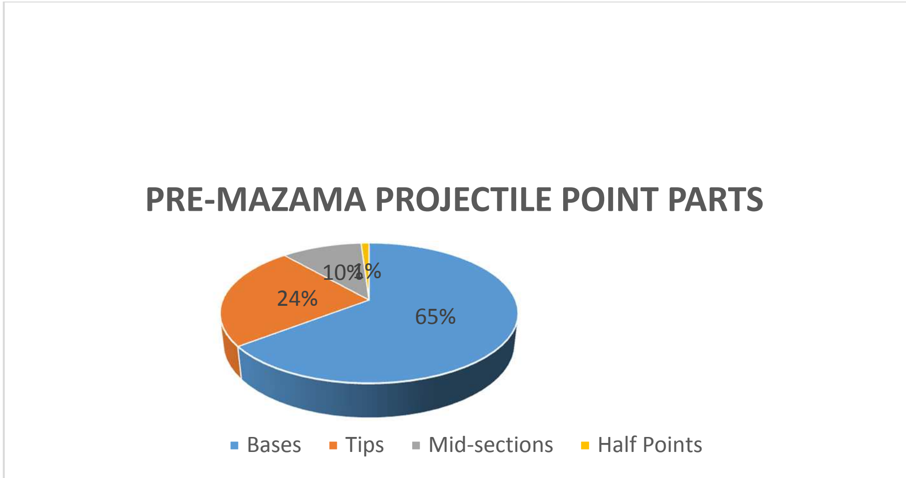

Figure 28: Pre-Mazama projectile point distribution

After the Mount Mazama eruption, the remaining 28.4% of the total 68% of projectile point hafting elements vary in form. The reasoning for this diversification could be related to environmental stabilization. Another hypotheses is that a new culture moved into the Columbia Plateau (Prentiss et al. 2006). Bernard Creek Rockshelter by itself cannot address such a large topic, however, it appears to be the same culture using the site because cascade style points are present at the site until layer 2. The amounts of cascade style points drastically decrease after the Mount Mazama eruption, which can potentially be contributed to different types of game being hunted and a stabilized environment (Davis 2001, Prentiss et al. 2006). Fundamentally, projectile points are not a great indicator of cultural immigration or site abandonment by themselves.

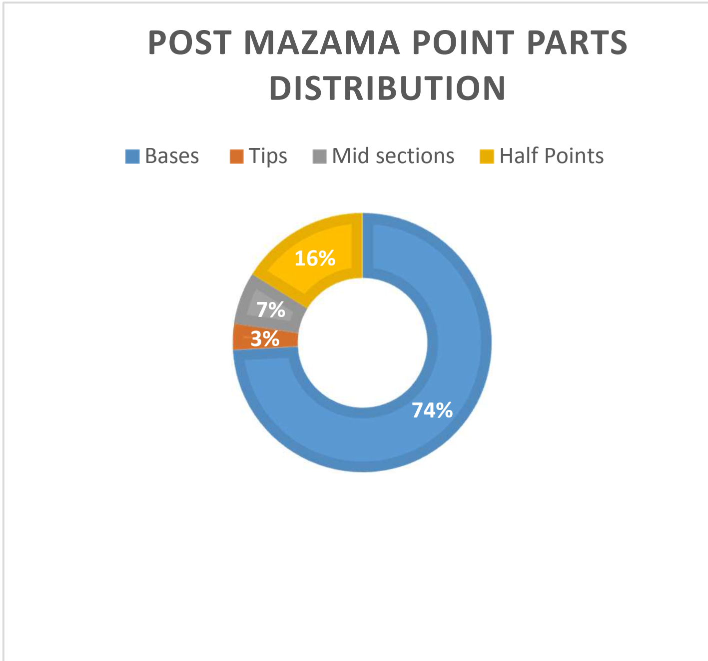

Figure 29: Post-Mazama projectile point parts distribution

<u>Cascade Projectile Points</u>

Two constant projectile points that are common throughout most levels of Bernard Creek Rockshelter are regular cascade points, and cascade points with convex stemmed bases. Generic cascade points were determined based off the hafting element being round and convex based. Cascade points with convex stemmed bases were labeled as Cascade sub-phase 1. Both type of Cascade points are the earliest, and most concentrated in the site. After the 150 cm level (Mazama ash layer), Cascade projectile points become less common and drop out at 10 to 20 cm. The Cascade sub-phase 1 points are sporadically used before the 150 cm level of strata. After the Mazama ash layers, Cascade sub-phase 1 projectile points become dominant at 60 to 70 cm in the site. After the 40 to 50 cm level the cascade sub-phase 1 points completely drop out of the lithic system.

The average for both cascade and cascade sub-phase 1 points were taken and divided into post-Mazama and pre-Mazama. Since both the Cascade and the sub-phase 1 variant are still typed under Cascade points, the average thicknesses and widths for both types were taken together. Test pits 1 and 3 are the only units that had cascade-style points within their strata. The average widths of pre-Mazama Cascade points are 12.62 mm, while the average widths of post-Mazama Cascade points are 16.01 mm. Regular thickness of pre-Mazama cascade points are 3.55mm, and ordinary post-Mazama cascade point thickness is 4.0mm. From this data and the amount of cascade and cascade sub-phase 1 points, I hypothesize that these points changed function. Pre-Mazama Cascade points, due to their smaller widths and increased distribution, possibly served several purposes and met their end as dart points, while post-Mazama Cascade points could have served a more specialized function such as butchering. The thickness of the hafting elements within the two separate time units are too close to suggest any difference. It should be noted that all stone tools are multifunctional in nature and other data will be required before any definitive conclusion can be reached.

Bernard Creek Rockshelter's Cascade phase ranges in time from 8000 to 5000 years ago (Browman and Munsell 1969, Davis 2001, Prentiss et al. 2006). This is when the majority of Cascade projectile points occur with the end dates in the strata being hypothesized to occur at about 60 to 70 cm. The oldest radiocarbon date at the site is 7200 years ago at the 370 cm level. Recently, another radiocarbon date was obtained at the 320 cm level of the site which was 7193 years BP. This suggests that Bernard Creek Rockshelter has been rapidly having sediments deposited at the site.

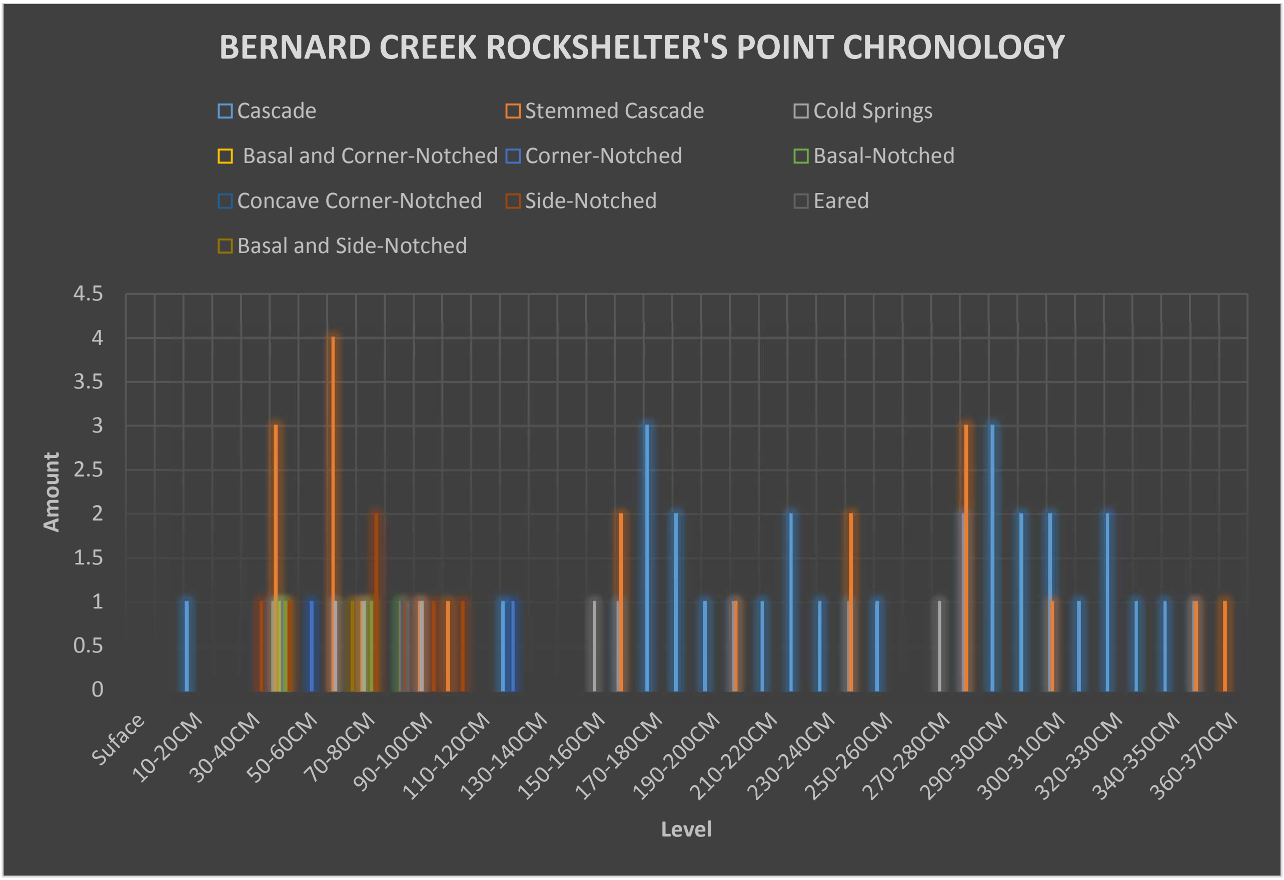

Figure 30: Bernard Creek Rockshelter's projectile point chronology.

<u>Cold Springs Projectile Points</u>

Projectile point diversification begins before the Mazama ash layer at the 270 to 280 cm level with the introduction of cold springs points. These projectile points were discarded rarely and probably used less than cascade points because of the intensive use of cascade-style points. The Cold Springs projectile points at Bernard Creek Rockshelter seem be a Middle to Late Archaic Phase adaptation. Slightly increased amounts occur after the Mazama layers, but then drop out of the lithic system. Some archaeologists have labeled this as Period 6 and 5, while others have labeled this period as Craig Mountain or Cascade Phase (Browman and Munsell 1969, Davis 200,; Prentiss et al. 2006). From a recently obtained radiocarbon date, the use of these points could have gone back to the lowest levels of the site. Between the levels of 370 to 150 cm in test pit 1 only 400 years are covered. The reason for such a small difference in time has been hypothesized to be the result of massive flooding before and after the eruption of Mount Mazama (personal communication with James Chatters 2015).

Corner-Notched Projectile Points

Corner-notched points first appear in the site assemblage at the levels 120 to 130 cm. Some archaeologists have argued that the appearance of corner notched points suggest influence from the northwest coast while others have argued for an in situ adaptation to the environment (Davis 2001, Prentiss et al 2006). The arrival of this style of hafting element has been labeled as either late Archaic, Classic Collectors (3600 to 2600 BP), or Grave Creek phase (3500 to 2000 BP) (Davis 2001, Prentiss et al. 2006, Smith 1983). One thing that all the archaeologists agree upon is that the environment was cool and moist during this time (Davis 2001, Prentiss et al. 2006).

Within the context of Bernard Creek Rockshelter, the presence of corner-notched points right after the Mazama ash layers (150 to 130 cm) suggest that there is an unconformity with the sediment (Randolph and Dahlstrom 1977). This can be seen within the site report itself. Most of the sites within the middle of Hells Canyon supposedly reveal evidence of massive flooding periods for a few centuries prior to the Mount Mazama eruption (personal communication with James Chatters 2014). There are two major types of projectile point morphologies that occur which represent two distinct temporal periods. The first corner-notched point is a Snake River projectile point, with a time distinction between 4000 to 3000 BP (Davis 2001, Leonhardy and Rice 1970, Prentiss et al. 2006, Smith 1983). Later, the generic Elko corner-notched enters into the lithic system (Prentiss et al. 2006).

Side-Notched Projectile Points

The intensification of side-notched points occurs during phases labeled as Classical Collector (3600 to 2600 BP) to Emergence of Complex Collector (2500 to 1800 BP) (Prentiss et al. 2006). Later side-notched points occur and the two main categories are Ahsahka and Elko side-notched (Leonhardy and Rice 1970; Thomas 1981). It should be noted that Elko points are extremely common and bad indicators of temporal limits (Thomas 1981). It has been argued that the presence of the bow and arrow occurred 2000 years ago and eventually became the dominant hunting tool used for a couple of hundred years (Prentiss et al. 2006). I hypothesize that side-notched points are used during the bow and arrow's arrival, but as always more evidence will be needed to support this. The environment starts to change from cool and wet to arid and dry conditions during this time, and the amount of fires also begins to increase compared to earlier phases (Prentiss et al. 2006). Side-notched points are heavily used during the 70 to 80 cm level of strata and drop out of the lithic assemblage at 30 to 40 cm.

Basal-Notched Projectile Points

The arrival of basal-notched points occur during the intensification of side-notched points. Basal notching is very limited and I hypothesize that it is related to the arrival of the bow and arrow.   At the level of 80 to 90 cm, basal notching starts to occur in the lithic assemblage, and leaves at 40 to 50 cm. After this period almost all the projectile point diversification disappears as do stone points in general. There is a general decrease in debitage during this period starting at the 100 to 90 cm level. I hypothesize that with the introduction of the bow and arrow at 2000 BP, Bernard Creek Rockshelter had less lithic manufacture occurring. It is possible that the Native Americans that inhabited the site fully changed their behavior to be more collector. This would explain the lack of formal tools present at the site.

In the last couple of levels of the site, the presence of debitage, bone, and projectile points completely vanish, and this disappearance of all material comes very drastically. It is possible that with the environment becoming drier and more arid the game left to higher and cooler grazing areas, thus making the site even less valuable for food resources (Prentiss et al. 2006). Another hypothesis is that with the complete integration of bow and arrow technology, the site became even less important for food resources, and that the Native Americans started to utilize sites closer to game that required less travel. Lastly, it is possible that a mixture of both a changing environment and integration of the bow and arrow would have caused the site to become abandoned.

Results Overall

From the recent data gathered from Bernard Creek Rockshelter, I argue that the site ranges in time from 7439 to about 1800 BP (Osterkamp 2014, Randolph and Dahlstrom 1977). The 7439 BP date is from a recently obtained radiocarbon assay. Basal-notched points are more common during later phases in archaeological sites in Hells Canyon (Davis 2001, Prentiss et al. 2006). Since there are so few basal-notched points within the site, I cannot say that there is a protohistoric component to the site. Also, the arrival of basal-notched points is correlated with the intensification of side-notched points. The overlap between the two styles suggests that there was a cultural preference for side-notching. It is possible that the Native Americans preferred the atlatl over the bow and arrow when the site was abandoned. This is indicative of the transition between Classic Collectors and Complex Collectors, the Rocky Canyon phase, or the Harder phase (Davis 2001, Prentiss et al. 2006, Leonhardy and Rice 1970). This assertion challenges the established ideal of the site, however, I argue it still puts the site within the oral tradition and ethnographic knowledge of the Nez Perce.

Another subtle assumption about Bernard Creek Rockshelter is that the site was heavily used by Native people (Randolph and Dahlstrom 1977). From all the data that I have gathered, the site does not appear to have been heavily utilized (Binford 1979; Binford 1980; Schiffer 1972). The most active projectile point producing periods were at 280 to 290 cm and 40 to 50 cm. During these times the Native Americans were making the most projectile points and site activity increases beyond normal levels.

I hypothesize that the chronology of the site is Cascade phase (early and middle Archaic) (7439 to 3800 BP), Late Archaic Collector (3600 to 2600 BP), and Transition to Complex Collector phase (2500 to 1800 BP) (Davis 2001, Prentiss et al. 2006). These periods are marked by changing environments. The Cascade phase within the site occurs during an introduction and intensification of generic Cascade points while point diversification occurs during Late Archaic Collector phase. Introduction of basal-notched points and intensification of side-notched points are during the Transition to Complex Collector phase (2500 to 1800) (Prentiss et al. 2006).

Bernard Creek Rockshelter has started to become popular in the archaeological literature (personal communication with Steve Hackenberger 2014, Osterkamp 2014). It has a history of interest to archaeologists that work in the Hells Canyon region (Regan and Womack 1981, Torgeson 1983). However, the site lacks an actual point chronology and there is an assumption that the site was used until the ethnographic period (Regan and Womack 1981). As has been stated, the site does not have a historic phase component. The three-phase typology I created for the site will need some refinement, however, it is heavily influenced by a Prentiss et al. article from 2006. This chronology challenges a few established assumptions about the site. (Prentiss et al 2006). Overall, this illustrates the idea that projectile point chronologies are still very relevant in archaeology. My hope is that it will get the metaphorical ball rolling and cause archaeologists to think about the projectile points of Bernard Creek Rockshelter.

Projectile Point Breakage

For every level of the site, all the broken projectile point fragments were recorded. The concept behind projectile point breakage it to determine foreshaft vs. non-foreshaft, and manufacture vs. usage breaks (Frison 1974). Answering this question requires a relatively large sample size. Broken projectile points cause some behavioral and site function questions to arise (Frison 1974). This study was originally undertaken by George Frison in 1974 and has had 40 years of replicative studies. I undertook this method as a way to address site function and to determine what type of dart and arrow hafting was being used. From all the data gathered, it appears that both atlatl and arrow points were attached to main shafts (Frison 1974).

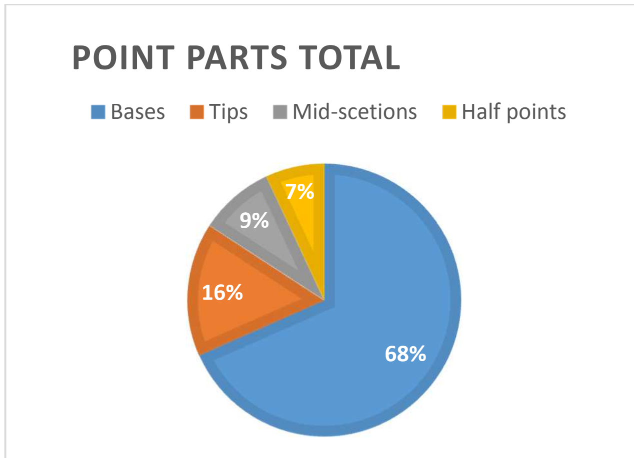

Figure 31: Bernard Creek Rockshelter projectile point parts distribution.

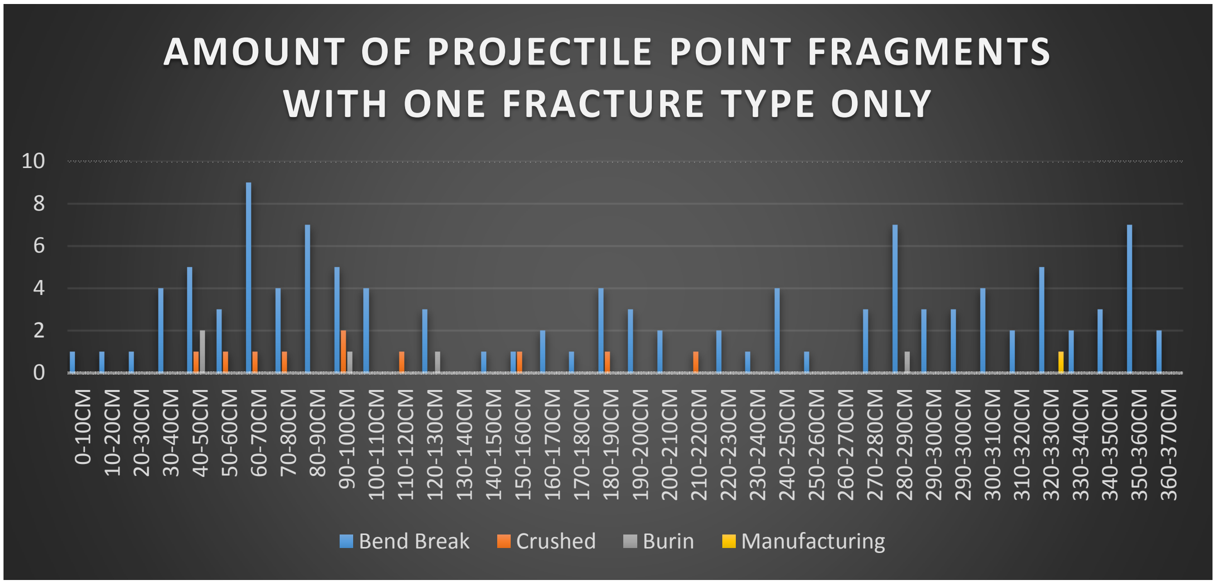

Figure 32: Projectile point fragments with one fracture type only.

The most common type of stone tool breakage is the bending fracture. A bending fracture is defined as any projectile point that is broken horizontally and has an impact fracture (Frison 1974). Fundamentally, this would make logical sense because the majority of all projectile point fragments are bases. Since this covers all temporal spans, there is a safe assumption that the majority of all projectile points were being made for hunting which was the main human activity occurring at the site. Even during periods when site function was changed to either resource procurement or minor flint knapping, the production of stone tools was still an important aspect of the Native American's life.

Most of the bending break fractures exhibit impact scars. Impact scars are small flake scars originating from the process of the projectile point breaking. The breaking is due to animal hides putting large amounts of force on a point stuck in the side of the animal at less than 90 degrees (Frison 1974). Since, almost all of the bending break fractures exhibit impact scars, it is more plausible that the stones were hafted to a foreshaft. A main shaft as a hafting device would not create impact scars on the projectile points (Frison 1974).

There are periods dominated by bending fractures such as levels 370 to 290 cm, 210 to 190 cm, and 100 to 40 cm. Each of these levels suggests a possible increase in successful hunts. There a few levels that are void of projectile points as well: 260 to 270 cm and 140 to 130 cm. The most unique absence of projectile points is the 140 cm to 130 cm layer because it formed during the time of the Mount Mazama eruption (Randolph and Dahlstrom 1977). Within the Mazama ash layers (150 to 130 cm) projectile point amounts decrease one per level or not at all which is very similar to 30 to 0 cm. The reason for the decrease at the 150 to 130 cm strata level is probably due to the Mount Mazama eruption, which changed the temperature and possibly caused game to flee (Chatters et al. 2003).

The next common breakage type is labeled as a bending break with rejuvenation fractures. These are projectile points that were broken in half during hunting and were large enough to be rejuvenated, however, during the process of rejuvenation, they broke when hit with a pressure flaking tool or even soft hammer. One of the most common ideas in lithic studies is that stone tools are able to be recycled (Schiffer 1972). When making stones tools, it is very economical to rework the stone if possible, especially in areas of poor raw lithic material sources. It is also theorized that collectors curated stone tools (Binford 1980). Increased manufacture breaks within the stone assemblage for Bernard Creek Rockshelter indicates an increased value in stone tool recycling (Schiffer 1972).

Crushed breakage patterns are also fairly common with in the Bernard Creek Rockshelter assemblage. Crushed breakage is a point that has been broken and successfully rejuvenated to use as a cutting tool (Frison 1974). In total, this pattern occurs ten times within the lithic assemblage. The majority of this fracture type is located between 120 cm and 40 cm, however, there a few outliers going as deep as 370 cm. Over time it appears that crushed patterns were more common, suggesting that an increase interest in stone tool curation occurred (Binford 1980). It is possible that after the Mazama eruption, subsistence patterns changed to those more like those of collectors (Binford 1980). The concept of stone tool curation was used first mentioned by Lewis Binford in the 1980s and has more recently been used by James Chatters in the Columbia Plateau (Chatters et al. 2003). Currently the idea in the Columbia Plateau is that Native Americans went from foragers to eventually complex collectors (Prentiss et al. 2006). As of right now, from projectile point breakage and raw material types, this original theory explains the breakage.

Burin break pattern is another type of breakage that is among the lithic assemblage. A burin break is a break that travels vertically throughout the projectile point. This style of break also suggests reuse of a projectile point as a burin later in the stone tools use life. A burin is a Native American drill used to puncture bone or leather. Since the amount of burin breaks are relatively small compared to the other styles, it was not a preferred choice. The temporal amount of variation is random and might possibly be a last choice expedient tool. Most of the burin breakage patterns occur after the Mount Mazama eruption, meaning that it might be an heirloom tradition from forager times. Since the site most likely goes to 1800 BP, from recent chronology, some traditions do not go away.

Some of the projectile points exhibit two types of breakage with the smallest number being bending and crushed fractures. Very few of these occur before the Mount Mazama eruption. This breakage suggests that a projectile point was used for hunting then retouched for cutting. Crushing of the projectile point could have been caused by butchering animals.

These types of breakage patterns on an individual tool suggests a matter of expedience. This makes logical sense when a person takes into account the low number of blades within the site. The total number of blades within all of Bernard Creek Rockshelter is three. All of the blades were made before the Mount Mazama eruption, however the site's collection contains several bags of utilized flakes ranging throughout the entire history of the site. The utilized flakes were most likely used for butchering.

All of this data suggests several things about the site. The first is that the site was never used intensively compared to the Hells Canyon Rockshelter across the river from it. The second point is that the main activity occurring at the site was hunting and butchering with some minor quarrying. Third, there appears to be a visual transition occurring between two different subsistence patterns: forager and collector. Lastly, that the Mount Mazama eruption altered stone tool manufacture, probably due to game leaving the area.

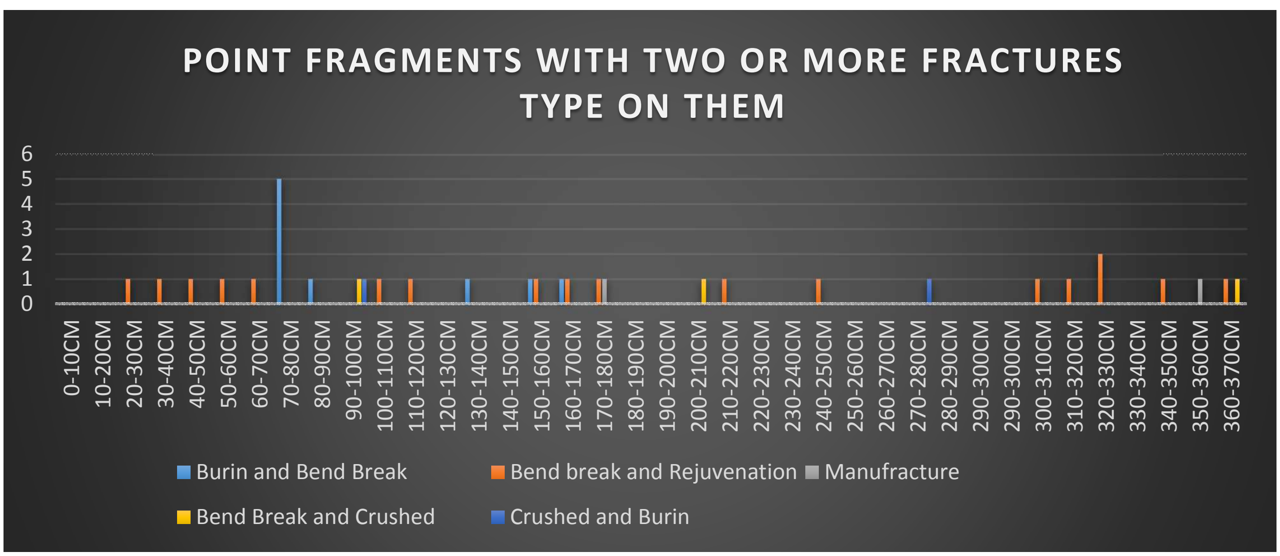

Figure 33: Projectile fragments with two or more fractures types.

Projectile Point length and Thickness Ratios

In 2006, an article came out suggesting that some projectile points were manufactured for the purpose to be used once (Cheshier and Kelly 2006). The authors of the report were to trying to determine if different animal hides broke projectile points sooner in the point's use life (Cheshier and Kelly 2006). The article suggested that any point with a thickness to length ratio of 0.121 cm or less was more likely to break after one use (Cheshier and Kelly 2006). Fundamental to their argument for these small points was that Native Americans used them to increase bleeding in game because of the fragmentation of the point hitting the target. Currently, there has been no follow up study to the original report.

To test this within Bernard Creek Rockshelter, I made an effort to use the most completed projectile points within the assemblage. Projectile point length is a variable measure and very subjective to both breakage and rejuvenation (Thomas 1981, Whittaker 1994). Fundamentally, projectile points observed in the archaeological record are the final end products of cultural transformations (Schiffer 1972, Thomas 1981). Cultural transformation in this context means the byproducts of stone tool manufacture (Schiffer 1972, Schiffer 1987). These end products, if not also disrupted by natural transformations, will retain their shape and stage of reduction (Schiffer 1972, Schiffer 1987, Thomas 1981, Whittaker 1994).

There are two attributes of projectile points that are most likely to retain their size: thickness and width. Thickness can be altered by stone tool making, however, it is more retainable and harder to manipulate than the length of projectile points (Whittaker 1994). Making a projectile point requires some thinning to get a finished product, however, length is easier to control for variable because the cone of percussion runs more vertically than horizontally (Whittaker 1994). This is also the reason that thickness is less variable because the cone of percussion usually takes off flakes that are longer (Whittaker 1994).

During the data collection, I wondered if certain lithic raw materials were chosen to make projectile points that were less than 0.121 cm in width. If this is so, then raw materials such as obsidian might have been used for making smaller projectile points because of its sharpness and its chance to fragment inside the animal. It could also be possible that there might have been a ceremonial and ritualistic value tied with them. Lastly, the points could have been used opportunistically as a last result for hunting game.

There are some complications with gathering all of the data. As previously stated, a majority of the projectile points are currently missing (see cultural chronology section). This is probably the result of several factors: division of the artifacts for different research intuitions, different managers managing the Northern Idaho Repository, and lack of funding for site rehabilitation. Bernard Creek Rockshelter's artifact assemblage is currently known to be housed at three different research institutions: AMS Direct, Central Washington University, and the University of Idaho. It is possible that the archaeological materials were at one time sent to Washington State University and the Wallowa Whitman National Forest. However, this problem is not unique to Bernard Creek Rockshelter and this has been a major issue since at least the 1970s (Marquardt et al. 1982).

Within the past 40 years, the Alfred Bowers Laboratory of Anthropology has had several different managers each one having a different need to allocate resources for managing archaeological and anthropological collections. For at least 40 years, money for archaeological site storage and curation has been scarce if not even considered. This has caused a lot of archaeological materials to fall into a state of disrepair. With budgets currently shrinking in the social sciences, archaeological materials suffer from a lack of economic resources to maintain them. At the same time, culture resource management projects rarely write a budget that allocates money for archaeological material curation. These factors are why Bernard Creek Rockshelter is separated and not rehabilitated.

Despite this lack of data, the one source that is available is the site's artifact log. I usually prefer to directly measure the artifacts, however, this is impossible. I was forced to use the artifact log, but some caution had to be taken. The original archaeologists did an impressive job writing the report and determining seasonality from faunal remains, however, some of their methods and conclusions were those of early Columbia Plateau archaeologists (Randolph and Dahlstrom 1977). During the report there were times when they alternated between 10 cm arbitrary levels and geographic layers. However, there is no direct key to figure geographic layers from the 10 cm arbitrary levels. I had to piece it together from their report. There was also a style of projectile point that was labeled as lanceolate, which in fact is most likely a dart point (Cascade point) (Davis 2001; Leonhardy and Rice 1970). Lastly, they were trained as zoo-archaeologists and geo-archaeologists not lithic researchers or experts.

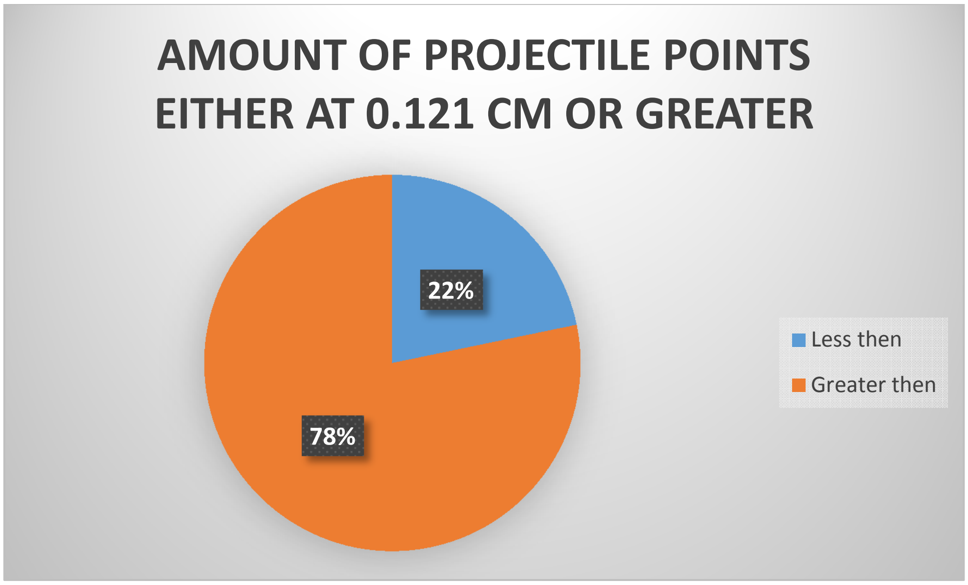

Figure 34: Amounts of projectile points in the sample.

For this study, I only used the control test pit (Block 1) and all samples that are from 0 CM to 150 cm. Out of the 23 complete projectile points, only 5 (22%) were less than or equal to the 0.121 cm mark. These projectile points were also variable in style and raw material type. The projectile point styles were corner-notched (3), side-notched (1), and stemmed point (1). Raw materials types chosen were chalcedony (3), basalt (1), and jasper (1). The temporal range is variable as well with them being between 50 and 20 cm. I hypothesize that these points were being used as a last resort for firing when trying to kill deer during a period when the environment was favorable for larger game herds.

These types of points are rare and were probably made within the last 4300 BP to 1800 BP, and could be the remnant of former foraging subsistence patterns (Binford 1980, Smith 1983). Since environmental conditions gradually change from warmer to cooler from 4100 to 4000 BP, the amount of game in the area was probably increasing (Smith 1983). This would create the need for a second arrow or dart point to shoot in order to kill game.

This is also the period of ethnography, so it would be interesting to see if there are any Columbia Plateau Native American oral histories that mention the use of small projectile points (Smith 1983).

After the 20 cm level these projectile points no longer occur. This period is possibly between 3100 and 1700 BP, and is known for changes to drought and drier conditions (Smith 1983). Within the site, this period is most likely when the site became abandoned. With the arrival of drought conditions, it was most likely that game left for cooler grazing grounds. The original site report suggests this as well because the top sediments do not have any rootlets and all the sediments seem to be blown in from the wind (Randolph and Dahlstrom 1977).

Chapter VI: Reflection and Conclusion

From all the data, methods, and theories applied to the Bernard Creek Rockshelter, I have learned that there are no definitive answers. This being said, the best an archaeologist can do is an educated guess based off data. The more data I have gathered and the more I read from all the articles makes one clear answer, I still know nothing but a guess about human behavior. Sometimes this educated guess can be guarded as the only truth, which can be problematic, such a Clovis first idea. I do not claim to be a postmodernist and still believe in objective science, however, a reality of the work as an anthropologist is just realizing that we do not know the unknown. Some of my hypotheses can never be truly tested without bringing some margin of researcher bias. This does not necessary mean that my guesses are wrong, but just another argument to fuel research.

My first research question of environmental correlation, is assumed to be the case. My data only really correlate to the Mount Mazama eruption. Within this research question was the assumption that debitage was somewhat sensitive to micro-environmental changes. Debitage does not increase or decrease on this scale. Macro-environmental changes are somewhat present within the debitage in the forms of amounts and frequencies. This is because increases or decreases in lithic activity is from hunting or processing game and not only environmental pressure. Lastly, social pressures could have caused changes in the lithic assemblage.

The amount of secondary flakes reveals that there is some environmental relationship at the levels of 160 to 130 cm and 80 to 20 cm. Both of these ranges are related by volcanic eruption events and not as much by droughts or floods. In hindsight, trying to quantify the environment as a single number to use on a statistical software program is not possible. When I tried to do a statistical relationship between debitage types and frequencies, I either got no correlation or “common sense” relationships.

A second assumption I had about the site was that debitage would reveal a lot about the site. Since I came into this project optimistically, I thought debitage analysis would answer most of my research questions. This clearly was not the case. It did, however, answer some of the questions about site function, and change of function through time. I argue that an argument for curation and experience production as a major function can be formed.

Conclusion and Summary

The data gathered from Bernard Creek Rockshelter make a few things clear. The majority of flakes being produced were secondary flake types, and most of them are not made out of basalt, indicating that Native peoples were bringing them in as blanks. Primary flakes at the site are made out of basalt, which suggests that some local raw material was being used in the process of creating stone tools. The common types of reduction being used were hard hammer percussion and pressure flaking because of large frequencies of microlithics and secondary flakes. Soft hammer percussion was being used, but not on a large scale. The debitage amounts and frequencies suggest that the site was never heavily used. This means that the major function of the site was for hunting and butchering. It is possible that the processing of game was to supply Hells Canyon Rockshelter (a known village site) with fresh meat to feed those people who inhabited the area.

Raw material types suggest that there is an increasing trend toward more stone tool curation within Bernard Creek Rockshelter occurring after the 150 to 130 cm levels (Binford 1979). This trend in stone tool curation could have begun as early as 180 cm. Early within the site's history quartz materials were valuable, however, they get replaced by obsidian. Unlike quartz, obsidian offers predictable breakage and is better quality stone to work with. Obsidian, over time, starts to become more constant and its use increases. Due to the rarity of obsidian within the site and the distance it would have had to travel, it could easily have been a status symbol. It is possible that obsidian could have been economically costly and if an individual flintknapper obtained it, they would have showed off their prestige. Throughout time, the cost of obsidian could have decreased because of the establishment of complex trade systems. Thus allowing for greater access to it later on in the site's history.

Obsidian becomes constant enough to eventually replace basalt near the end of the site's occupation. At times, obsidian and basalt flake frequencies seem to have a visible inverse relationship. Mathematically, there is no correlation between the frequencies. This could be from the debitage method used. Mass analysis assumes that all reduction is from a core. Obsidian does not naturally occur near the site which suggest that it most likely was knapped from a pre-existing biface. Basalt flake frequency at the site reveals a binomial distribution. This is because basalt is common within the site, suggesting that there was some minor quarrying occurring for expedient tools, such as utilized flakes for butchering. For the most part, basalt during and after the Mazama eruption goes on a downward trend until the site becomes abandoned.

Bone weights and debitage suggest that there were several changes of function within Bernard Creek Rockshelter. The site was originally a hunting stand and through time switched to a minor lithic quarry utilizing local basalt between the levels of 370 to 280 cm (Binford 1980). From levels 90 cm to surface, the site's main function was resource procurement of game to feed a close by village site. It would remain this way until the site was abandoned at 1800 BP during a time of drought (Leonhardy and Rice 1970; Smith 1983).

From all known projectile points that were measured, the site seems to have been inhabited between 7439 BP and 1800 BP. This places the site within the Emergence of the Complex Collectors (see chronology section for dates) when it was abandoned (Chatters et al. 2006; Leonhardy and Rice 1970). This time period is suggested to be during a period of drought and drier conditions (Smith 1983). Bernard Creek Rockshelter's site report states that the top layer of the site is missing all forms of rootlets (Randolph and Dahlstrom 1977).

The lowest levels of the site have been radiocarbon dated to 7200 BP which puts it in the early Cascade phase (Leonhardy and Rice 1970; Randolph and Dahlstrom 1977). The site contains only one actual ash layer being the Mazama ash (Randolph and Dahlstrom 1977). This information combined with the fact that there are few basal-notched points that are occurring when side-notch points were being intensified, suggest that the site was abandoned at the time of the emergence of the bow and arrow. An assumption about the site was that it was used into the protohistoric period (Chatters et al. 2003). Data acquired suggests otherwise, however, the site was left recently enough to be within the ethnographic period. The reason for the site being abandoned was possibly due to a drought, which caused most of the game to leave.

Projectile point breakage patterns suggest several things about Bernard Creek Rockshelter. First is that the site was never heavily utilized by Native Americans. Second is that the main use of projectile points within the site was for hunting. Most of those projectile points have bending fractures associated with impact flake scars. This implies that Native Americans used foreshafts with their atlatls and arrows. Later on within the site's history, reusable projectile points were being heavily recycled for cutting and scraping. This is evident with crushed projectile point breaks. The Mount Mazama eruption altered Native Americans' use of the site because the amount of breakage on projectile points is very low in numbers. Lastly, there is a visible increase in curative technology because the amount of manufacture errors increase after the Mount Mazama eruption.

A sample of projectile points were obtained from Block 1 and between the levels of 0 and 150 cm. These samples were gathered to test if there were any projectile points with a thickness to length ratio of 0.121 cm or less. From the 23 completed projectile points gathered, there were five (22%) that were less than or equal to 0.121 cm. These five projectile points are rare in the Bernard Creek Rockshelter lithic assemblage. Lithic raw material and projectile point style did not affect how these points were made. It is possible that these types of points were a reflection of the environment between 4000 and 1800 BP. During this time the environment changed from cool to eventually dry and drought-like conditions. It is possible that when the game left the area, so too did the Native Americans occupying the site and using the small projectile points.

Bernard Creek Rockshelter's narrative of the site has remained constant for about 40 years. Hopefully this thesis will start bringing in a discussion of the actual importance of the site. The lithics of the site are not significant, in fact the possible importance of the site will remain with its age and faunal remains. Bernard Creek Rockshelter located in Hells Canyon is a hunting stand used by a small group of people between 7200 to 1800 BP. Originally, there was no attempt by the original archaeologists to theorize or put into context how the archaeological site fit into the HCAD (Personal Communication Joseph Randolph 2015). The site has the potential to go back in time to 8000 BP (Personal Communication with Joseph Randolph 2015). Hopefully, this information will provide a glimpse of truth into past human behavior at the site. Even though this site was excavated back in 1976, it still provides useful data. I hope that future researchers of the HCAD will be able to use the information provided. Further research about the site could be to see how Hells Canyon Rockshelter influenced it through material culture. Understanding the lithics within Bernard Creek Rockshelter, can help us understand how past humans dealt with changing environments. Lastly, my results should not be the final say about the site. As a researcher I did, unintentionally, bring in my own biases to the information. Despite the biases, this research should be an invitation to other archaeologists to study the HCAD.

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