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Spherical Objects Among the Fremont

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ABSTRACT

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Rounded objects, such as spheroids, are frequently found throughout the Fremont region. Because little information is known about these spheroids, this comprehensive analysis of spheroids contributes to definitions of and variation among Fremont spherical objects. I analyzed over 400 Fremont spheroids recording the size, weight, stone type, and other quantifiable aspects for each spheroid. The provenience of spheroids highlights some of the patterns and variability within the Fremont world. I also compare ethnographic accounts of purposes of spheroids in hopes to develop a better understanding of the function of these objects.

Keywords: Fremont, stone balls, stone spheres, spheroids, use-wear, gaming, grinding stones

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1. Introduction

Archaeologists frequently find spherical objects, oftentimes referred to as “stone balls” or “stone spheres,” at Fremont sites. Although common, these spherical objects, which I will refer to as “spheroids,” are often not included in the list of objects that distinguish the Fremont culture tradition. Spheroids have been found at several Fremont sites such as Paragonah Mounds, Five Finger Ridge, Evans Mound, Pharo Village, Median Village, Garrison Site, Kanosh Mounds, Nephi Mounds, Backhoe Village, Snake Rock Village, Caldwell Village, Bear River II and III, Old Woman Site, Injun Creek, and Cowboy Cave.

Defining the Problem

Spheroids are mentioned in various publications, but not in great detail. Generally, only the range of size among the different assemblages is noted. This lack of research on spheroids, in addition to the paltry publications about spheroids, has contributed to a gap in our understanding of the manufacture and utilization of spherical objects. Until recently, Fremont spheroids had never been analyzed comprehensively, and only rarely analyzed quantitatively. Most of the quantitative research gathered on spheroids revolves around measuring the diameter. The size range holds no value to archaeologists unless a clear definition exists for what distinguishes an object as a spheroid.

Fremont archaeologists have yet to develop a clear definition or set of characteristic traits for spheroids. A lack of time, or interest, in researching spherical objects, likely facilitated the ambiguity in information surrounding this artifact type. The vague definition for Fremont spheroids has led to misnomers. During field work, archaeologists collected suspected spheroids, and these were later categorized by either lab specialists or museum professionals and then rarely studied again. Spheroids typically fall under the category of "ground stone" in many archaeological collections at museums and state facilities. Ground stone is a vague category as well, which makes recognizing what distinguishes spherical objects a unique problem. In the past, many slightly rounded, and variously sized and shaped objects have been called stone balls or stone spheres. The use of the terms stone balls and stone spheres has caused confusion because a ball can sometimes be an oval shape or a sphere, whereas a sphere should only describe a spherical shape. Since no straightforward definition existed, my examination of over 400 spheroids has aided in developing key characteristics and a working definition.

A spheroid is "a body that is almost but not quite a sphere." [1] The term spheroid would include the wide variety of shapes I observed during my analysis. I define a spheroid as any object that was shaped into a spherical form and appears variously as, a sphere, an oval, a fat hockey puck like shape, or a rounded cube through either natural or intentional processes. This definition is a fairly broad definition to prevent any possible exclusions of patterns or variation. I will use the term spheroid throughout the rest of this thesis, unless I am referring to a specific type of spheroid (i.e. asymmetrical, sphere, partial, etc.).

Research Objectives

Referring to prehistoric spheroids from Puebloan groups, Adams (2013:201) suggested that there is a need to create categories for the different types of spheroids "through time and space." The purpose of my research is to contribute to this goal, categorizing spheroids that correlate, at least, with the areas occupied by the Fremont.

[1] https://www.collinsdictionary.com/dictionary/english/spheroid

I asked the question how do Fremont spheroids vary? This question required me to understand what patterns spheroids display as a result of their manufacture and or use-wear. Additionally, I analyzed spheroids with known provenience to show possible patterns in distribution among Fremont sites.

To answer these questions, and in preparation for my research on spheroids, I reviewed site reports, articles, and books associated with the Fremont culture area that mentioned spheroids. I found that many Fremont sites contained at least one spheroid, and that several sites, especially Fremont village sites, had larger numbers of spheroids. I identified several repositories in Utah that had Fremont spheroids in their collections. I chose to examine spheroids from Brigham Young University's (BYU) Museum of Peoples and Cultures (MPC), the Natural History Museum of Utah (NHMU), Fremont Indian State Park Museum (FISPM), and Utah State University Eastern's (USU-Eastern) Prehistoric Museum (USUEPM).

Thesis Scope and Limitations

I chose spheroids that had provenience information, including a county associated with them. Some of the spheroids came from private collections that were later bequeathed to museums. Looted or disturbed Fremont sites possibly hindered my results for the number and type of spheroids produced at specific Fremont sites. Many of the spheroids that I analyzed from private collections at museums were very spherical and smooth specimens. There is a possibility that other highly polished and spherical spheroids produced by the Fremont have been privately collected, skewing the representation of smoothed spheres.

The early excavation of Fremont sites, such as Paragonah Mounds or Nephi Mounds, has caused problems with provenience. Montgomery (1894:303) indicated that in "Paragoonah" (now Paragonah), the mounds had been disturbed years earlier by either "Major Powell of the U.S. Geological Survey, or by Dr. Palmer." Montgomery (1894:306) wrote that he had explored "Beaver, Tooele, Salt Lake, Emery, Utah, Millard, and other counties" in Utah, which might mean many Fremont sites had been investigated before they were excavated.

Often, site reports referred to spheroids without describing their appearance. I noticed that sometimes the number of spheroids from a report did not correlate with the number of spheroids a museum had for a particular site. Also, some of the spheroids had irregular round shapes, which might reflect miscategorization made either by lab analysts or museum workers.

Some spheroids were difficult to distinguish as naturally rounded or purposefully manufactured to be round. Due to my own learning curve with analyzing ground stone, I might have categorized some natural spheroids as human-made spheroids, especially at the beginning of my analysis. Naturally rounded river cobbles might have the appearance of peck marks or smoothing but are likely the result of natural water smoothing or bumping against other rocks in flowing water. Regardless of the manufacture or formation of spheroids, Fremont people probably collected these rounded objects conveying the utility of the spheroid shape.

Thesis Organization

The following chapter gives background information on the Fremont cultural tradition. In Chapter 3, I review previous research and literature specific to spheroids. In the fourth chapter, I develop a working definition of spheroids and the methods I utilized to generate the data in this thesis. In the fifth chapter, I present the results of the analysis and discuss possible categories. Finally, in the concluding chapter, I discuss some possible meanings of the results and consider some future directions for research on spheroids.

2. Defining the Fremont Cultural Tradition

In the past fifty or so years, archaeologists have debated the origin of Fremont people, lifeways, and the extent of the Fremont culture. When archaeologists first studied Fremont sites, they considered the Fremont to be part of the Greater Southwest region (Madsen and Simms 1998). Archaeologists in the early period of Fremont archaeology focused on defining and comparing the artifacts, housing, foodways, and rock art. They saw many similarities between the cultural objects of Fremont people and those of Ancestral Puebloan people (Janetski 1997). Many archaeologists also noticed distinct differences between Fremont and other contemporary prehistoric groups and began theorizing about the origin of Fremont people (Fowler 1980). The work of archaeologists during the 1900s to 1950s became foundational for later Fremont archaeological researchers (Janetski 1997).

A History of Fremont Archaeology

Neil Judd (1926:1), after observing certain Fremont sites, stated that those areas were inhabited "unquestionably by individuals we have come to regard as Puebloan." He suggested that the sites varied greatly, and that this northern area of the U.S. Southwest might have "[retrogressed]" in progression (Judd 1926:152). Steward (1933) concluded that the Fremont sites he observed seemed to reflect a Southwestern group of people who never developed further than Basketmaker II times (Steward 1933). Steward (1933:16-17) acknowledged that the "Northern Periphery," the phrase some Southwestern archaeologists used to signify the Fremont region, lacked several of the characteristics of later Southwestern cultures, such as sandals, the "grooved stone axe," and domesticated turkeys.

Noel Morss (1931) participated in an expedition to find more data on the transition of groups from Basketmaker II to later Pueblo times in the Southwest regions. Morss, who coined the term "Fremont," noticed that the people of the Fremont River had distinct material remains from that of other ancient people in the Southwest (Fowler 1980; Morss 1931; Madsen and Simms 1998). Morss (1931) concluded that Southwestern cultures influenced the Fremont River people.

The excavation and research of caves once utilized by Fremont people has led many archaeologists to differing conclusions about the Fremont cultural tradition. Jesse Jennings, a primary Fremont archaeologist who "dominated Utah archaeology for three decades," influenced a generation of archaeologists studying the Fremont area (Janetski 1997:124). Jennings excavated several caves, those in Wendover being the most notable (Janetski 1997). His work at Danger Cave, coupled with some of Steward's ethnographic research, gave rise to the "desert culture concept" (Janetski 1997:120; Madsen and O'Connell 1982). In his book *Prehistory of Utah and the Eastern Great Basin,* Jennings (1978:155) stated his belief "that the Fremont developed from a Desert Archaic beginning." Jenning's desert culture concept suggested that archaic cultures survived the introduction of later cultural traditions in the region (Janetski 1997). When times became hard, people returned to their desert culture lifeways of drawing upon the accessible resources surrounding them and utilizing "basketry and milling stones" regularly (Aikens 1970:201; Fowler 1980; Madsen and O'Connell 1982). Many archaeologists debated the validity of this concept as applied to the Fremont cultural tradition (Janetski 1997; Madsen and O'Connell 1982). According to Madsen and O'Connell (1982), the existence of a constant culture, which would have originated in part from a similar unchanging environment, is a debate that continues presently.

Jennings' desert culture concept, and his disassociation with other Southwestern archaeologists, led to a change in the way archaeologists approached studying Fremont archaeological sites. Jennings also greatly impacted Fremont archaeology by the amount of research and excavation conducted during his professional career (Janetski 1997). Jennings and his colleagues formed the Great Basin Archaeology Conference, which created a new context for archaeologists to disseminate their research of the Fremont cultural tradition, a conference that continues today (Janetski 1997; Allison 2016b). This split from the network of Greater Southwest archeologists facilitated a diverse approach to the way archaeologists research the Fremont culture area. Some archaeologists draw from "Great Basin hunter-gatherer studies," whereas others draw from Southwestern theories on "social interactions" (Allison 2008). Kelly (1999) stated that the Great Basin Region contains numerous hunter-gatherer related sites, which has led some archaeologists to stress subsistence patterns, a greater focus on human behavioral ecology, optimal foraging theories, and environmental factors. Madsen and Simms (1998) have suggested that one issue in studying this region is that some archaeologists view Fremont subsistence as having shifted, which might explain the dispute over predominating Fremont lifeways.

Before the 1980s, the University of Utah led most of the research done in Utah, at least until Cultural Resource Management and other institutions became involved (Fowler 1980; Janetski 1997). The University of Utah's dominance of Fremont research likely contributed to some of the current direction of Fremont archaeological research, including a focus on human behavioral ecology.

Archaeologists who study Fremont people have deliberated the reliance Fremont people had on farming, the time frame in which the Fremont cultural tradition occurred, and other characteristics of the Fremont cultural tradition. Some archaeologists have called for a reuniting of Fremont archaeology with Greater Southwest archaeology (Allison 2008; Allison 2010; Allison 2016b; Lekson 2014). Bringing both areas of study together again could enhance the approaches archaeologists use to analyze Fremont lifeways. Allison (2008; 2016b) emphasized how several Fremont sites fit within the Southwestern archaeological theory models that focus on social interactions. He indicated that a combination of both the theoretical approaches from the Southwest and the Great Basin would benefit Fremont archaeology (Allison 2008).

Defining the Fremont

Archaeologists began noting patterns in the types of artifacts found at sites once inhabited by Fremont people (see Wormington 1955 for examples). Figurines, distinctive anthropomorphic or geometric rock art, rectangular pit houses, one-rod-and-bundle basketry, grayware ceramics, and moccasins are some commonly cited material remains that distinguish Fremont people from other contemporaneous societies (Madsen 1989; Searcy and Talbot 2015; Talbot 2000). From these trait lists, archaeologists began to define the Fremont cultural tradition and incorporate other sites that exemplified those culture traits into the tradition.

Several tools utilized by the Fremont originated around 2000 and 1500 years ago (Madsen and Simms 1998). Madsen and Simms (1998:261), stated that local people began including "many of the objects associated with the use of domesticates such as pottery, large basin-shaped grinding implements, and bell-shaped storage pits" into their lifestyles. Several of the foraging groups in the Fremont region perpetuated their use of ceramic vessels and maize, spreading the influence of those tools to other people (Madsen and Simms 1998).

Defining Fremont people based solely on recovered artifacts causes discrepancies, either because those trait lists might include Southwestern tribes as "Fremont" people and possibly leave out others considered to be Fremont groups, or else the lists might be too general to determine which people from all the North American farming groups count as "Fremont" (Madsen and Simms 1998). Madsen and Simms (1998) emphasized that Fremont people varied depending on the region and area and therefore need more criteria than solely artifacts to group them into a culture. Their interpretation is that the Fremont were not bound to set lifestyles and could transition from being full-time hunter gatherers to part-time foraging and farming people, or from full-time farming people to part-time farming people. This idea of fluidity in subsistence practices is the basis behind Madsen and Simms (1998) Fremont Complex. The Fremont should not be simply defined as a uniform people (see Janetski and Talbot 2014).

Fremont archaeologists have questioned how to define the Fremont cultural tradition when Fremont behavior seems to vary widely according to location and over time (Madsen and Simms 1998). Some archaeologists have explored the idea of subregions among the Fremont based on patterns of living, architectural structures, rock art, pottery style, and figurines (Janetski et al. 2010; Searcy and Talbot 2015). According to Janetski (1997:115), Steward "was one of the first to recognize variability in the Northern Periphery and [formed] a model of regional variation based on material traits." Talbot (2019) explained that the variation in Fremont behavior occurred when people adapted to their differing landscapes. Some archaeologists have suggested that Fremont societies segregated into tribes (Janetski and Talbot 2014). The people living throughout the region might have spoken different languages, similar to how those living ancestors of Puebloan groups speak different languages from the same "language [family]" (Madsen and Simms 1998:257). Viewing Fremont people as part of tribal societies could help to explain the variation observed among their material remains (Janetski and Talbot 2014).

The Fremont region is delimited by archaeological sites that exhibit several of the shared cultural traits of the overarching cultural tradition. Fremont sites have been discovered in the Uinta Basin, the San Rafael region in central Utah, Parowan Valley, Utah Valley, the Sevier River Valley, and east of the Great Salt Lake, to name a few areas (Figure 2.1). At certain time periods, Fremont people also lived in parts of southern Idaho and western Wyoming, and in far east-central Nevada and northwestern Colorado (Barlow 2002; Madsen and Simms 1998; Searcy and Talbot 2015). Fremont people living during the Late Fremont period, around 1000 years ago, thrived in several areas of Utah and bordering states (Madsen and Simms 1998). Madsen and Simms (1998:263) noted that "To the south, the Fremont variously merged into or abutted the Anasazi areas along the drainages of the Colorado River."

Archaeologists typically find long-term sedentary Fremont sites on "alluvial fans and stream terraces along the eastern Great Basin/northern Colorado Plateau rim" (Coltrain and Leavitt 2002:254). Fremont habitation sites are "commonly located in sage/pinyon-juniper transition zones" (Coltrain and Leavitt 2002:454).

The temperature in the eastern Great Basin and the northern Colorado Plateau area is cooler than those areas of the western part of the Great Basin (Madsen and Simms 1998). Rain generally occurs more in the "lower elevation areas" of these regions (Madsen and Simms 1998:256). The water in the lower valley areas comes from the melting snow in the mountains (Madsen and Simms 1998). Coltrain and Leavitt (2002:457) explained that before "European contact, extensive wetlands lined the eastern margins of the GSL from Salt Lake City north to

Brigham City." Archaeologists have found numerous archaeological sites in those wetland areas (Coltrain and Leavitt 2002).

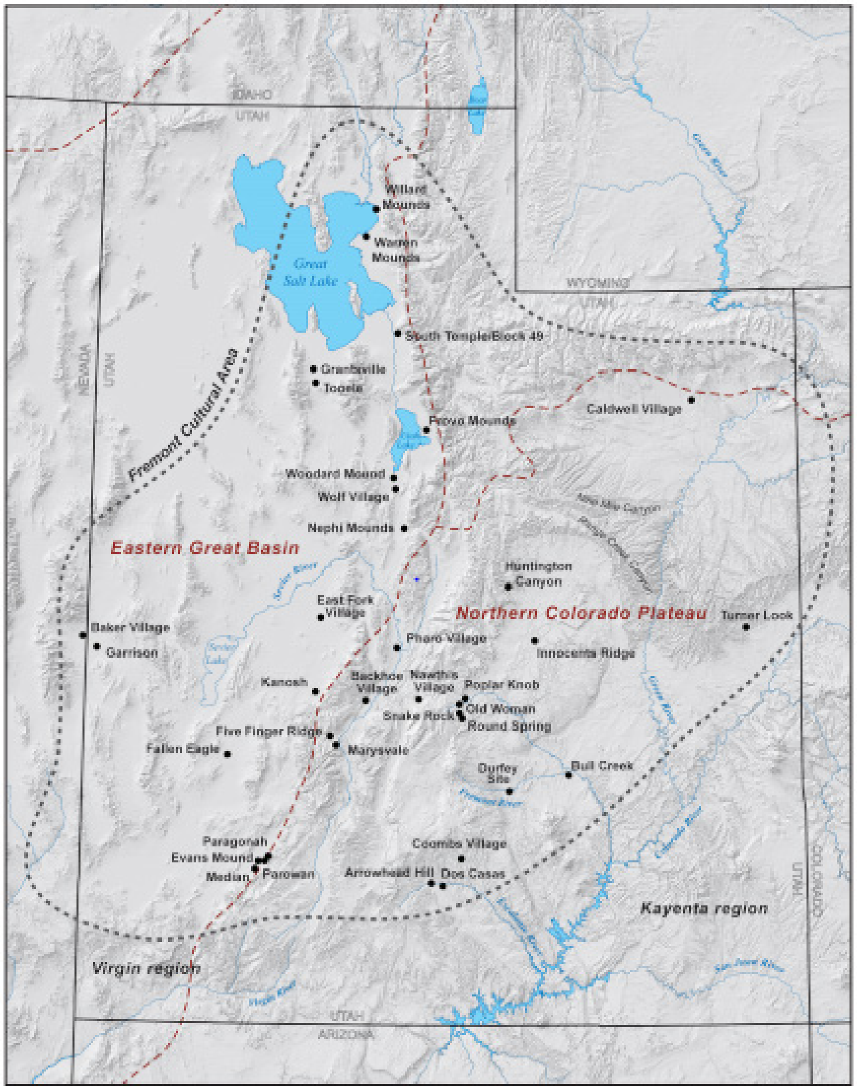


Figure 2.1 Map of Fremont culture region with well-known Fremont sites (Ure 2013:Figure 12).

Coltrain and Leavitt (2002:456) also suggested that some archaeologists theorize that the Fremont period correlated with a time when the climate was abnormally warmer and wetter, due to intruding "summer monsoons." These storms would have lengthened the time crops could grow without risk of frost. Some archaeologists maintain that the Fremont cultural tradition ended when the climate changed again to shorter growing periods for crops and less moist conditions (Coltrain and Leavitt 2002). Possibly a drought, or a change in rain patterns, contributed to the abandonment of farming by people living “east of the GSL wetlands” (Coltrain and Leavitt 2002:477). The exact reasons for the eventual disappearance of the Fremont cultural tradition remains a mystery.

Fremont Chronology

The exact timing of the Fremont cultural tradition’s beginning and end continues to be a disputed topic among Fremont archaeologists. Many of the shared Fremont characteristics appeared as early as AD 500 until AD 1300 (Talbot 2000).

Talbot (2000) has asserted that the Fremont occupation can be divided into early, middle, and late periods. The Early Period began sometime around AD 1, which Talbot stated is the time of “the earliest maize cultivation north of the Colorado River (Talbot 2000:280). The Middle Period began in AD 500, and the Late Period began AD 900 and ended AD 1300 (Talbot 2019: Table 17.1). Madsen and Simms (1998:264) indicated that by 700 to 500 BP the “classic traits such as one-rod-and-bundle basketry, thin-walled gray pottery, and clay figurines disappear from the Fremont region.” Around 600 years ago, farming appears to vanish “from the central Fremont area” (Madsen and Simms 1998:264).

A large issue in pinpointing a particular time frame for Fremont culture stems from the difficulty in defining what identifies people in these areas as “Fremont” (Allison 2016a). Allison (2016a) argues that focusing on the different character traits or cultural materials of the people could change the timing that archaeologists consider as the “Fremont” period (Allison 2016a). This issue of defining which material traits or lifeways exemplify “Fremont” people is certainly one reason why many contradictory viewpoints exist about whether Fremont people lived as foragers, farmers, or a mix of the two lifeways.

In order to address this problem with greater accuracy, Allison (2016a) encouraged the reevaluation of certain radiocarbon dates gleaned from charcoal or old wood. He proposed radiocarbon dating corn in order to clear up discrepancies, and he has reworked the timing on several sites using these corn cob dates. Allison's (2016a, 2016b) redating of Fremont sites revealed that settled village life became widespread around AD 1000 (Allison 2016a; Allison 2016b). He suggested that an increase in "population growth" and reliance on maize in the Fremont region, around AD 900 and AD 1000, coincided with the "Pueblo II period in the northern Southwest" (Allison 2019:285). Reestablishing when Fremont people lived might not solve the problem of how archaeologists define "Fremont," but the revised dates will aid in determining the timing of cultural change.

Fremont Lifeways

Social Organization

Fremont communities varied; some functioned as either small scale groups, likely comprising a family, or as a large village (Madsen 1989). Fremont social structure is similar to structures found among Puebloan people (Janetski and Talbot 2014). Steward believed that Fremont sites were like Basketmaker III communities, and that these residential areas were comprised of around "10 houses" where extended family would have lived together (Janetski and Talbot 2014:118). Archaeologists deliberate whether most Fremont people lived in large residential sites. According to some archaeologists, the Fremont organized themselves on an immediate family level, and larger households are evidence of reoccupation over the years

(Talbot 2000). Gunnerson (1969) noted that Fremont houses probably fit one family suggesting that social interactions were mainly on a familial level, but that other villages would have been close enough for neighbor interactions. Community level interaction likely occurred based on Gunnerson's (1969:157) observations that "small villages" congregated "along a single stream." He further suggested that Fremont people could have coordinated on a larger level in order to implement and manage irrigation ditches (Gunnerson 1969).

Architecture and Site Organization

Most of the current understanding of Fremont social structures comes from the excavation of housing units and villages. Typically, Fremont dwellings consist of "well-developed pithouses...occasional adobe or jacal surface houses, [and/or] integrative structures" (Talbot 2000:278). Pithouses are semi-subterranean structures, which vary in construction and appearance throughout the region.

During what Talbot (2000) called the Early and Middle Fremont periods, several "open site" buildings changed from "small, thin-walled habitation structures and subterranean storage pits to larger semi-subterranean timber and mud houses and aboveground mud or rock-walled granaries" (Madsen and Simms 1998:261). During the Late Fremont period, houses were also built with adobe around the Fremont and Puebloan border (Talbot 2000). In contrast, the Fremont people living on the Colorado Plateau used stones for their houses (Talbot 2000). Some structures have been found on "ridge tops," similar to the "Puebloan styles in the Canyonlands and Hovenweep areas" (Talbot 2000:283).

Communal spaces have been found at some Fremont sites. Archaeologists believe the presence of these structures indicates communal activities (Talbot 2000). Central structures began appearing around AD 900 “in well-watered locations along the Basin/Plateau rim” (Coltrain and Leavitt 2002:454). Johansson (2019) gave four examples of central structures among Fremont sites: central structures, storage structures, plazas, and oversized pit structures.

Archaeologists associate central structures, which appear as houses organized around a central structure, with large populations (Coltrain and Leavitt 2002). Central structures were sometimes large houses made of “jacal, coursed adobe, and masonry” built above ground (Johansson 2019:411). These central structures could have functioned as ceremonial spaces (Johansson 2019). Other southwestern farming communities during this same time period had similar central structures (Janetski and Talbot 2014).

Janetski and Talbot (2014:120) wrote about “two architecturally unique structures” from Five Finger Ridge, where one structure may have functioned as a house for a “community leader,” and the other possibly became a place for the community to come together for communal activities. Janetski and Talbot (2014:120) argued that these communal structures at the Five Finger Ridge site convey increasing complexity for people of the Fremont cultural tradition.

Farming of Corn

Many archaeologists agree that growing maize is an important element in defining the Fremont cultural tradition (Madsen and Simms 1998; Talbot 2000). The inclusion of maize farming and many other “traits associated with the farming societies of the Southwest and Mexico” happened gradually around 2500 years ago to 1500 BP (Madsen and Simms 1998:260). Populations increased during this time period, in part due to either hunter-gatherers adopting agriculture or migrating farmers (Madsen and Simms 1998). Madsen and Simms (1998:261) indicated that around 1200 BP, Fremont people living on “both the east and west sides of the

Wasatch Plateau" implemented farming and sedentary lifeways. They began living in pithouse villages and farmed corn, squash, and beans (Madsen and Simms 1998:268). Fremont farming has been identified north and east of the Great Salt Lake, at the Garrison and Baker drainages by the border of Nevada and Utah, in the Uintah Basin, on the Tavaputs Plateau, and near the drainages of the Colorado and Green Rivers (Coltrain and Leavitt 2002).

Prehistoric peoples living in those areas stowed their harvested food in storage structures, such as a "bell-shaped storage pits," subterranean pits, granary rooms, or "aboveground" adobe or masonry granaries (Madsen and Simms 1998:261). These "aboveground mud or rock-walled granaries," or storage pits, imply that people were becoming more sedentary and less dependent on undomesticated foods (Madsen and Simms 1998:261).

Yoder (2005) explained that the type of storage structures (either on site or off site) used by prehistoric people mirrored their level of mobility. Over time, the Fremont began using on-site storage structures that were consistent with sedentary life, implying that these groups became less mobile (Yoder 2005). The benefits of storing maize motivated Fremont people to care for and maintain corn rather than simply foraging (Talbot 2011).

Fremont people have been characterized as mobile farmers that stationed themselves next to good farming lands, but also relied on some of the surrounding wildlife for their sustenance (Janetski and Talbot 2014). While the extent to which Fremont people farmed is debated, archaeologists agree that at least some groups practiced "irrigation" farming (Madsen 1989:33). Coltrain and Leavitt (2002) found that the diets of Fremont people living during the same period varied widely in the amount of corn or wild plants eaten. This use of wild plants was to enhance the Fremont diet, not to replace the use of corn (Allison 2008).

Morss indicated that Fremont people, unlike sedentary people in the Southwest and hunter-gatherer groups in the Great Basin, likely farmed in the summer and hunted in the winter (Madsen and Simms 1998). Allison (2008) somewhat agrees with the notion that Fremont people cycled through different patterns of subsistence, but they were more nuanced and had variable regional manifestations.

Religious and Other Activities

The exact belief system of Fremont people is unknown. Unfortunately, there are no "known direct descendants" to draw analogies from for religious beliefs, or any prehistoric religious practices (Madsen and Simms 1998: 258). Lekson (2014) stated his belief that the Fremont were affected by the Chaco system, a centralized and shared ideological or political movement that originated in New Mexico. Some archaeologists, such as Michael Searcy, disagree that early Fremont culture was influenced by the Chaco system (Michael Searcy personal communication 2020). Studying the possibility that Fremont people were influenced by the Chaco system might help archaeologists better understand the possible pressures and the scope Chaco had on the development of Fremont culture, but more work is required especially regarding the ethnogenesis of Fremont traditions in the first millennium A.D.

Rock art and clay figurines are two cultural traits that could reflect cultural ideology. Both hunter gatherer populations and farming village populations created various forms and designs on rock (Madsen and Simms 1998). The rock art created during the Fremont period might reflect differences in "ideological views" across the Fremont region (Madsen and Simms 1998:257). Madsen and Simms (1998:264) indicated that along the Colorado Plateau area, certain clay figurines "resemble rock art figures in some areas" (Madsen and Simms 1998, Figure 4).

Gaming pieces found at Fremont sites convey the important role gaming played among Fremont people. Lambert (2018:179) described Fremont bone gaming pieces as "small, usually flat, rectangular pieces of worked bone often made from large mammal long bones." Bone and wooden gaming pieces (marked with lines, dots, and red ochre) have been found at village sites, such as Parowan Valley, and at cave sites, such as Promontory Cave I and Hogup Cave (Janetski 2017). Hopi gaming pieces have been compared with Fremont gaming pieces for their shared characteristics (Lambert 2018). Finding bone gaming pieces among the Fremont is "much more common" than finding bone gaming pieces among the southern Ancestral Puebloan people from that same time period (Madsen and Simms 1998:305). Janetski (2017:138) stated that the "sheer quantity of [gaming] items suggests the importance of games and amusements in Fremont society, and likely the stakes for which the games were played went beyond the secular." Bone gaming pieces may have functioned as representative items during rituals of abandonment (Lambert 2018). Fremont sites that contained several gaming pieces likely served as places for gathering and socializing in the Fremont region (Janetski 2017).

Fremont Interactions and Associations

Many archaeologists acknowledge that Fremont people interacted with surrounding groups through trade and other social activities. Talbot (2000) proposed that archeologists focus more on trading and cross-cultural relations of Fremont and Puebloan people. Placing emphasis on trade might highlight some of the Fremont culture's shared characteristics with Ancestral Puebloans.

According to Janetski et al. (2010:48), the Fremont cultural tradition should be "thought of as an interaction spheroid." Larger Fremont village sites may have served as host areas for yearly trade gatherings (Janetski 2017). These trading centers might explain the variety of "exotic" goods such as turquoise, marine shell ornaments, or dice made from bone in those areas (Janetski 2017:135).

Fremont ceramics and other Southwestern ceramics also provide some evidence of trade. Madsen and Simms (1998) suggested that due to the fluidity of foraging people, Fremont pottery could have spread through the interactions of hunting and gathering groups from the Fremont region to southern Idaho, parts of Southern Wyoming, and Western Colorado. Some non-Fremont ceramics were traded in the Fremont region, with Virgin ceramics being found in southern Fremont sites, and Kayenta ceramics being found in sites near Colorado, but large-scale trade between the Fremont and neighboring groups has not been commonly identified (Searcy and Talbot 2015; Talbot 2000). The amount of traded Anasazi and Fremont ceramics appear to have been controlled, evidenced by the low presence of Anasazi wares in Parowan Valley and the low presence of Fremont wares at Virgin Anasazi sites (Searcy and Talbot 2015).

In contrast, the Coombs site, which is near the border of the Fremont region and the Pueblo region, likely acted as a spot for interaction between Fremont and Puebloan people. Other goods, like obsidian and unpainted ceramics were interpreted to suggest trade "in down-the-line fashion to central places as well as smaller sites" (Janetski et al. 2010:47).

I propose that spheroids be added to the Fremont trait list. These rounded objects, like other Fremont material traits, vary in form from site to site, but are almost ubiquitous across the Fremont world. While large numbers of spheroids are not found at every Fremont site, their ubiquity across the Fremont region appears to be as much a defining material trait of the Fremont cultural tradition as pipes or figurines.

Conclusion

The Fremont cultural tradition represents a modern idea of how prehistoric people who shared similar patterns of behavior and material traits lived and interacted in the Greater Southwest's Northern Periphery. Similarities in rock art, ceramics, farming, and other goods have led archaeologists to believe that the Fremont practiced a way of life distinct from other hunter gatherer societies and other Southwestern groups.

3. Previous Research on Spheroids

Throughout my research, I quickly discovered that fashioning spheroids from stone is not unique to Fremont people. Spherical objects made from stone appear around the world in various forms. For example, a quick Google™ search will bring up gigantic, unexplained stone spheroids from Costa Rica. On BYU's campus, one of these giant Costa Rican spheroids sits on display. In addition to Costa Rican stone spheroids, "man-made spheres of basalt" have been found in the Veracruz region of Mexico (Stirling and Cupp 1969:295). Kubikova (2015) told of stone spheroids throughout Mesoamerica that ranged in diameter from 20 mm to 60 mm and that were smooth on the surface.

People from other areas of North America also manufactured spheroids in places such as California, Nevada, Oregon, and South Dakota (Kubikova 2015; Sutton and Koerper 2009; Wedel 1955). A search on eBay™ for "Indian game ball" will also bring up various sized "prehistoric" stone spheroids from Pennsylvania, Kentucky, Tennessee, Iowa, and Arkansas.

Several publications mention spheroids in varying detail, such as Hewes (1941) who noted stone spheroids at some archaeological sites in the San Joaquin Valley of California. Engelbrecht et al. (2018:44) indicated that at some Iroquoian sites, "a few spherical stone balls" were present, but he did not give an exact timeline or location for those stone spheroids. Stone spheroids with diameters ranging from 26 mm to 48 mm were found in burial sites in South Dakota (Wedel 1955). Jones (1873) indicated that indigenous people living in the southern states (Georgia, Florida, South and North Carolina, Virginia, Tennessee, Mississippi, and Alabama) created missiles from either spheroid type stones or river cobbles.

Stone spheroids in the Middle East, Europe, or the Pacific islands are typically thought of as sling stones. Sling stones, rounded or sometimes egg shaped stones that were thrown far distances, have been found in many different countries (see Korfmann's 1973 map on page 42). Archaeologists, such as Kubikova (2015), proposed that many of the stone spheroids throughout the world are actually sling missiles. Korfmann (1973:37) suggested that Roman and Greek people "carefully shaped stone, clay or lead missiles" for slinging. On the island of Niue in the South Pacific Ocean, the people produced smoothed sling/throwing stones made from basalt (Isaac and Isaac 2011).

Archaeologists have proposed that spheroids could have other purposes besides gaming or weaponry. Neolithic period stone spheroids ranging in diameter from 38.1 mm to 63.5 mm from the northern part of Karnataka (modern-day India) were likely used for grinding (Allchin 1957). Foote (1916:81) called these Karnataka stones "corncrushers," which indicates that they were used to grind corn. Allchin (1957) related that spherical stones smaller than 38.1 mm likely functioned as weights or gaming implements. Mann (1913) asserted that round, intentionally shaped rocks from Scotland functioned as weights with scales. He compared these Scottish spheroids to holey, clay balls that the British likely used as weights.

With so many spheroids found in different areas of the world, it would be highly unlikely that each spherical object functioned or was created for the same purpose. Many people have explained spheroids found in the U.S. as gaming objects, tools for cooking, as heated stones maneuvered to singe unwanted aspects of a hide, and as objects used for ceremonies (Yeager 1986). Yeager (1986), an amateur archaeologist and collector, wrote that spheroids range from the size of a "pea" to a "baseball," but most often spheroids fall into the size range of a "golf-ball" (Yeager 1986:89). He suggested various purposes for spheroids according to sizing: small spheroids were gaming implements, medium sized spheroids would have aided in cooking, and big spheroids functioned either as gaming spheroids or spheroids for religious rites (Yeager 1986).

It is likely that the areas immediately around the Fremont region that produced spheroids hold the most potential for comparisons on spheroid variation. Interactions between Fremont people and others through trade, migration, or the diffusion of ideas may have introduced the production and use of these objects to the Fremont. Spheroids have been noted in great amounts throughout Southern California, the Northwestern Great Basin, and areas of the Greater Southwest (Adams 2013; Sutton and Koerper 2009).

Spheroids in Southern California and the Northwestern Great Basin

Sutton and Koerper (2009) reported spheroids from several parts of California, and some in Nevada and Oregon. They believe that the spheroids found in those aforementioned areas aid their argument that the southern part of California and the northwestern portion of the Great Basin interacted in a “sphere” of mutual influence “during the Middle Holocene” (Sutton and Koerper 2009:1). Sutton and Koerper (2009) analyzed literature written about stone spheroids found in California, Nevada, and Oregon to compare how spheroids varied throughout those regions.

Californian stone spheroids have been found primarily in southern California (Figure 3.1). A few stone spheroids from California have links to burials (Sutton and Koerper 2009). Most of the stone spheroids that occurred in Oregon came from areas “150 km of each other” (Sutton and Koerper 2009:8). Stone spheroids in Nevada come from Lovelock Cave. Overall, sandstone, granite, and basalt rocks make up most of the spheroids from California, Oregon, and

Nevada. Spheroids from California, Nevada, and Oregon had a wide range of sizes: 30 mm to 300 mm for Californian spheroids, 13 mm to 40 mm for Nevada spheroids, and 63 mm to 129 mm for Oregon spheroids (Figure 3.2) (Sutton and Koerper 2009).

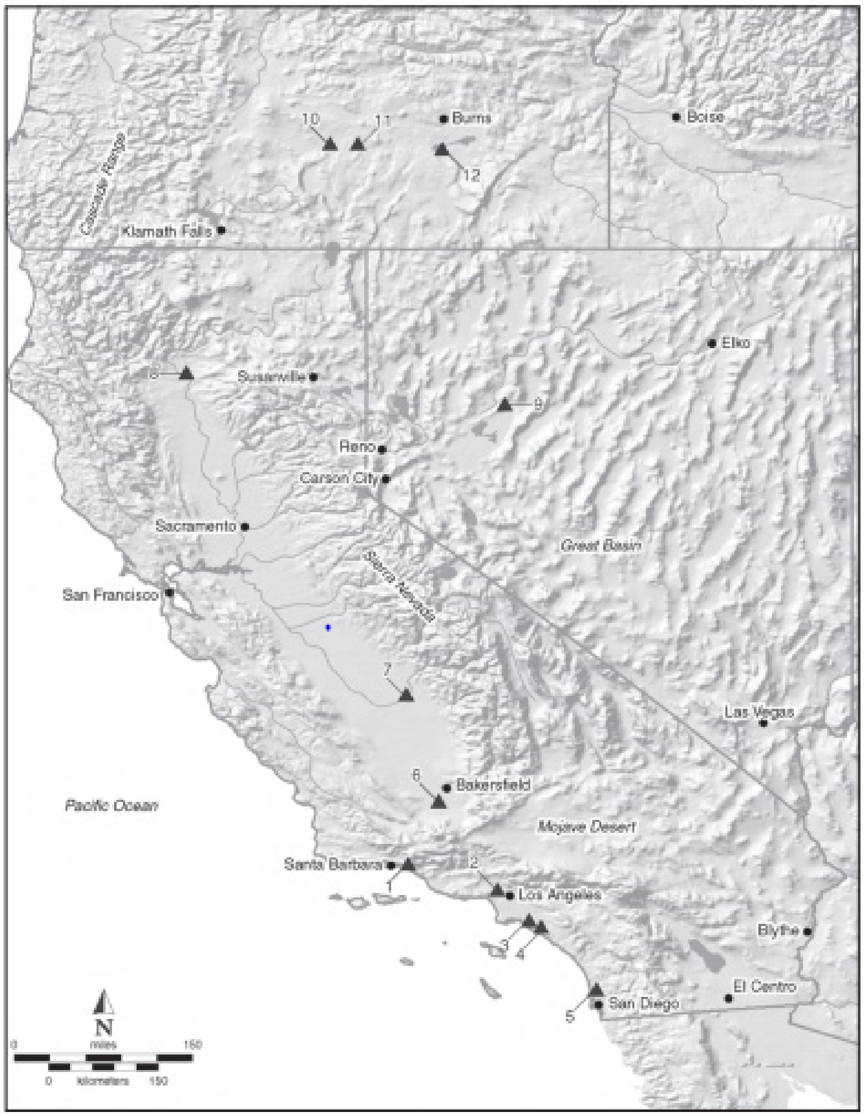


Figure 3.1 Map depicting the well-finished spheroids in Western North America (Sutton and Koerper 2009:Figure 7).

Sutton and Koerper (2009:5) suggested that the degree of "finish" (a smoothed or polished surface texture) on the spheroids had more meaning than the size of each spheroid. Smaller "roughly" finished spheroids might have functioned as gaming stones and larger "well-finished" spheroids could have been used in ceremonial activities (Sutton and Koerper 2009:5). Stone spheroids that were not "finished" might have possibly been "milling stones" (Sutton and Koerper 2009:5).

Figure 3.2 A stone spheroid from Oregon's Christmas Lake Valley (Sutton and Koerper 2009:Figure 6).

Some southern Californian sites had large numbers of spheroids. Sutton and Koerper (2009:8) reported that one site, the Irvine site, from southern California contained 70 stone spheroids. The majority of the spheroids from that particular site previously mentioned ranged from 50 mm to 130 mm (Sutton and Koerper 2009:8). These 70 spheroids date to 4,300 BP. The Irvine Site spheroids appeared before the Fremont cultural tradition began. The existence of these older spheroids provides some older correlates to compare with Fremont manufactured spheroids.

Spheroids in the Greater Southwest

Archaeologists working in the U.S. Southwest have investigated possible patterns and purposes of spherical objects among Puebloan groups. Spheroids of several different sizes occurred during the Late Archaic time period of 800 BC to AD 150 throughout the Southwest, and in a few areas of the Southwest during AD 400 to AD 1350 (Adams 2013). The Mogollon region of the Greater Southwest has produced spheroids, which Janetski (2017) proposed could signify "Fremont contact or ancestral relations." Virgin Anasazi sites that correspond to the Fremont time frame from the southern part of Nevada, and the farthest reaches of southwestern Utah also appear to contain spheroids (Janetski 2017).

Adams (2013:198) indicated that the majority of information regarding the function of spheroids stems from "ethnographic references and archaeological associations." Drawing from ethnographies, archaeologists have suggested various functions for Puebloan and other prehistoric spheroids. Various Southwestern ethnographic accounts on groups such as the Hopi, Zuni, and the Piman tribes describe the use of spheroids as "gaming pieces, club heads, noisemaking stones, or racing stones" (Adams 2013:198).

Adams (2013) presented quantitative categories that explain and categorize Puebloan spheroids. She revealed that the categories for spheroid type (racing stones, thunderstones, and gaming stones) stem from the diameter measurements and use-wear, such as flattening or fractured spots. The diameters of gaming stones measure from 30 mm to 40 mm, racing stones, or kickballs, have diameters that measure from 50 mm to 70 mm, and thunderstones have diameters that range from 70 mm to 100 mm (Adams 2013).

Adams (2013) explained that striations, which are representative of either grinding or polishing, help archaeologists derive the use-wear patterns or manufacture patterns of a stone. The fractures found on the surface of the spheroid may be indicative of kickballs. Thunderstones might display evidence of rolling, which would be observed on a microscopic level where "natural asperities, should be rounded" (Adams 2013:199). Gaming stones, especially those stones that have been lightly used or covered in skins, have either difficult to recognize use-wear, or possibly no observable use-wear. Adams (2013:199) suggested that evidence of "handling," or the "sheen" that appears on the surface of a stone, comes from being wrapped in leather.

Fremont Spheroids

Spheroids appear in a wide array throughout the Fremont region, although the number of spheroids varies according to site (Janetski 2017). Wormington (1955:178) stated that the Fremont culture appears to have "large numbers of smooth stone balls," unlike other Ancestral Puebloan groups.

Madsen and Lindsay (1977:68) define Fremont spheroids as "spherical ground stone implements ranging from 34 mm to 54 mm in diameter." Anderson (1967:79) described Fremont spheroids as "highly polished and very nearly spherical." Determining that a spheroid should be highly rounded and smoothed excludes other possible spheroids with flat spots and rough textures.

Fremont stone spheroids were likely formed through pecking (striking one stone against another stone in order to shape a globular spheroid) and smoothing (a process of rubbing the shaped stone with another rough stone to create a finished or polished surface) (Janetski 2017). Fremont spheroids range in diameter from 25.4 mm to 101.6 mm (Anderson 1967). According to Janetski (2017), the average size for spheroids is around 40 mm. Spheroids made from stone were primarily manufactured from limestone and sandstone (Taylor 1957). Some of the other stone types identified for stone spheroids were granite, basalt, lava, chalcedony, quartzite, pumice, obsidian, chert, and flint (Metcalf et al. 1993; Steward 1936; Taylor 1957).

Judd (1919:17) recounted that one spheroid from Paragonah had a fragment of “clay covering” the outside surface. Spheroids made entirely from clay that fit within the Fremont spheroid size range are uncommon (Janetski 2017). Radford Roost had some “marble-sized” clay spheroids, which is an unusually large size for a clay spheroid (Janetski 2017:134).

Fremont spheroids are most often found in and around buildings, trash mounds, or “on the surface” at Fremont sites (Anderson 1967:79). Taylor (1957) found that the stone spheroids that he excavated from the Old Woman site and Poplar Knob appeared to be naturally rounded stones that had additional modifications made to them. He noted that one spheroid was larger than that of a “baseball” and that this spheroid might have been used for different purposes than the purposes of the “smaller spheres” (Taylor 1957:72). This larger spheroid was discovered “imbedded in the floor of House 3...between [the] fireplace” and a pit containing five figurines (Taylor 1957:75). Because of the large number of figurines found in the house, Taylor (1957) referred to the house as Shrine House. Taylor (1957) compared the placement of the spheroid in the floor to the ritual holes in the floor, known as sipapu, of Ancestral Puebloan houses. Archaeologists have also found spheroids imbedded in the floors of houses at both the Round Spring Site and at Five Finger Ridge (Metcalf et al. 1993; Talbot et al. 2000).

Several ideas exist on the purposes of Fremont spheroids, but overall, the functions of spheroids remain disputed. Taylor (1957:118) wrote that some archaeologists have believed spheroids to be “fetishes, missiles, or merely curiosities.” Spheroids have also been “categorized as gaming pieces, ceremonial objects, or simply enigmatic artifacts” (Madsen and Lindsay 1977:66).

Fremont archaeologists, such as Judd (1919), Steward (1936), Wormington (1955), Gunnerson (1957), Taylor (1957), Leach (1966), Anderson (1967), and Janetski (2017) all propose that spheroids were used for various games.

Anderson's (1967) article dedicates three pages to discussing Fremont spheroids and their function. He suggested juggling as a possible explanation for the use-wear and existence of spheroids. Anderson (1967) draws from Dorsey's (1901) ethnographic account of a juggling game played by Shoshonean women, alluding to the possibility that Fremont spheroids were used in a similar manner. The spheroids used by the Shoshonean women were made from gypsum, unfired clay, or round river cobbles (Anderson 1967).

Janetski (2017) discussed the importance of gaming among Fremont people and how spheroids might have functioned as gaming objects. He concluded that Fremont people may have utilized spheroids in foot racing, a game where the players raced to an endpoint while kicking either a wooden or stone ball (Janetski 2017).

Janetski (2017) told about several archaeologists who noticed flat spots or evidence of grinding on some spheroids (see Madsen and Lindsay 1977; Montgomery and Montgomery 1993; Metcalf et al. 1993). Stone spheroids that were "in direct association with manos on the floors of two separate pit structures" were found at backhoe village (Madsen and Lindsay 1977:66). Fremont people may have employed some stone spheroids to grind food on the smaller platform of Utah-type metates (Madsen and Lindsay 1977). Some spheroids at the Round Spring Site appear to have been moved in grinding motions, as indicated by flat spots and striations (Metcalf et al. 1993). One spheroid from the Evans Mound site exhibited some form of a "rolling," grinding or smoothing motion on the surface of the spheroid, evidenced by "the shape of the depression" (Dodd 1982:68). Janetski (2017) suggested that spheroids with flat spots did not happen often, and that they might indicate that the spheroids were repurposed after being used in games.

Although pinpointing the function of Fremont spheroids might seem impossible, I suggest starting with recording measurable information. Placing emphasis on the quantitative measurements of spheroids will help to record variations, which might highlight possible patterns of manufacture.

My methods for gathering the data were guided, in part, by the work of Adams (2013), who has provided some good guidelines and categories for analyzing ground stone. A discussion of my adaptation of Adams's (2013) appendix resources, and my other methods in analyzing Fremont spheroids is presented in the next chapter.

4. Methods of Research and Analysis

Spheroids seem to be ubiquitous and mysteriously appear in museum collection boxes without having been accessioned into the museum collection. Originally, I set a goal to analyze around 350 spheroids, but to my surprise, several museums held more spheroids than either I or the collections managers had accounted for. To the best of my ability, I examined Fremont spheroids as comprehensively as time and money allowed. Many spheroids remain unaccounted for and will likely surprise the next researcher who opens a box of ground stone objects. The remaining missing spheroids, and any unaccounted for spheroids, will hopefully aid future researchers.

In this section I discuss my methods for gathering data, my definition of "spheroid," and the procedures I used to physically analyze the spheroids. I also review how I found the physical locations and the spheroid count of Fremont sites containing spheroids. That information contributed to the Fremont spheroid distribution map.

Methods

I began my research by calling and emailing museums in Utah to get a scope of the spheroids held in museum collections. Once I established that a museum had at least 15 spheroids with good provenience, I began planning which Utah museums I would visit to analyze their collections. Some museums corresponded with me to help me create a list of the spheroids in their collections. I have listed the museums that I visited and the number of spheroids that I analyzed at each particular museum in Table 4.1 (Table 4.1 includes excluded spheroids in the museum counts). In total, I analyzed 484 spheroids, but my final dataset includes only 438 spheroids. As I refined my definition of a spheroid, I excluded various spheroids that no longer fit the criteria (further discussion on excluded spheroids is given in Chapter 5).

Table 4.1 Museum Collections Analyzed with Spheroid Count per Museum

Museum Name	**Spheroid Count**
Fremont Indian State Park	56
BYU’s Museum of Peoples and Cultures	35
Natural History Museum of Utah	342
USU’s Eastern Prehistoric Museum	51

Initially, I had the collections manager for each museum pull every object labeled as “ball” from Fremont sites. This method proved to be frustrating during my analysis of the MPC and the NHMU collections. I found that several of the objects labeled as balls more closely resembled hammerstones, sinkers, or sometimes pestles. For several decades, generally rounded stones have been variously labeled and/or mislabeled as balls. As previously mentioned in Chapter 1, I believe these misnomers likely come from a lab analyst, a museum professional, or the mix-up of FS logs and catalog records.

Once I recognized that the underlying issue of these miscategorizations stemmed from a vague or nonexistent definition of “stone ball,” I devised some criteria that a spherical object had to meet to be considered a spheroid in the dataset.

Defining A Spheroid

Museums categorize spheroids as part of the ground stone category under the subtype of ball. The definition for what makes an object a ground stone is broad and somewhat vague and needs refining. Similarly, “stone ball,” a term employed by museums and archaeologists, encompasses a wide range of rounded objects, which no one has ever officially defined. I have chosen the term “spheroid” to refer to the wide variety of rounded shapes in the sample and those spheres mentioned in museum catalogs or publications. The term spheroid includes rounded objects not made of stone and objects that are not completely sphere shaped. I define a spheroid as natural or intentionally shaped objects that look like spheres, ovals, rounded cubes, or fat hockey puck shapes.

When I refer to naturally shaped spheroids, I include all concretions or naturally rounded objects that were likely formed in nature or passively shaped by a river or other body of moving water. Natural spheroids were included in the dataset because of their potential use-wear, although evidence of use on these naturally formed spheroids was not always easy to identify. Natural stones were sometimes used as gaming pieces among some Puebloan cultures (Adams 2013).

The intentionally shaped spheroids varied in use-wear. Some examples of intentional shaping were groove marks, a pecked surface or area, and flat spots or striations from grinding or smoothing. Some intentionally shaped spheroids appeared to be incomplete or broken. Spheroids had to be at least 50 percent complete in order to assess a diameter for the final analysis. Broken spheroids and grooved spheroids were included because of their potential to contribute to various facets of analysis, such as stone type and the identification of use-wear damage. Some examples of use-wear damage would be cracking from heating or from tying fibers around the spheroid.

Gathering Data

A search for the term ball in museum collection databases returned results for spheroids from several other cultural contexts besides those associated with the Fremont. I chose to analyze spheroids that came from counties with known Fremont sites in order to narrow my search. I ruled out studying spheroids belonging to San Juan County, Washington County, and any sites with a mixed Ancestral Puebloan context. I chose to include some cave and rock shelter sites (such as Cowboy Cave), and I also analyzed a few privately collected spheroids held in museum collections that had known provenience.

Methods of Analysis

In order to assess spheroid variation and possible patterns among Fremont spheroids, I formulated several qualitative and quantitative measurements to get an overall view of a spheroid's shape, texture, size, roundness, color, and material type. Some of the measurements came from Adams's (2013:239, 244) *General Artifact Form* and her *Examples of Coding for General Artifact Form*. I decided to collect a few other traits and/or measurements for this analysis, such as the degree of roundness, a note on color, general notes, and stone type. The initial information recorded for each spheroid was a project site number or name, the feature number associated with the artifact, and the artifact number as listed on the bag of each object.

Adams's (2013) *General Artifact Form* has several categories that help describe ground stone artifacts. The first step in her form is to distinguish which "artifact type," the observer is analyzing. As described above, each of the objects analyzed were identified as balls based on my definition for spheroid. Creating my own adaption of Adams's (2013) groupings for "subtype," I used flat spot (F), 2 or more flat spots (2F), natural river cobble/concretion (N), oval (O), sphere (S), partial (P), and asymmetrical (A) (Figures 4.1-4.7).

I categorized a spheroid as having a flat spot (F) when I saw an angle or corner anywhere on the spheroid. I tried to look for the flat plane that some types of manos have, which I did by holding the spheroid close to my nose and looking around the surface. When I observed a flat plane, I determined how many flat spots occurred on the spheroid. If there was more than one, I noted that the spheroid fit into the subtype (2F), two or more flat spots.

Figure 4.1 Stone spheroid exhibiting one flat spot (F). Courtesy of Natural History Museum of Utah (UMNH 42WN267FS1).

Natural spheroids (N), were any spheroids that appeared to have river worn surfaces (a smooth and even appearance), but that lacked any pecking that looked intentional to shaping the spheroid. At times, the spheroids were categorized as Natural (N) because they looked naturally formed (such as a moki marble), having been smoothed and shaped, likely by moving water, into a spheroid, oval, or other irregular but ball-like shape. Sometimes a Natural spheroid had a flat spot, but since I did not know for certain whether the flat spot was human caused, I chose the category of Natural (N) to ultimately describe the spheroid subtype.

Figure 4.2 Stone spheroid exhibiting two or more flat spots (2F). Courtesy of Natural History Museum of Utah (UMNH 42UN95FS223.18).

Figure 4.3 Natural stone spheroid (N) with no cultural modification. Courtesy of Natural History Museum of Utah (UMNH 42WN420FS842.7).

Oval shaped spheroids (O) were those spheroids that appeared to have been shaped into egg shapes and slightly oblong ball shapes. These spheroids were longer in longitudinal cross section than in transverse cross section. The distinction between these formed ovals was if the spheroid had pecking on the surface, and an unnaturally smooth appearance (e.g., the spheroid was ground and smoothed into shape). I might have counted some oval shaped natural spheroids in my oval (O) subtype distinction or recorded some human formed oval spheroids as natural spheroids (N). As stated earlier in this thesis, the distinction between naturally altered spheroids and intentionally shaped spheroids was not always clear.

Figure 4.4 Stone shaped into an oval (O). Courtesy of Natural History Museum of Utah (UMNH 7365).

Spheroids that were categorized as Sphere (S) looked like very round spheroids and had degrees of roundness smaller than three. As I refined what made these spheroids distinct from other spheroid types, I noticed that spheroids with degrees of roundness higher than three were better fitted with the other subtypes based on my analysis notes. Spheres (S) did not have any flat spots on the surface. Partial spheroids (P) were typically those spheroids that were broken or fragmented. If the spheroid could not be attributed to one of the other subtypes because it was a fragment of a spheroid, then I categorized the spheroid as a partial spheroid (P). Asymmetrical spheroids (A) were spheroids that were not smoothly rounded, had degrees of roundness greater than 3, and that usually had irregularly rounded shapes. Sometimes large divots or pecking caused them to appear less spherical.

Figure 4.5 Stone shaped into a sphere (S). Courtesy of Natural History Museum of Utah (UMNH 42IN43 902).

Figure 4.6 Broken spheroid demonstrating the subtype category of partial spheroids (P). Courtesy of Natural History Museum of Utah (UMNH 42SV21AR5574).

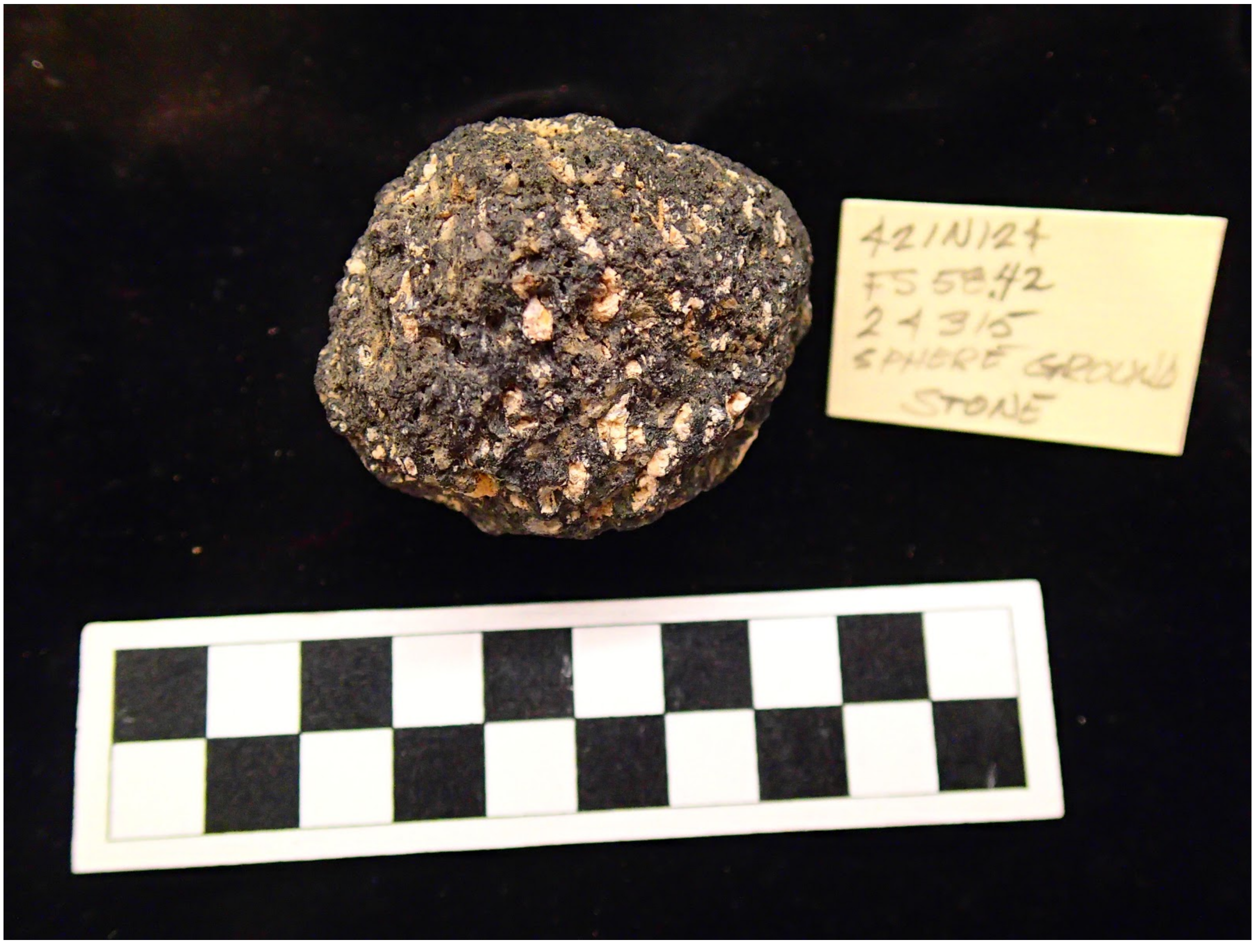


Figure 4.7 Asymmetrically shaped stone demonstrating the subtype category of (A). Courtesy of Natural History Museum of Utah (UMNH 42IN124FS58.42).

I adapted Adams's (2013) description term "condition" to reflect whether the object made a complete spheroid, or if the spheroid had missing sections (i.e. if the spheroid was broken in half, or if part of the spheroid had chipped off). I noted the condition in percentages. For example, spheroids that were mostly complete except for small voids, I noted the percentage of completeness (e.g., 80%) (Figure 4.8).

Figure 4.8 Partial spheroid that was noted as 85% complete. Courtesy of Natural History Museum of Utah (UMNH 42SV455FS43.23).

In order to further describe what the spheroid looked like, Adams (2013) suggested classifying the shape as either spherical (s), ovoid (o), or irregular (i) (half formed/broken spheroids or rounded shapeless spheroids). I adapted Adams's (2013) "texture" section of the form so that the texture of the spheroid described the evenness of the spheroid's surface. Feeling the spheroid's surface with my gloved or ungloved hands, I described the texture with numbers 1 through 5. Coarse and uneven surfaces of spheroids were described by a number one (1) for "coarse." Spheroids with a rough texture and grains that were tightly compacted (i.e. fine-grained materials) were recorded as two (2), "coarse and fine." Bumpy spheroids with a smooth texture that appeared to have an even surface were categorized as three (3) or “fine and medium.” Those spheroids with very smooth and even surfaces had four (4) for “fine” as their texture level. The balls that had highly smooth textures, similar to a shine from polishing, or smoothed balls that had a defined patina were considered “polished/patina” with the number (5). I hoped that the category of texture would inform me about any possible patterns for texture among Fremont spheroids (i.e. if perhaps smooth textures appeared more frequently).

Adams (2013) used “expedient” and “strategic” to discuss manufacturing, but I refrained from applying those terms to an object because I did not know for certain whether the analyzed spheroid represented the manufacturers finished or unfinished project. I categorized the way a spheroid was manufactured based on the spheroid’s appearance. This category “Manufacturing” included notes on whether the spheroid had been pecked, smoothed, ground (which term I used when I observed flat spots on the rock), or if there was a patina from handling. I left the column for manufacturing open as a note section so that I could write specifically how the spheroid appeared to be manufactured. For example, I noted evidence of manufacturing on concretions or natural spheroids that manifested flat spots, drill holes, or divots caused by pecking.

During my analysis, I began noticing deep divots or indentations that sometimes occurred along with flat spots. To record this finding, I added five columns to include divots, flat spots, finger holds, grooving, and any pigment present on a spheroid. I used a presence or absence system for each observation where an observation present equaled (1) and the lack of that observation equaled (0). The first column recorded the presence or absence of recesses or divots on the spheroid’s surface. The second observation was whether there were flat spots on the spheroid, which were observed as an angular plane on the surface. Third, I recorded the presence or absence of finger holds (finger holds were ultimately determined by holding a spheroid by the recesses and checking that one or more flat spots faced out of the palm). I recognize that the ergonomic attributes of a spheroid could be a subjective quality as my hands may not be the same size as those of the person who used or manufactured a particular spheroid. Grooving was also noted as present or absent, as well as the presence or absence of any pigment.

Adams (2013) included a section on her form for recording burned objects. I primarily looked for “blackening” or a combination of blackening and cracking for evidence of whether the object had been burned (Adams 2013:239). When a suspected burn mark (i.e. dark brownish spots or black charcoal spots) could be scratched and leave a little residue on my glove or fingernail, I noted that the spheroid had a burn mark, or sooting as I later called the blackening. Once I had conducted my quick scratch test, I recorded either the presence or absence of burn marks or sooting using a presence or absence system where no sooting present equaled (0) and sooting present equaled (1).

The other qualitative measurements looked at the features of each spheroid, such as the spheroid’s overall color, material type, and other descriptive notes on the overall appearance of the spheroid. Using the Munsell's Color Chart, I recorded the color that best matched the overall color of the spheroid. When a spheroid had a color underneath its surface, as though there was some patina or dirt covering the rock, I would try to match the surface color under the covering to the color chart. Distinguishing the spheroid’s true color tone proved difficult, I matched the spheroid’s overall hue to a color. For rocks such as granite, I tried to match the dominant color to a color swatch. I also described the spheroid’s color in my own words and noted whether there was dirt or any other kind of buildup on the surface of the rock. I noted when a color match failed to represent the color of the spheroid. At times, I defined the color of the discolored spots on a spheroid using the Munsell Color Chart; however, this did not begin happening until partway through my research and was not consistent throughout my analysis.

For the material type, I noted either the material or type of rock used to make the spheroid. I adapted my rock identification method from the Pellant (2002) guide to identifying rocks. Pellant (2002) gives three stages for identifying and distinguishing igneous, metamorphic, and sedimentary rocks. I recorded three attributes for each rock. The first attribute was a description of whether a rock was igneous (i), metamorphic (m), or sedimentary (s). I relied on the presence of mica to determine that a rock was not sedimentary. The next attribute described whether a rock was coarse-grained (1), medium-grained (2), or fine grained (3). Coarse-grained rocks have large crystals (seen with just your eyes), whereas fine grained rocks have small crystals (observed under a microscope). Granite is an example of a coarse-grained stone, and obsidian is a fine-grained stone.

The last attribute recorded was whether the rock was light colored (l), medium colored (m), or dark colored (d). Some spheroids had colors that did not fit ideally in these categories, so I had to determine the closest fit. For example, sometimes I would end up with a light pink colored rock which color fit closer with light (l) than medium (m). My process for establishing the rock type aligned with the criteria for identifying igneous rocks in Pellant's (2002) guide, but the first two stages aided me in narrowing down the rock types. After determining the three attributes for rock type, I would check Pellant's guide, when needed, for the type of rocks that had those qualities. I relied heavily on a fellow BYU anthropology graduate student, Josie Newbold who is also a geologist, to help me determine rock type. She further instructed me in determining rock type. Whenever I could not determine the rock type for a particular spheroid, I at least indicated whether the spheroid was igneous, sedimentary, metamorphic, or “indeterminate.” For non-rock materials, such as bone, I simply stated the material type and left the other attributes blank.

Finally, I described everything that I felt was worth mentioning from simply observing the spheroid. Often, I noted if a spheroid was highly spherical, heavily pecked, or smooth as various Fremont publications have described stone balls. I summarized whether the spheroid had pigment, pecked marks that appeared in conjunction with a flat spot or an ergonomic hold using the divots, discoloration, a patina, and any interesting designs or groove marks.

Photos were taken from both a digital camera (Olympus Tough TG-2) and a microscope camera (Dino-Lite). I used the digital camera, a swatch of black velvet as a backdrop, and a photo scale to capture the varying views of the spheroid. The collections manager at NHMU asked me to take my photos with tags that detailed the catalog number of the spheroid. I continued this practice at each museum I visited. I took pictures with the camera looking down at and parallel with the spheroid. For the first photo, I positioned the spheroid with the museum label facing the viewer. If the spheroid lacked a label, I oriented the spheroid from the most unique characteristic. The museum label side, or distinctive spot, became known as the starting point or “front” of the spheroid. For the second photo, I flipped the spheroid so that the front of the spheroid faced the black velvet. The third and fourth photos were views of the spheroid with the front of the spheroid facing to the right and to the left. Any other photos that I took were views of either the top or bottom of the spheroid, and close ups of any interesting attributes on the spheroid.

Microscope photos were taken with a Dino-Lite microscope camera. I photographed the surface structure of the spheroid to help identify material type, possible pigments, or any substance that looked noteworthy. Often, I photographed spheroids with flat sides and finger holds because the Dino-Lite app could draw and mark the photo digitally immediately after taking the photo. This allowed me to orient the flat spot and finger marks at the time I took the picture.

An important aspect of my analysis was to record quantifiable measurements for each spheroid, which included measuring six diameter measurements and the weight of each stone. I hoped that each of my quantifiable measurements would bring to light morphological patterns that might suggest whether the spheroids could be grouped based on diameter, density, and other physical qualities. The diameter measurements and the weight of each spheroid aided me in finding the average diameter, the degree of roundness, the volume, and the density for each spheroid. In the following paragraphs, I will focus on my procedures for gathering my quantitative data.

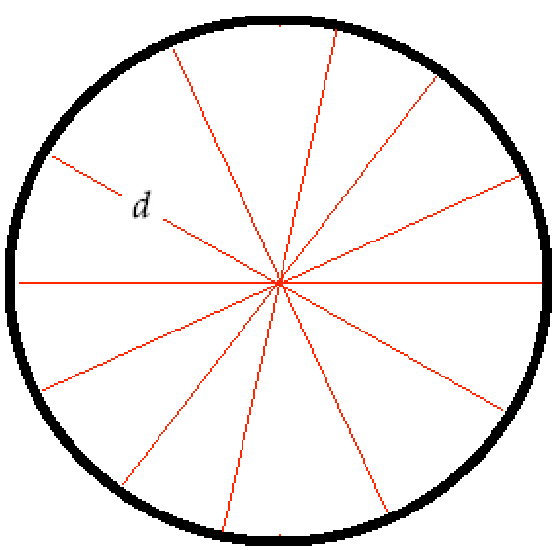
Using digital calipers, I took six different diameter measurements for each spheroid in millimeters (mm). I oriented my measurements by facing the front (the side with the museum label) of the object towards me. Some museum labels were off centered on poorly rounded or irregular shaped spheroids, which complicated some of my diameter measurements with the calipers. I remedied this problem by measuring the spheroid as though the label was located in the center. Despite the discrepancies caused by askew labels, the multiple diameter measurements used to determine the level of roundness a spheroid has (the degree of roundness) will not be affected by the placement of the front as long as the other five measurements are different diameter measurements.

I started with finding the length, by orienting the ruler section of the calipers perpendicular to the label with the caliper jaws placed on the top and bottom of the spheroid. For certain spheroids in the MPC collection, I measured the length with the label facing me and the calipers on the side of the spheroid measuring with one jaw on the bottom center and the other jaw on the top center. Some spheroids had large grooves that seemed to affect the roundness of the object (measuring in front kept the ends of the calipers from reaching the groove). I measured from the side to accurately depict the spheroid's diameter. None of the other museum stones that I measured needed this adjustment.

The next measurements I recorded were width and thickness. The width measurement oriented the ruler section of the calipers parallel with the label in the center of the spheroid and the caliper jaws on either side of the spheroid. Placing each of the calipers' jaws on the front and back center part of the spheroid gave me the measurement for the thickness of the spheroid. The thickness measurement looked like I made a line from the label extending through the inside of the rock to the back.

I took three more diameter measurements. The next two measurements, following the thickness measurement were typically made diagonally over the label of the spheroid. My first diagonal measurement started with the outer caliper jaws on the upper left portion of the spheroid, and then the inner caliper jaws rested on the bottom right portion of the spheroid. The ruler portion of the calipers hovered over the label making a diagonal line as a tactical diameter line. In a similar manner to the first diagonal, the second diagonal started with the outer caliper jaws on the upper right portion of the spheroid, and the inner caliper jaws extended to the lower left area of the spheroid. The final measurement centered the outer caliper jaw in between the label and the top of the spheroid and the inner caliper opposite the outer caliper jaw on the back of the spheroid. This last diameter measurement was fairly close to the thickness and the length measurements.

With all six diameter measurements, I was able to find the "Degree of Roundness" measurement (Figure 4.9). The degree of roundness measurement is my own method used to find the relative roundness of a spheroid. The degree of roundness is the standard deviation for the six diameter measurements. Ideally, a spheroid shaped like a perfect sphere would have similar diameter measurements around any part of the spheroid, making the standard deviation a very low number (i.e. close to zero). A spheroid that had varying diameters would result in a higher standard deviation. Summing the square of several radius measurements and subtracting those from the radius measurements of a calculated inner circle is a more accurate way to gauge out-of-roundness (Sui and Zhang 2012). Because I could not physically measure the center of the object to the outside surface, I had to settle on using the diameter measurements. Ultimately, I chose to use my method (degree of roundness) for gauging the out-of-roundness of a spheroid in order to compare spheroids and not as a true indicator of the spheroid's roundness.



$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(d_i - \mu)^2}$$

$$N = 6$$

Figure 4.9 Diagram depicting the six diameter measurements and the standard deviation formula used to determine degree of roundness.

After deriving this measurement for each spheroid, I would compare the spheroids to determine which were “more perfectly round,” allowing me to recognize possible patterns or standards of manufacture related to other variables.

After measuring the six diameter measurements and calculating the degree of roundness, each stone was weighed on a scale in grams (g). Most often, I used a digital scale to weigh each spheroid, but there were some exceptions because I relied on the scales available to me at each museum. This could possibly have caused my numbers to be slightly inconsistent. The three types of scales I used were digital, weighted, and analog. During my first visit at FISPM and USUEPM, I used a weighted scale. At NHMU, which provided most of the spheroids in my dataset, I used the same digital scale to weigh all the spheroids. The one time that I weighed with an analog scale was for my largest spheroid from the MPC because that spheroid surpassed the weight capacity of the digital scale.

The last three steps of my methods were to find the average diameter, volume, and density of the spheroid. Drawing from the six diameter measurements, I calculated the average diameter of each spheroid. The measurements taken from a spheroid’s six diameters and a spheroid’s weight comprised the calculations for a spheroid’s volume, and density. Initially, determining the volume of the spheroids was difficult. I first tried to find the volume by placing the spheroids in a plastic zippable bag and then dipping the spheroids into a graduated cylinder full of water to measure the displaced water. While trying to figure out this process on a very large spheroid at the MPC, I noticed that there was no container large enough to measure hefty spheroids in water and no way to drop the spheroid in the water without displacing too much water in the process. Additionally, accuracy in displaced water was lost because some of the graduated cylinders did not have precise markings, and the ones that did have precise markings could only fit small spheroids. If I had measured larger spheroids in the less precise bigger containers, I would have had to estimate several measurements. Accuracy was also affected by keeping the spheroids in plastic bags, which affected the displaced water amount.

Instead, I used a formula for calculating the volume of the spheroids without using water and found that I got comparable results. The advantages for finding the volume without water was that I reduced the time I spent trying to find the volume, and I avoided possibly harming the artifacts. I calculated the volume by taking the average of the six diameter measurements to the third power and then multiplying that number by Pi. This gave me the volume, but to keep the measurement in milliliters, I multiplied the final number by 0.001. This formula was used: volume = PI()*U2^3/6*0.001). To find the density measurement of each spheroid, the weight was divided by the volume of the spheroid in grams per milliliter.

I acknowledge that calculating the volume and density of an irregular spheroid (i.e. a spheroid with a flat side) by using only mathematical equations will not reflect the object's actual volume or density because the average diameter is skewed. But the calculations used provided a safer method for determining volume and density and also saved time.

Establishing My Data Set for the Distribution Map

In order to understand the distribution patterns of spherical objects, I developed a map displaying as many locations as possible where Fremont spheroids have been discovered in Utah, and Nevada. With the help of Joseph Bryce and a digital library he created containing numerous Fremont publications, I searched this literature for all instances in which the word "ball" was mentioned. Once I located these publications I worked to determine if the objects were from Fremont contexts. Using catalog information from museums, I made a list of spheroids that came from Fremont sites which I combined with the list previously mentioned. For spheroids from museum collections that I wanted to verify as Fremont, I consulted the site notes or site report where a spheroid was found to determine if the spheroid could be attributed to the Fremont cultural tradition. For caves or rock shelters, researching which layer a spheroid was found in helped me rule out spheroids that did not come from a Fremont context.

Through my personal communication with David Yoder, I received Yoder's digital list of stone balls that appear in publications and in collections that he had researched. The list of publications from both Bryce's and Yoder's datasets plus my own research on spheroids at museums, aided me in compiling a master spreadsheet showing the site names, locations, and spheroid counts for Fremont sites with spheroids. I found provenience for some of the spheroids by reading site notes and site reports. If the report indicated a specific intrasite location for where a spheroid was found, I noted the location. Spheroid provenience was not well recorded for some of the older excavated sites and for privately collected spheroids.

While reading through publications on Fremont sites, I noticed that the spheroid counts in publications did not always match the spheroid count listed in museum catalogs. Sometimes museums had a higher count than what was recorded in the site report, or vice versa. I attribute the inconsistency in spheroid count to the unclear definition of stone ball. One clear example of this discrepancy are the stones from Five Finger Ridge. In the site report, it is stated that 47 stone balls were found, but FISPM listed 77 stone balls from Five Finger Ridge and Icicle Bench. There is a chance that some of the one handed manos and pecking stones were included in this list.

Whenever I encountered a discrepancy between the number of spheroids a museum held from a particular site and the number of spheroids reported from the site, I chose the higher count of spheroids for the map representing the spheroid distribution. I reasoned that due to issues with misclassifying spheroids, private collecting, and looting, Fremont spheroids might be underrepresented.

Methods Used to Create Graphics: *RStudio™ Methods*

I utilized Rstudio™ to explore the data set, and to create several figures and graphs for this thesis. In order to create the distribution maps for spheroids throughout the Fremont region, spheroids with finger holds, and spheroids with pigment, I had to obtain an account with Google™ Cloud. The Google™ Cloud account provided me access to an API which is necessary for RStudio™ to collaborate with Google™ Maps. The code for this particular graph requires an API to access locations and a map background from Google™. Once I had the code to connect to Google™ Earth and Google™ Maps, I prepared a spreadsheet that included the site name, spheroid count, and site location for each Fremont site with spheroids. Using the same method described above, I created two other distribution maps displaying the sample percentages for spheroids with finger holds and for spheroids with pigment.

For site location, I had to find the longitude and latitude in military grid reference system from Google™ Earth to work with the Google™ Maps package used to create the scatterplot map. When I did not have coordinates for a site, I approximated the location of a site by using a map from a site report and then selecting a spot on Google™ Earth to match the location from the site report map. Once I had coded everything for the merge between the site locations on the map and the spheroid counts, I was able to add dots that represented frequency ranges for spheroids at Fremont sites.

5. Results and Analysis

I examined a total of 484 spheroids. During the analysis process, I excluded 46 spheroids. Therefore, the final dataset included a total of 438 spheroids (see Appendix A), which all came from Fremont sites. Reasons for excluding the 46 spheroids mentioned above included whether a spheroid was associated with Fremont contexts (22 spheroids), if the artifact made up less than 50% of a spherical shape (10 spheroids), and if the combination of the shape description and my notes indicated that the spheroid might better fit with another artifact type, such as a sharpener, an experimental core, polishing stone, net sinker, pestle, or hammerstone (10 spheroids). I excluded four spheroids that did not seem like spheroids, two were more disc shaped with high degree of roundness values (8.71 and higher), and the other two did not fit with a spheroid subtype and were described as "shapeless" or "not a spheroid" in my analysis notes.

Of the 22 unlikely Fremont spheroids, there were several spheroids that came from questionable Fremont sites and the information about those sites was not in a searchable and accessible state for me to double check (7 spheroids). While conducting analysis at NHMU, I chose to include a couple of rounded rocks that the museum labeled differently than "ball" because those spheroids fit my definition of spheroid (later some of these might have been excluded as I refined my working definition of spheroid). Privately collected spheroids are somewhat questionable as to their Fremont association, but they do come from counties that contain several Fremont sites. Overall, the dataset represents a sampling of those spheroids in the Fremont region.

A majority of the spheroids came from the following sites: Five Finger Ridge, Backhoe Village, Median Village, Evans Mound, Paragonah Mounds, Nephi Mounds, Pharo Village, Garrison Site, Snake Rock Village, Kanosh Mounds, Huntington Canyon, Round Spring Site, and Beaver Mounds (see Appendix A). One reason why so many spheroids come from some of these larger sites is likely due to the more comprehensive excavations carried out by institutions such as the University of Utah and BYU. For example, the University of Utah excavated Evans Mound for an extensive time (Berry 1972; Dodd 1982). Another reason large villages seem to yield higher amounts of spheroids is because often, large sites had a higher number of people living in those areas than at smaller sites, such as open campsites or cave sites. The length of time Fremont people spent at a site might also factor into why so many spheroids appear at large villages.

Fremont Spheroid Distribution

With the established dataset, and from data I gathered about spheroids mentioned in Fremont publications, I created a map to demonstrate the distribution of spheroids during the Fremont period (Figure 5.1). This map is only intended to be a sampling of Fremont spheroids among Fremont sites.

Sites with more than one site number, such as the Garrison site (26WP6 and 26WP7), were combined under one site number. Kanosh Mounds and Grantsville Mounds were other sites where I picked one site number to represent the site (see Appendix A). I typically picked the site number associated with the most spheroids. I found location coordinates for each site and converted those locations to longitude and latitude. Many sites only listed township, range, and section coordinates that I then had to convert to longitude and latitude using the Earthpoint website[2]. For any sites with UTM locations, I used The Engineering Toolbox website[3] to convert

[2] http://www.earthpoint.us/TownshipsSearchByDescription.aspx
[3] https://www.engineeringtoolbox.com/utm-latitude-longitude-d_1370.html

the location to longitude and latitude. At times, I used Google Maps™ and Google Earth™ to estimate the latitude and longitude of site locations based on the spot indicated by a publication's site map.

For the spheroid count at each site, I checked the site report and the number of spheroids in a museum collection for that particular site. There is a possibility that some of the spheroids included in the counts for sites are spheroids excluded from the final dataset. This spheroid count is representative and not exact. As mentioned in the last chapter, I found that a museum's count of spheroids for a site and the spheroid count listed in the publication did not correspond. In these cases, I chose to use the highest number of spheroids listed. For example, I noticed that the report on Backhoe Village mentions 15 stone balls, much less than the 35 spheroids I analyzed from the combined collections of NHMU and USUEPM that were collected at these sites. Another example of this is Median Village where the site report lists 50 spheroids, but the museum count is only 42 spheroids (Marwitt 1970).

Using RStudio™, I generated the spheroid distribution map using the ggmaps package. The dots on the map represent frequencies of spheroids at a particular site. The largest dots correlate with sites that had 60-80 spheroids, the second largest dot represents sites with 30-59 spheroids, the third largest dot reflects sites with 15-29 spheroids, and the smallest dot size represents sites with 1-14 spheroids (Figure 5.1). The largest dots are found near the Sevier river area trending south and southwest (Figure 5.1). The dots in those locations are some of the biggest village sites excavated in the Fremont region. Several smaller dots representing the category of 1-14 spheroids are spread throughout the Fremont region. Most of the smaller dots (1-29 spheroids) occur in the Northern part of Utah north of Provo, and to the east of the Sevier river in the Uintah Basin region. This map shows that spheroid production, or use, was widespread in the Fremont region (Figure 5.1).

Wolf Village only had two recorded spheroids, but while briefly looking through some of the Wolf Village collections at the MPC, I found around five likely spheroids (Figure 5.1). The Wolf Village collection might contain more spheroids than the two spheroids that I counted as Wolf Village spheroids (one spheroid was from Gilsen's 1968 thesis and the other spheroid was from the FS Log for Wolf Village, although that log has yet to be finalized). The fact that I saw more possible spheroids makes me wonder how many spheroids would be likely at a site such as Wolf Village that had nine structures (Lambert 2018). Bear River No. 3, a site with seven structures, had two spheroids (Shields and Dalley 1978). Bear River No. 3's similar amount of site structures and spheroids leads me to believe that Wolf Village's two spheroids might be an accurate representation of the site's minimum spheroid count.

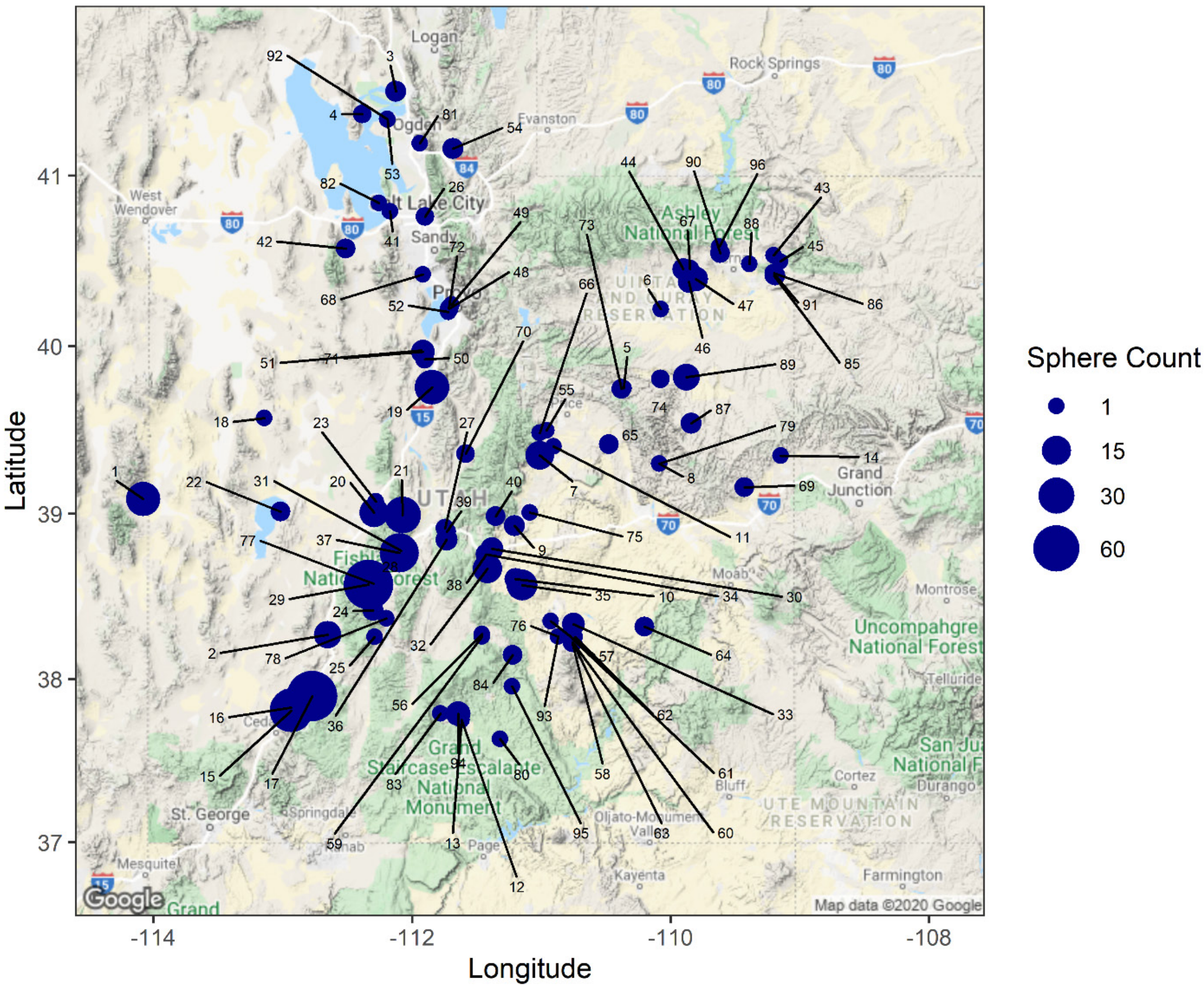


Figure 5.1 Distribution of spheroids throughout the Fremont region

(1) Garrison Site, (2) Beaver Mounds, (3) Bear River No. 2, (4) Bear River No. 3, (5) Beacon Ridge N.M. 2, (6) Flattop Butte, (7) Huntington Canyon, (8) Range Creek, (9) Emery Site, (10) 42EM63, (11) Windy Ridge Village, (12) Rattlesnake Point, (13) Spencer Site, (14) Bryson Canyon, (15) Median Village, (16) Evans Mound, (17) Paragonah Mounds, (18) Fish Springs Man Site, (19) Nephi Mounds, (20) Kanosh Mounds, (21) Pharo Village, (22) Sevier Lake Site 2, (23) 42MD76, (24) Marysvale 7, (25) 42PI508, (26) Block 49, (27) 42SV128, (28) Icicle Bench, (29) Five Finger Ridge, (30) Popular Knob, (31) Mukwitch village, (32) Round Spring Site, (33) Last Chance, (34) Fallen Woman Site, (35) Snake Rock Village, (36) Nawthis Village, (37) Backhoe Village, (38) Old Woman Site, (39) Wild Bill Knoll, (40) Crazy Bird Shelter, (41) Grantsville Mounds, (42) Grantsville Mounds, (43) Deluge Shelter, (44) Whiterocks Village, (45) Goodrich Site, (46) Uinta Basin Mounds, (47) Caldwell Village, (48) Hinckley Mounds, (49) Smoking Pipe Site, (50) Wolf Village, (51) White Farm, (52) Benson Mound, (53) 42WB318, (54) Injun Creek, (55) Durfey Site, (56) 42WN2151, (57) North Point, (58) 42WN238, (59) 42WN2401, (60) Alice Hunt Site, (61) 42WN267, (62) 42WN286, (63) Playa Site, (64) Cow Boy Cave, (65) Cedar Mountain, Ut, (66) Price and Hiwatha, Ut, (67) Tridell, Ut, (68) Bee site #64, (69) Turner-Look Site, (70) Witch's Knoll Ephraim 1, (71) Woodard Mound, (72) Seamons Mound, (73) Sky House N.M.13, (74) Frank's Place, (75) Clyde's Cavern, (76) 42WN27, (77) Radford Roost, (78) Marysvale 3, (79) Deluxe Apartment in the Sky, (80) Triangle Cave, (81) Chournos Springs, (82) Swallow Shelter, (83) Hummingbird Hill, (84) Image Cave, (85) Burnt House Village, (86) MacLeod Site, (87) Wagon Run, (88) Wholeplace Village, (89) Boundary Village, (90) Merkley Butte, (91) Arrowhead Point Campsite, (92) 42WB317, (93) 42WN27, (94) 42GA6264, (95) 42GA4433, (96) 42UN2580

A few discrepancies must be noted. Because the definition for a spheroid has been vague, many of the spheroids included on the map might fit a different artifact type, such as hammerstone, net sinker, or disk. Many of the questionable spheroids come from various publications; without viewing the stone in person, I was unable to verify that those stones were or were not spheroids.

A majority of the spheroids came from Five Finger Ridge 42SV1686 (54 spheroids), Backhoe Village 42SV662 (35 spheroids), Median Village 42IN124 (35 spheroids), Evans Mound 42IN40 (29 spheroids), Paragonah Mounds 42IN43 (29 spheroids), Nephi Mounds 42JB2 (24 spheroids), Pharo Village 42MD180 (24 spheroids), Garrison Site 26WP6 (19 spheroids), Snake Rock Village 42SV5 (18 spheroids), Kanosh Mounds 42MD2 (15 spheroids), Round Spring Site 42SV23 (15 spheroids), Huntington Canyon 42EM2095 (14 spheroids), and Beaver Mounds 42BE974 (12 Spheroids). There were 70 site numbers used in my dataset. This is a higher number than that of site names because I combined site numbers for some site names, such as for Garrison site, Kanosh Mounds and Granstville Mounds. Some of my site names were actually locations, such as Hiwatha, Utah, or Tridell, Utah. Those names were used for privately collected spheroids.

Spheroid Material Types

The spheroids in my dataset were primarily stone, with the exception of one bone spheroid, an adobe spheroid, and five mineral spheroids. Of the mineral spheroids, 4 were iron concretions, and 1 was a pebble of galena. Among the rock spheroids, there were 148 igneous, 267 sedimentary, and 16 metamorphic. My dataset included spheroids made of 28 different material types. The most common type of stone was san002dstone (n=226), followed by granite (n=57), tuff (n=30), and limestone (n=28). Other rock types were represented by 17 or fewer specimens: vesicular basalt (17 stones), quartzite (14 stones), gabbro (13 stones), basalt (12 stones), chert (6 stones), shale (3 stones), and unknown stone types (10 stones). Of the unknown types, only one was identified as sedimentary while the rest were igneous. Figure 5.2 displays the frequency of all the material types in the dataset. The high amount of sandstone spheroids suggests it was a medium of choice for past manufacturers who made or collected spheroids. Depending on the grain size and hardness of the rock, sandstone can be shaped easily.

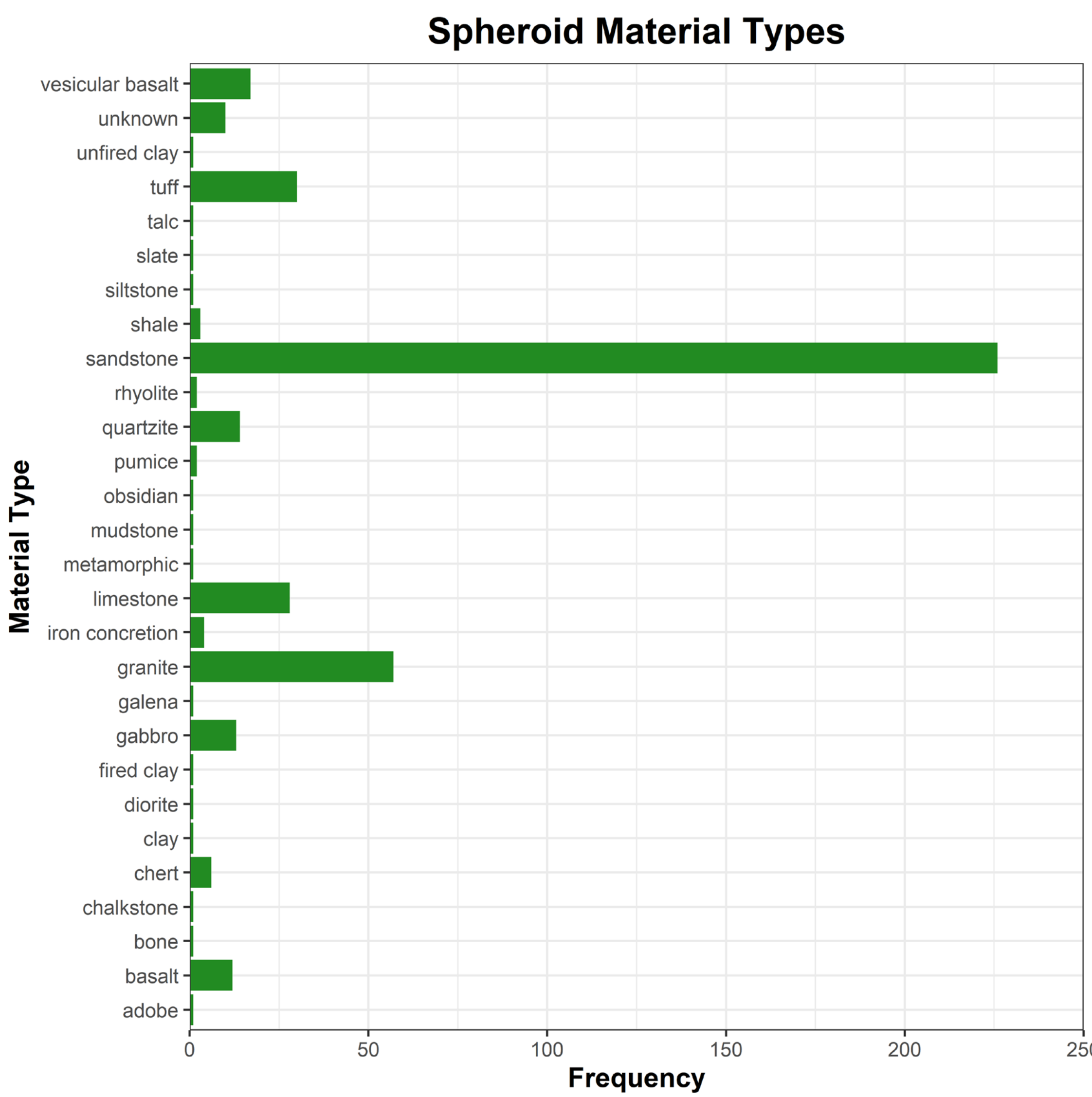


Figure 5.2 Frequency of spheroid material types (n=438).

Clay, Adobe, and Bone Spheroids

One clay spheroid from Backhoe Village that was a half spheroid with a diameter of 27.2 mm (calculated from the spheroid's largest diameter). An unfired clay spheroid from Round Spring Site had an average diameter measuring 23.52 mm. My largest complete clay spheroid (42BO98FS153.33) from Bear River No. 3 had a diameter size of 25.43 mm. Janetski (2017) mentioned that clay spheroids were typically the size of a marble or smaller. The clay spheroid from Bear River No. 3 seems to be similar, if not slightly larger than a marble in size. Backhoe Village had the only adobe spheroid (52.42 mm in diameter) included in the sample. The bone spheroid came from Hogan Pass at the Round Spring Site and appears to be a bone feature that might have been smoothed (Figure 5.3).

Figure 5.3 Bone spheroid from Round Spring Site. Courtesy of USU-Eastern Prehistoric Museum, CEUM08366.

Weight, Volume, and Density

For the following measurements, data included partial spheroids, for which a discrepancy arose due to the incompleteness of these specimens. Incomplete diameters and weights affected the calculations of volume, density, and degree of roundness. To mitigate these discrepancies, I included calculations for only complete spheroids in order to factor out broken specimens (n=401 whole spheroids).

The results of the weight, volume, and density measurements are summarized in several graphs below. I categorized the data sample into a group that only included whole spheroids (n=401). The graphs for weight, volume, and density depict data on whole spheroids. The median measurement for weight was 74 grams. The average spheroid weight was 94.19 grams. Two outlying spheroid weights have likely skewed the average to be higher. One outlier was a large sandstone spheroid (42MD76FS9.25) that weighed 759 grams and had a diameter of 83.69 mm, and the other weighed 838 grams (42SV7FS77) and had an average diameter of 83.11 mm. The smallest spheroid weighed one gram and had an average diameter measuring 9.4 mm (42JB2FS714.175).

The histogram in Figure 5.4 depicts the weights of the spheroids in the sample. The histogram is skewed to the right, meaning that most of the spheroids weighed less than 125 grams, but several spheroids weighed more than 125 grams causing a tail extending to the right. Overall, the histogram has a unimodal spread. Most of the spheroids had weights within the range of 50 grams and 100 grams. Only 95 spheroids with weights greater than 125 grams were recorded, as indicated on the histogram (Figure 5.4). Figure 5.5 shows the weight of spheroids excluding spheroids over 125 grams. There appears to be a smooth distribution of spheroid weights suggesting a widely variable range of weights for spheroids.

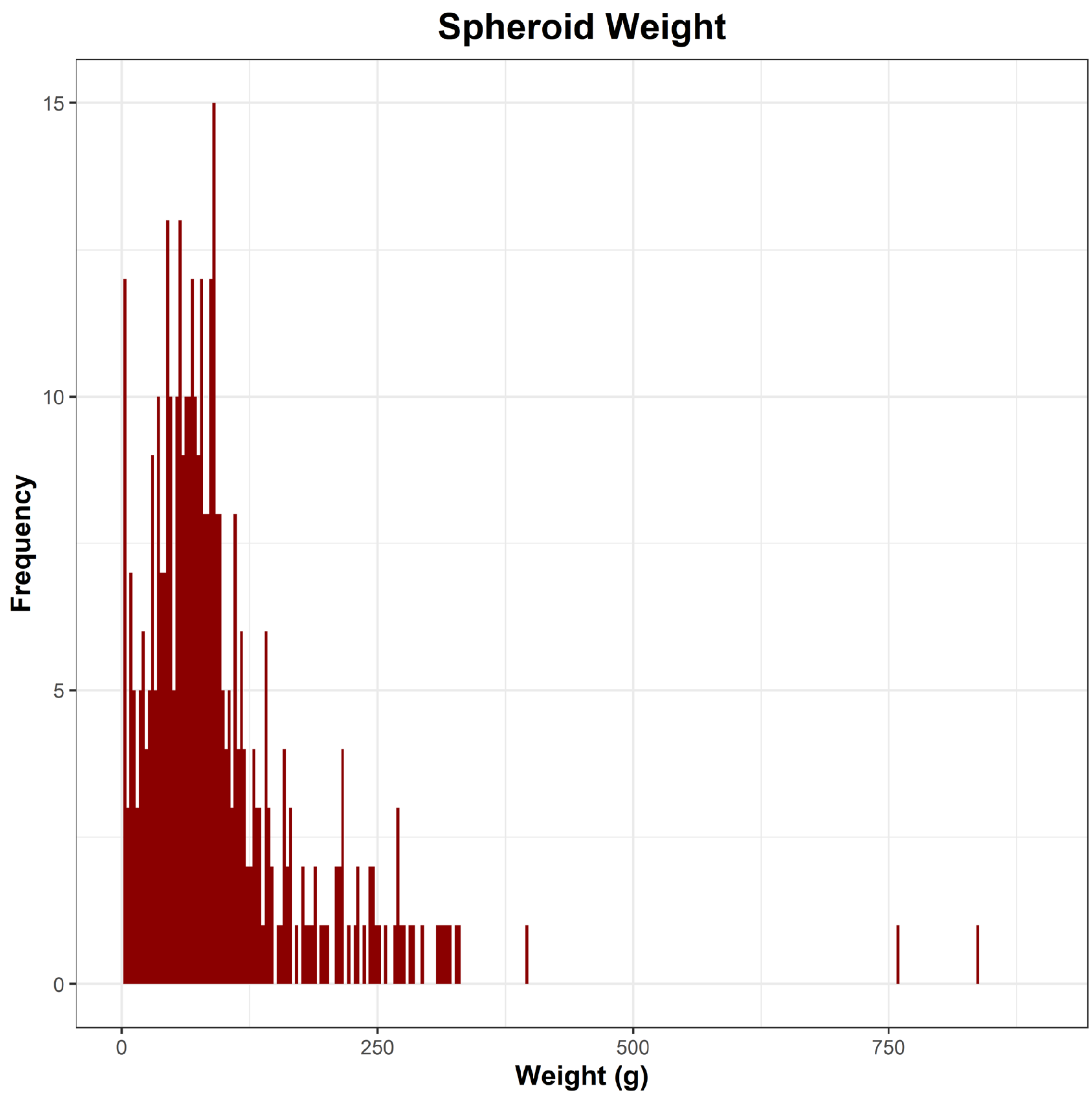


Figure 5.4 Spheroid weights observed in the sample. *Partial spheroids were excluded (n=401).

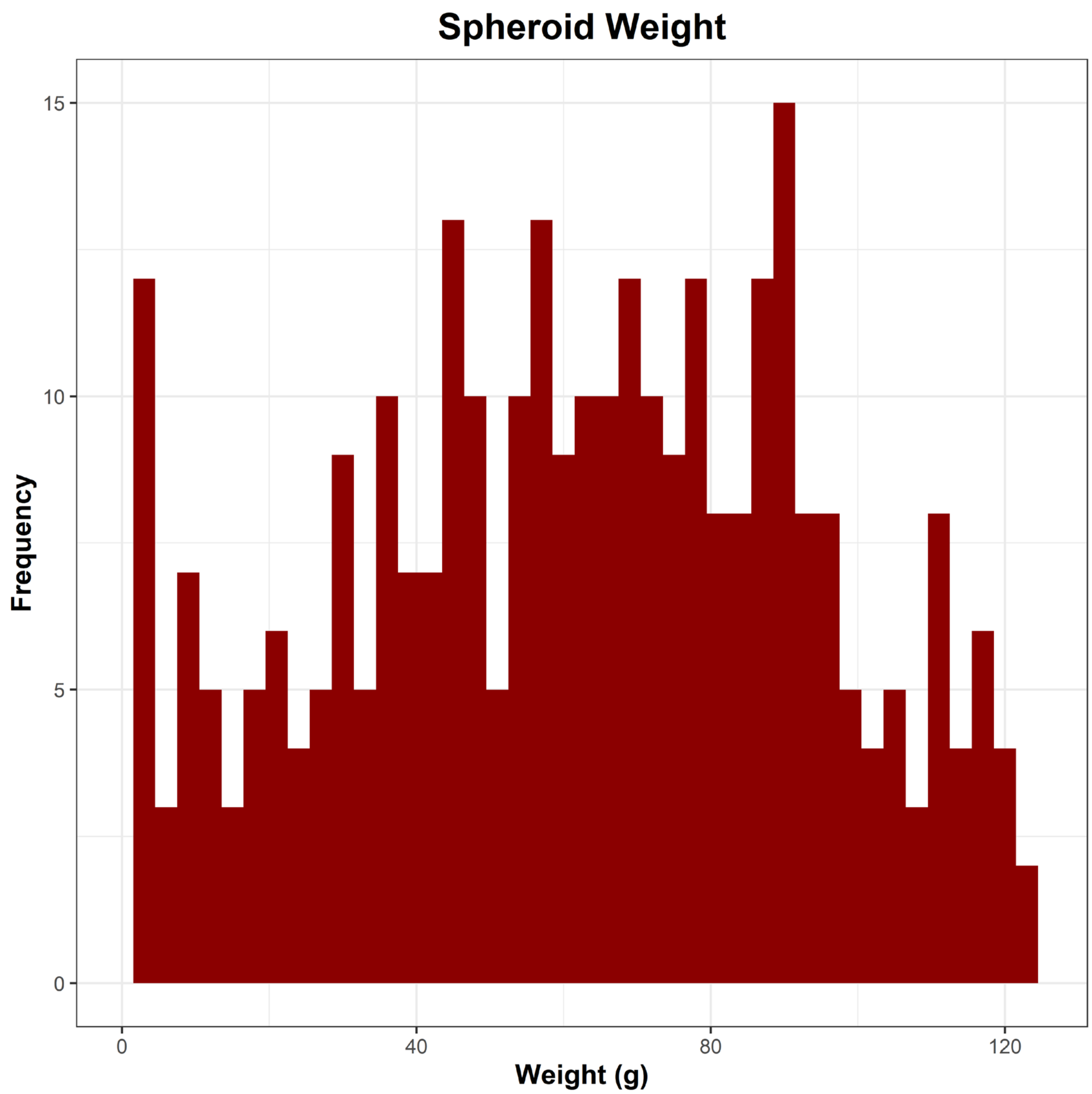


Figure 5.5 View of spheroid weights for those below 125 gms. *Partial spheroids were excluded (n=401).

Comparing the measurements for weight to the average diameter measurement yields a strong positive nonlinear correlation, which should be expected for spherically shaped objects made primarily of stone (Figure 5.6). The weight of the spheroids seems to increase exponentially the larger the spheroids are in size. Three outlying dots are indicative of spheroids with the heaviest weights and the largest diameters. Two of the outliers are the same outliers depicted in Figure 5.5. The third (67.047.002.1 from Nephi Mounds) had the largest average diameter (88.10 mm) but weighed less than the other two outliers. Spheroid 67.047.002.1 was a spherical concretion made of sandstone that had streaks of quartz banded around the surface. This spheroid might be a geode (Josie Newbold personal communication 2018). The hollow interior of a geode could explain why the spheroid weighs less than the other two spheroids despite having a larger average diameter. The material types contribute to the varying weights of each spheroid. Figure 5.7 is an individual value plot showing the material types versus the weight of each spheroid. Many spheroids made from rock types such as vesicular basalt, tuff, sandstone, limestone, granite, gabbro, and basalt had several spheroid weights that are close together, likely because these specimens were similar in size.

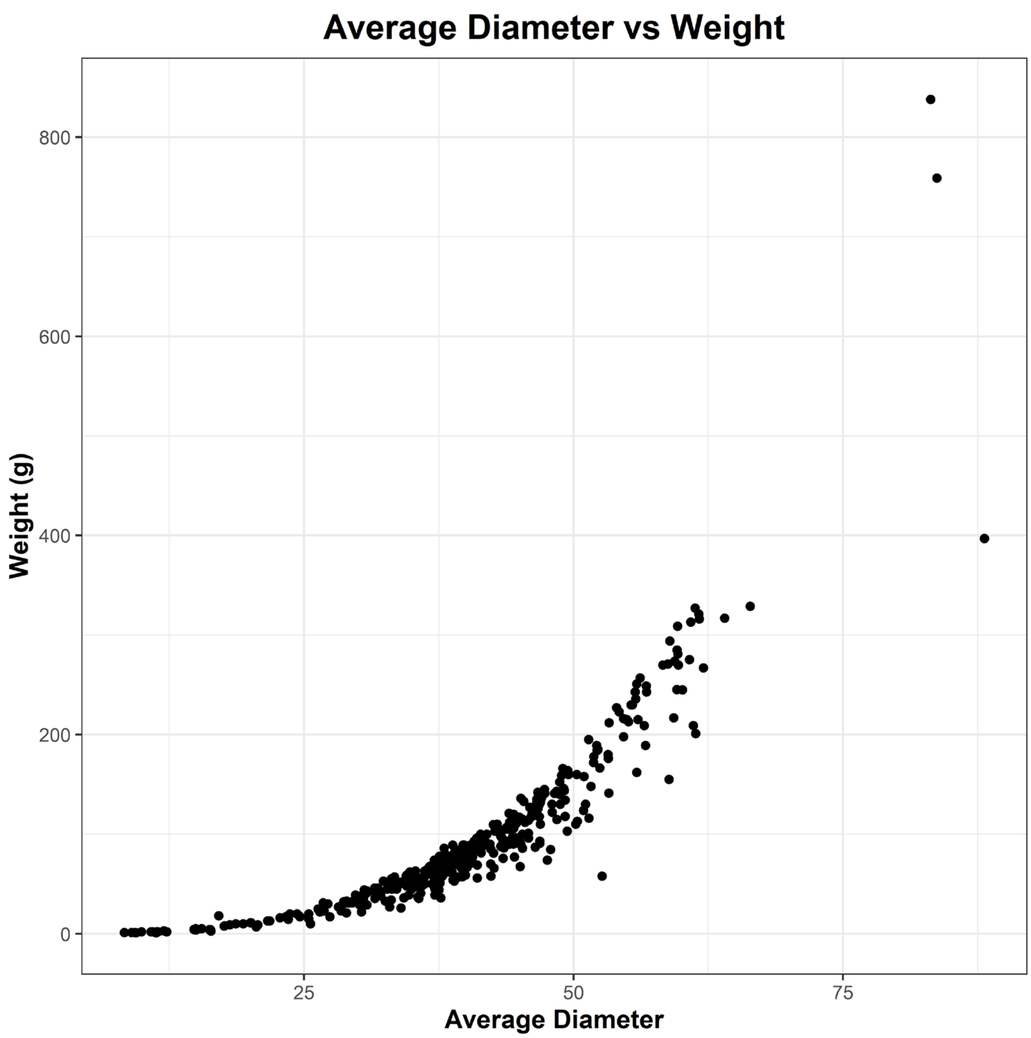


Figure 5.6 Scatterplot of weight versus diameter. *Partial spheroids were excluded (n=401).

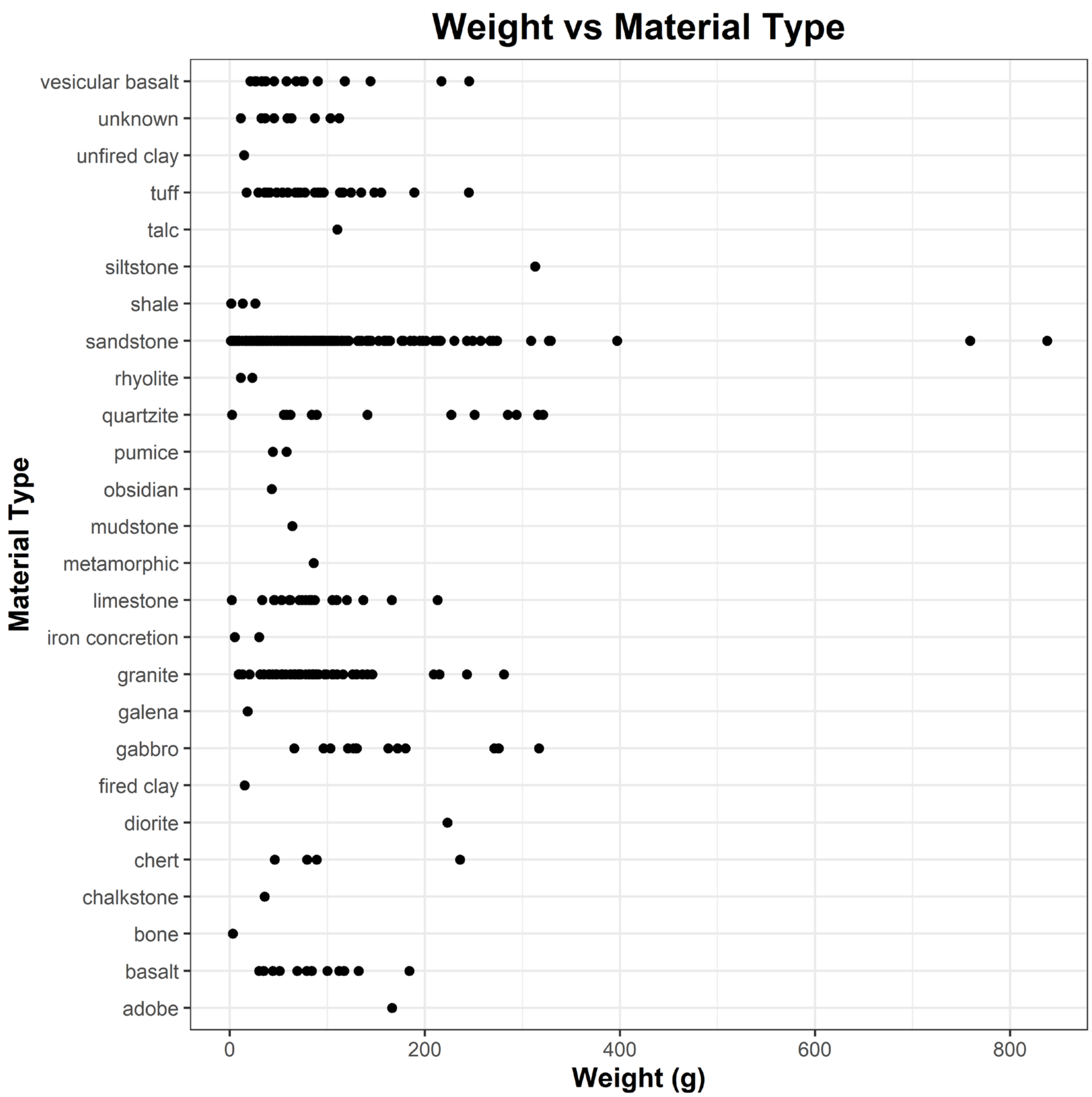


Figure 5.7 Individual value plot of weight and material type. *Partial spheroids were excluded (n=401).

The two main outliers in Figure 5.7 are the same two outliers mentioned previously in both Figure 5.4 and Figure 5.6. Although not major outliers in the dataset, siltstone and diorite each had one spheroid that weighed more than 200 grams. The siltstone spheroid (42SV805FS150.1) weighed 313 grams and had an average diameter of 60.87 mm. The diorite spheroid (42MD1 9848) weighed 223 grams and had an average diameter of 54.23 mm.

The volumes of the spheroids recorded in this analysis resulted in a median of 32.52 cm^3 and an average of 41.36 cm^3. These values are illustrated in the peak of the histogram depicting volume (Figure 5.8). The distribution of volume for spheroids is skewed to the right. While the majority of spheroids had a volume of 40 cm^3 or less, a few outliers can be observed in Figure 5.8 causing a tail and a little bimodal peak after 100 cm^3. The three major outliers shown in Figure 5.8 are the same three outlying spheroids previously mentioned for the graphs showing weight (67.047.002.1 from Nephi Mounds, 42MD76FS9.25, and 42SV7FS77). Viewing only the spheroid volumes that range from zero to 100 cm^3 conveys that the volumes of spheroids do not spread symmetrically and continue to trail off to the right (Figure 5.9). The measurements for volume and weight have a strong positive linear correlation as seen in Figure 5.10. As would be expected, the larger the volume of the spheroid, the heavier in weight.

The measurement for volume might misrepresent the actual volume of certain spheroids that had imperfect shapes, such as oval spheroids (O), spheroids with flat spots (F and 2F), or asymmetrical spheroids (A). This discrepancy stems from the formula that I used to calculate volume as it relied on the average diameter measurement, which could also have discrepancies depending on the shape of the spheroid and where I took my diameter measurements.

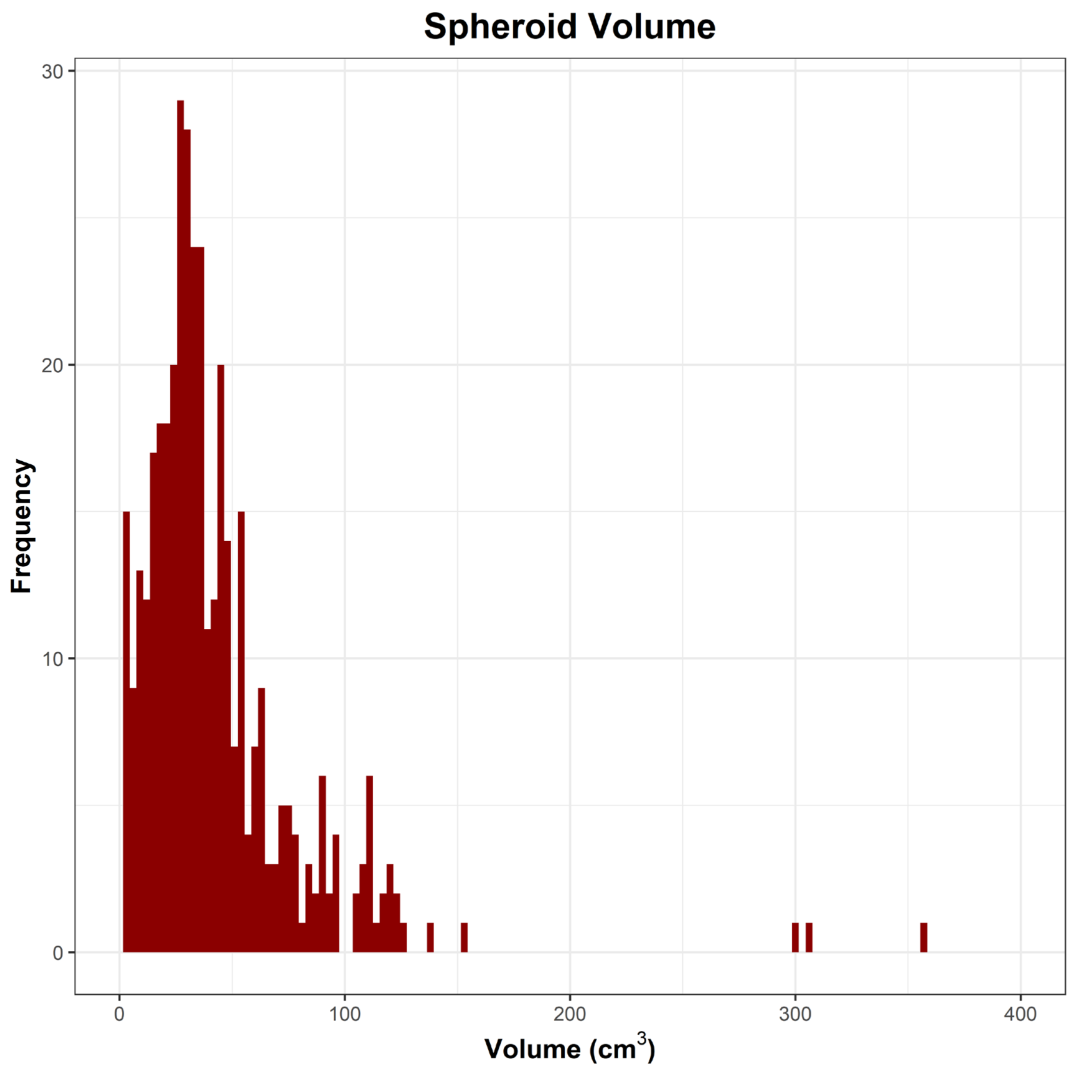


Figure 5.8 Spheroid volumes observed in the sample. *Partial spheroids were excluded

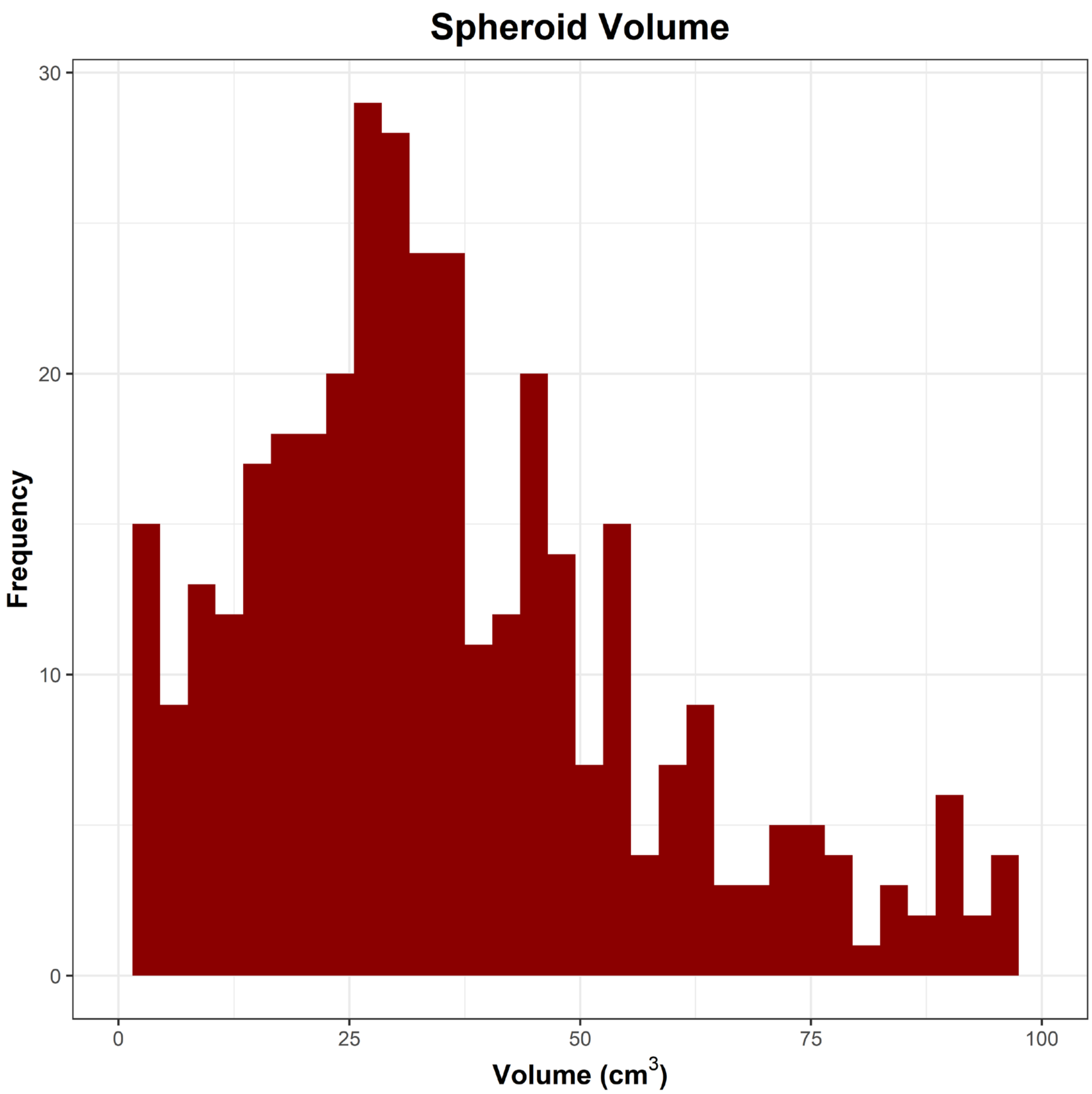


Figure 5.9 View of spheroid volumes for those below 100 cm3. *Partial spheroids were excluded (n=401).

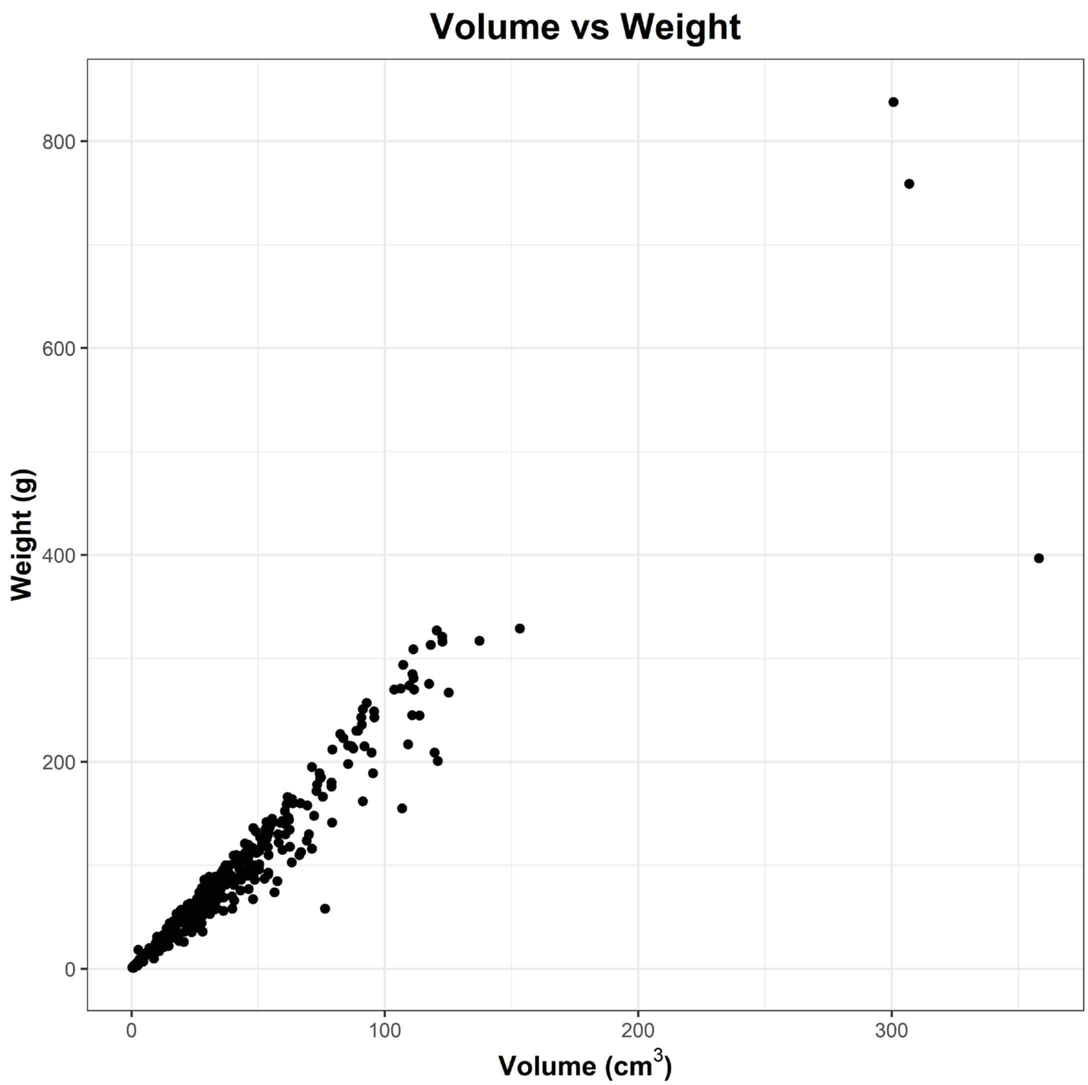


Figure 5.10 Scatterplot depicting the relationship of volume and weight. *Partial spheroids were excluded (n=401).

The median density for all spheroids was 2.36 g/cm^3 and they averaged 2.33 g/cm^3 (Figure 5.11). The shape of the histogram in Figure 5.11 resembles a symmetrical spread, except for the few specimens on both the left and right of the histogram. The histogram has one peak around 2.36 g/cm^3, which the majority of spheroids had densities between the range of 1.25 g/cm^3 and 3.6 g/cm^3. Figure 5.12 excludes the outlying spheroids to the right of the histogram in Figure 5.11. Without the outliers, the spread of the graph still has a symmetrical, unimodal spread with the center of the graph occurring around 2.3 g/cm^3. As was mentioned above, regarding the measurement of density, it was calculated using both the average diameter and volume. Density is dependent on the outcome of those two variables, which could cause the density measurement to misrepresent spheroids with flat spots (F and 2F), oval spheroids (O), or asymmetrical spheroids (A).

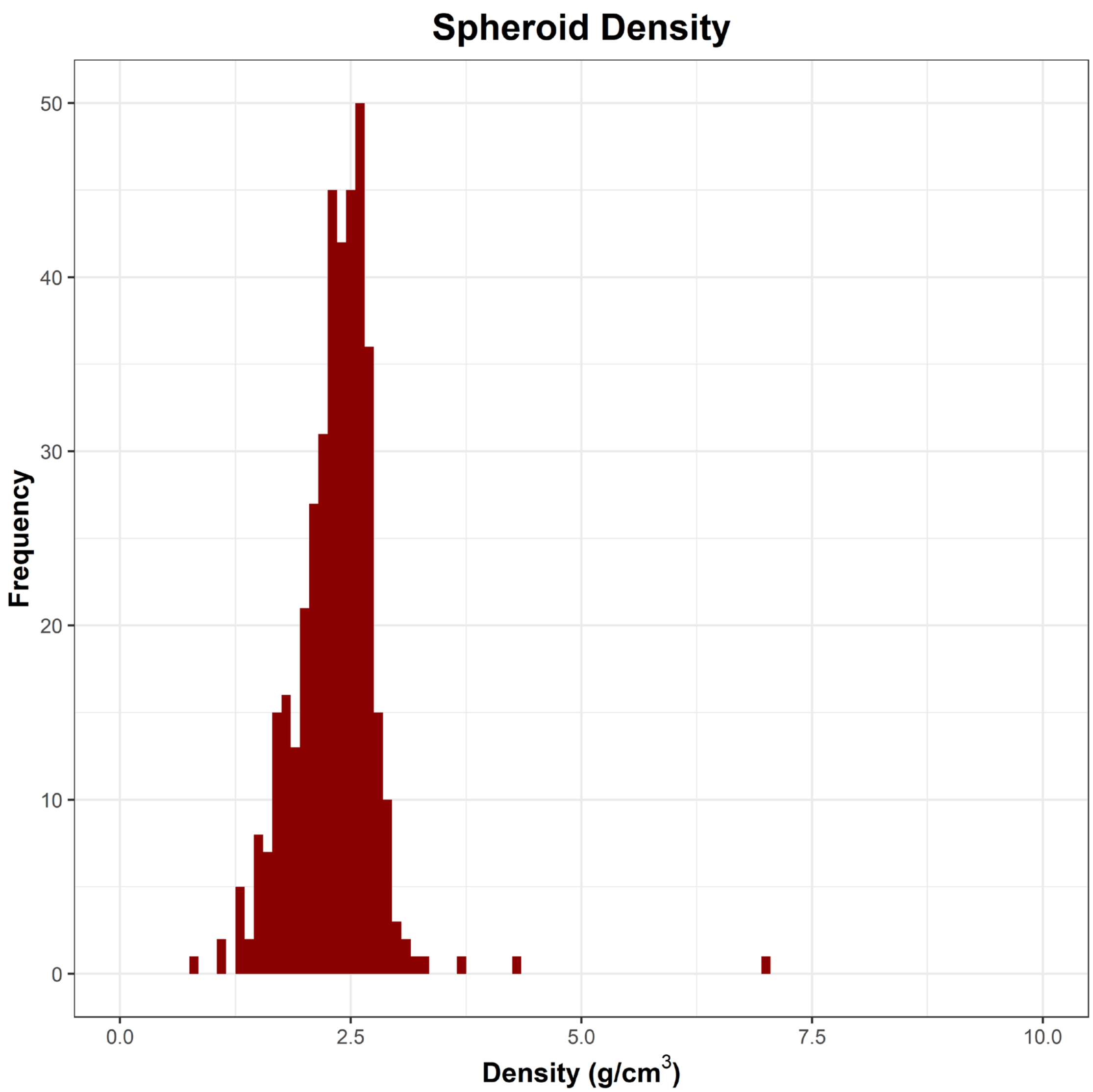


Figure 5.11 Spheroid densities observed in the sample. *Partial spheroids excluded (n=401).

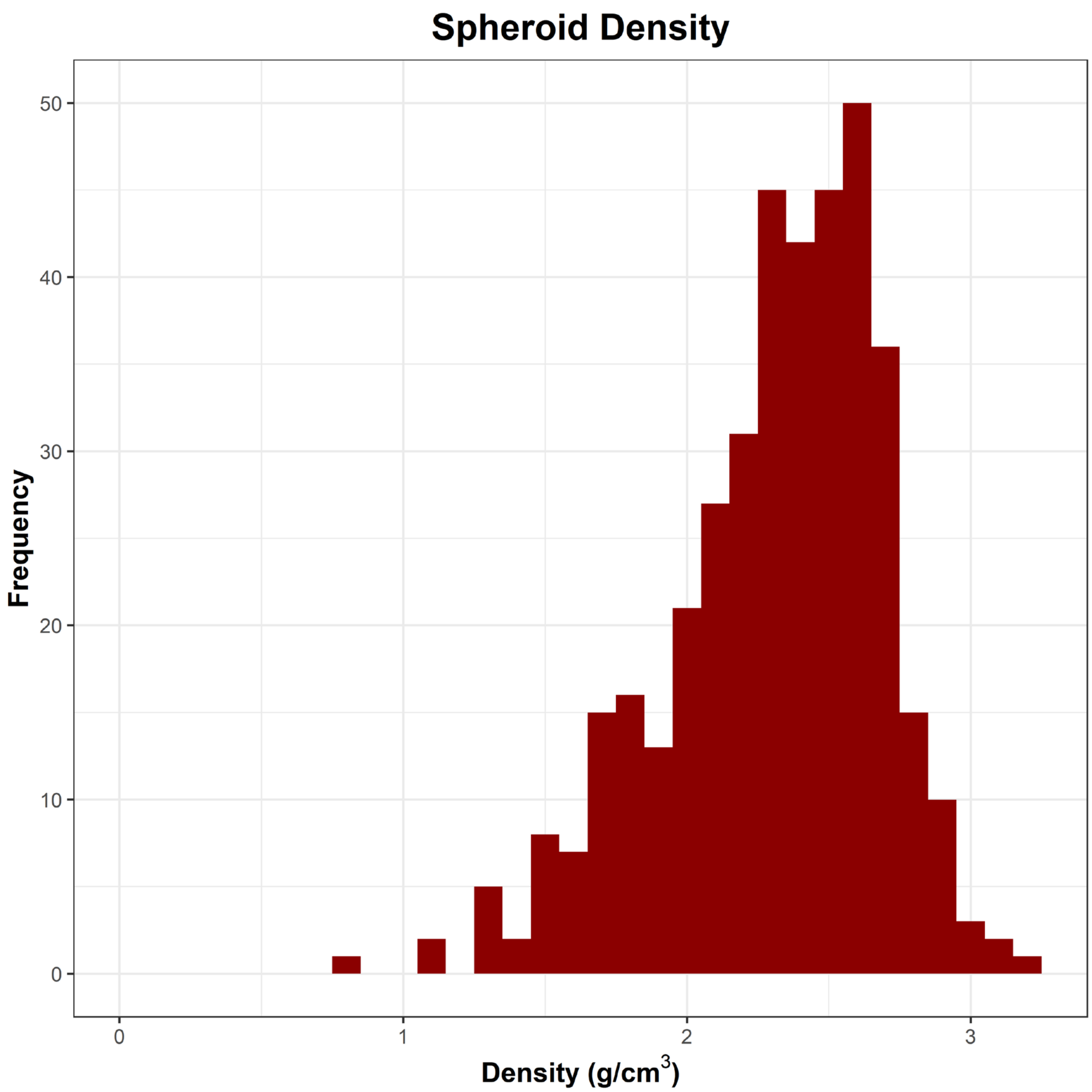


Figure 5.12 View of spheroid densities for those below 3.5 g/cm3. *Partial spheroids were excluded (n=401).

Degree of Roundness and Average Diameter

The median degree of roundness measurement for whole spheroids was 1.52 and the average measurement was 1.96. Spheroids categorized as asymmetrical (A), oval (O), or as having flat spots (F and 2F), had higher degrees of roundness impacting the average degree of roundness measurement. The lowest degree of roundness measurement was 0.08, a sandstone spheroid (42IN40FS820.42). The highest degree of roundness measurement was 9.37, an oval spheroid also made from sandstone (7365 from Nephi Mounds).

The histogram displaying degree of roundness is skewed to the right with a tail trailing to the right (Figure 5.13). Most spheroids have a degree of roundness of less than 5. The bulk of spheroids from the dataset fall in the range of 0 to 1.25. Figure 5.14 shows the degree of roundness excluding spheroids that had degrees of roundness over 5. This zoomed in view of the histogram from Figure 5.13 shows that as the degree of roundness gets larger, the quantity of spheroids goes down.

Dividing the dataset into ranges based on the degree of roundness yields 10 groups, if binned by one (Figure 5.15). These groupings do not represent the groups prehistoric people would have made, but my own attempt to simplify the data. I binned the dataset by one in order to see how many spheroids had a degree of roundness of smaller than 1. The smaller degree of roundness conveys the likelihood a spheroid was very round. Similar to both Figure 5.13 and Figure 5.14, this binned graph looks like a descending line so that as the degree of roundness increases, less spheroids have those higher values. There were 147 spheroids, roughly 36.6% of all the whole spheroids in the dataset, that had a degree of roundness less than one. These very round spheroids come from both large and small residential sites (36 sites). Spheroids with a degree of roundness of 1 to 2 (n=92) comprise 22.9% of all the whole spheroids in the dataset and represent the second largest group.

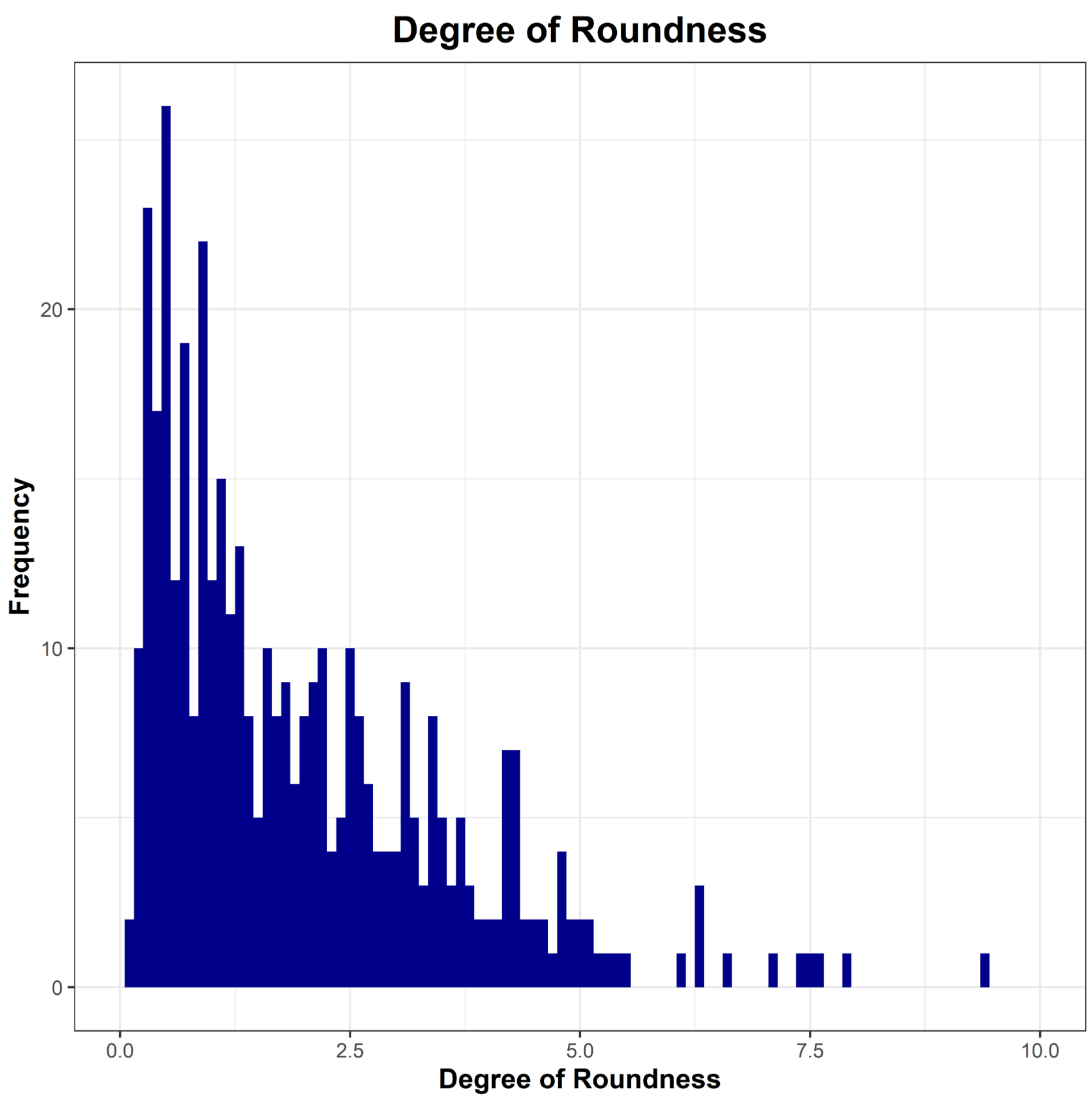


Figure 5.13 Degree of roundness values observed in the sample. *Partial spheroids were excluded (n=401).

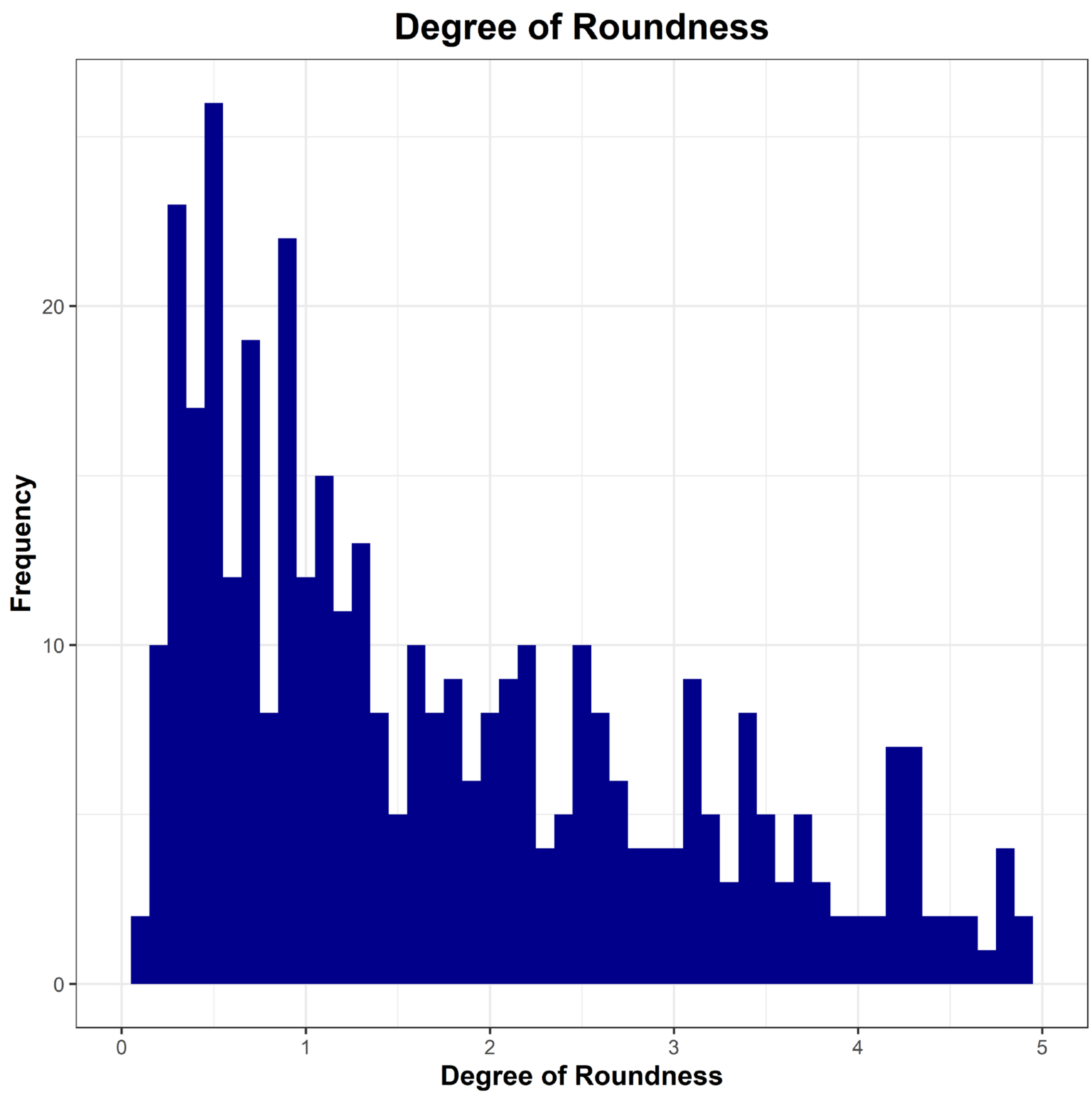


Figure 5.14 View of spheroid degree of roundness for those below a value of 5. *Partial spheroids excluded (n=401).

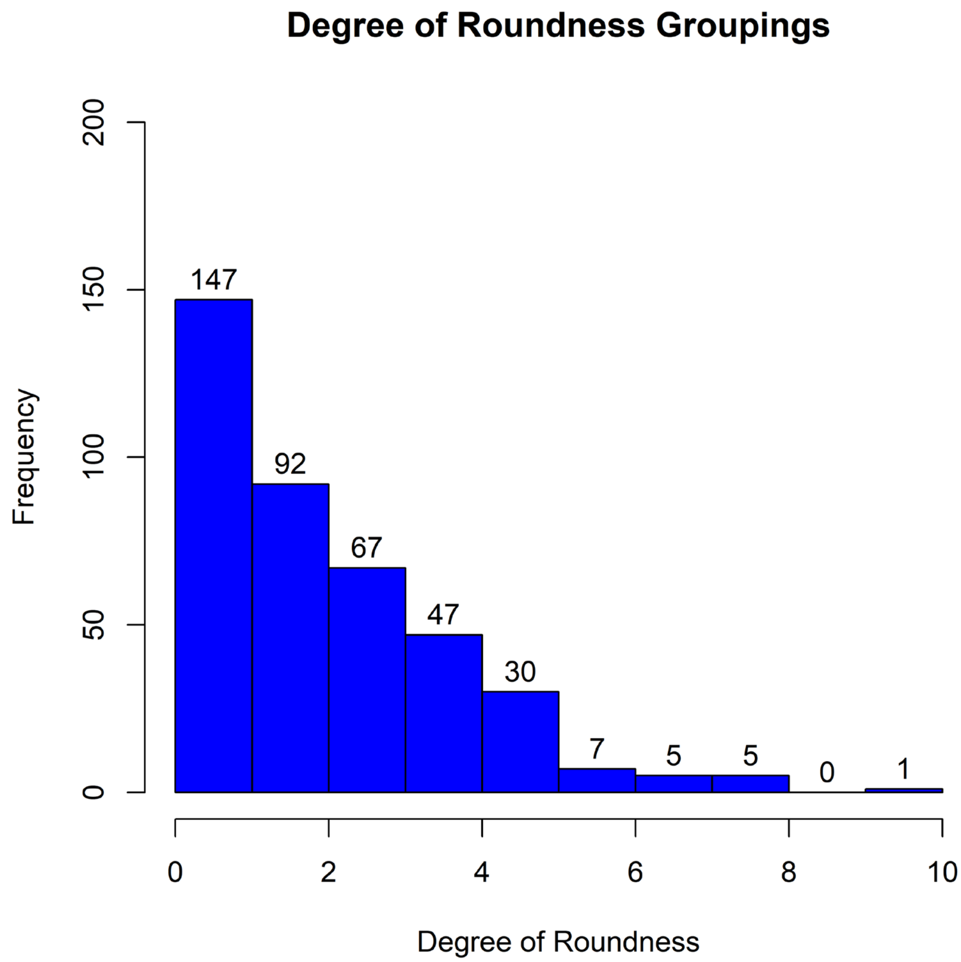


Figure 5.15 Binned histogram showing degree of roundness. Binned by 1. *Partial spheroids excluded (n=401).

The degree of roundness varies depending on the spheroid subtype (one flat spot (F), two or more flat spots (2F), natural or concretion (N), asymmetrical (A), oval (O), and sphere (S)). The subtype categories for spheroids seem to correlate with degrees of roundness. The boxplot in Figure 5.16 shows the degree of roundness according to the subtype of spheroid (partial spheroids were excluded [n=37]). Oval spheroids and asymmetrical spheroids had median measurements between 3.75 and 5 with oval spheroids having a higher median measurement than asymmetrical spheroids. As would be expected, spheroids with the lowest median measurement for degree of roundness were those that were the most consistently shaped or smoothed. Not surprisingly, natural (N), one flat spot (F), and 2 or more flat spots (2F) spheroids had median degrees of roundness scores under 2.5. Despite their sometimes imperfect, spheroid shape, flat and 2 flat spheroids were more spherical than natural spheroids, oval spheroids, and asymmetrical spheroids. Spheres (S) had the lowest median degree of roundness below 1.25. More than likely, the placement of where I took my six diameter measurements affected the degree of roundness. This discrepancy might be resolved by taking more diameter measurements during analysis.

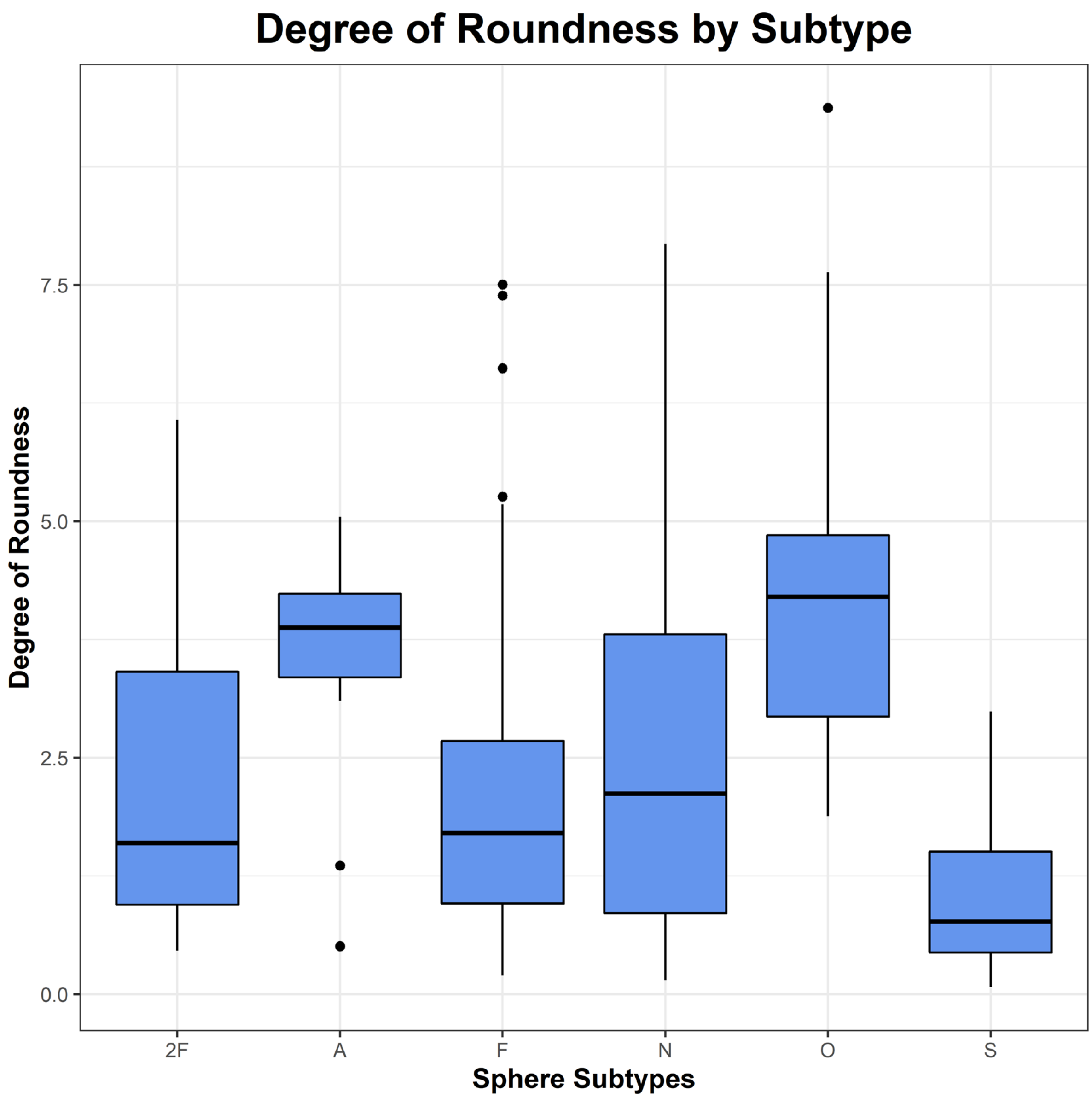


Figure 5.16 Boxplot depicting the degree of roundness of spheroid subtypes (two or more flat spots (2F), asymmetrical (A), one flat spot (F), natural (N), oval (O), and spherical (S)). *Partial spheroids excluded (n=401).

I created an individual plot to look for trends in the degree of roundness according to material type (Figure 5.17). One trend I anticipated was that certain rock types might have lower degrees of roundness because those rocks were either less dense or had a friable matrix. Manufacturers of some spheroids might not have intended to make perfectly round spheroids; it is assumed that some sphericity was attempted. Sandstone had the widest range for degree of roundness, and the most aggregated clusters occur below the 5 degree of roundness mark. Most of the spheroids with a degree of roundness higher than 5 are made from sandstone, but this may be due to the fact that sandstone spheroids made up the majority of the sample. The second most common stone type, granite, had several spheroids under the 5 degree of roundness line. Granite spheroids seem to cluster in groups with degree of roundness scores that are less than 5. Limestone, tuff, and vesicular basalt all have aggregated groups below 5, though not as dense as sandstone and granite. These stones may exhibit lower degrees of roundness due to the fact they are easier to shape because of morphological properties such as hardness and friability.

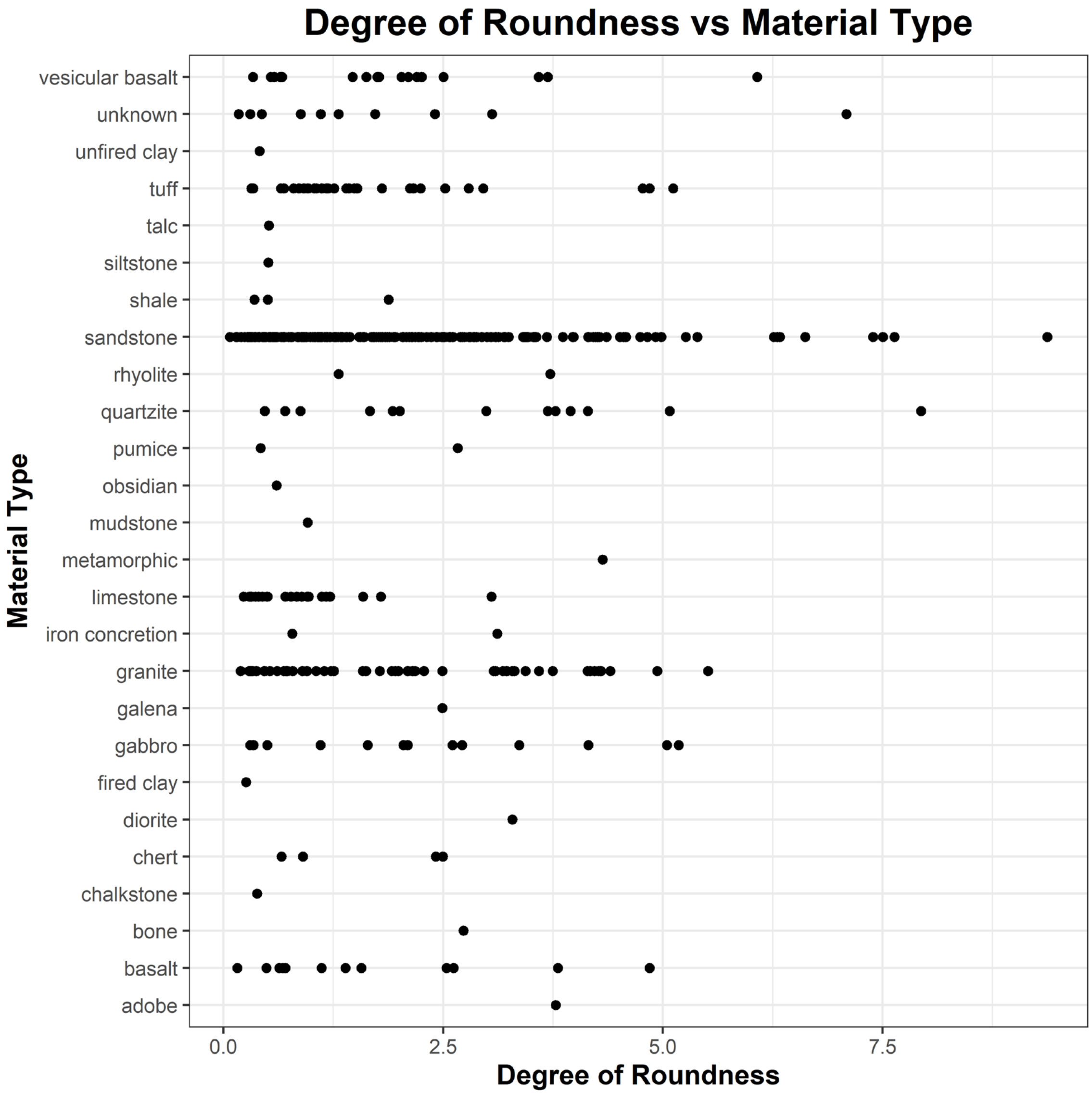


Figure 5.17 Individual plot showing the degree of roundness by material type. *Partial spheroids excluded (n=401).

The average diameter measurement was the mean of six different diameter measurements taken around each spheroid. The average mean diameter was 39.69 mm and the median diameter was 39.60 mm. The average diameter ranged in mean size from 8.33-88.10 mm. The graph displaying average diameters appears as a symmetrical histogram with three outliers (Figure 5.18). Most of the spheroids measured less than 65 mm in diameter. There appears to be a small modal peak around 8–12.5 mm, which correlates with the smallest spheroids. These spheroids might belong in a different artifact type, such as beads because they appear to be distinct in size and exhibit their own spread. Figure 5.19 shows the average diameter for spheroids from 65mm and below and demonstrates a smooth increase and decrease around the histogram peak range of 35 mm to 45mm.

Dividing the average diameter measurement into nine groups (when binned by 10) creates size ranges and possible size categories (Figure 5.19). These categories likely do not represent size categories that Fremont people created, but rather indicate possible ranges I think could be made to assess the data. Most whole spheroids have average diameter measurements within the size ranges of 31-40 mm and 41-50 mm, which those ranges combined include 68.1% (n=273 spheroids) of all whole spheroids. The range 21-30 mm (n= 40 spheroids), and the range 51-60 mm (n=49 spheroids) combined make up 22.2% of the whole spheroid dataset. The lack of breaks in the histogram in Figure 5.18 might be an indication that size categories do not exist in such a clear manner as Figure 5.20 would suggest, rather the data seem to suggest a wide variety in spheroid sizes.

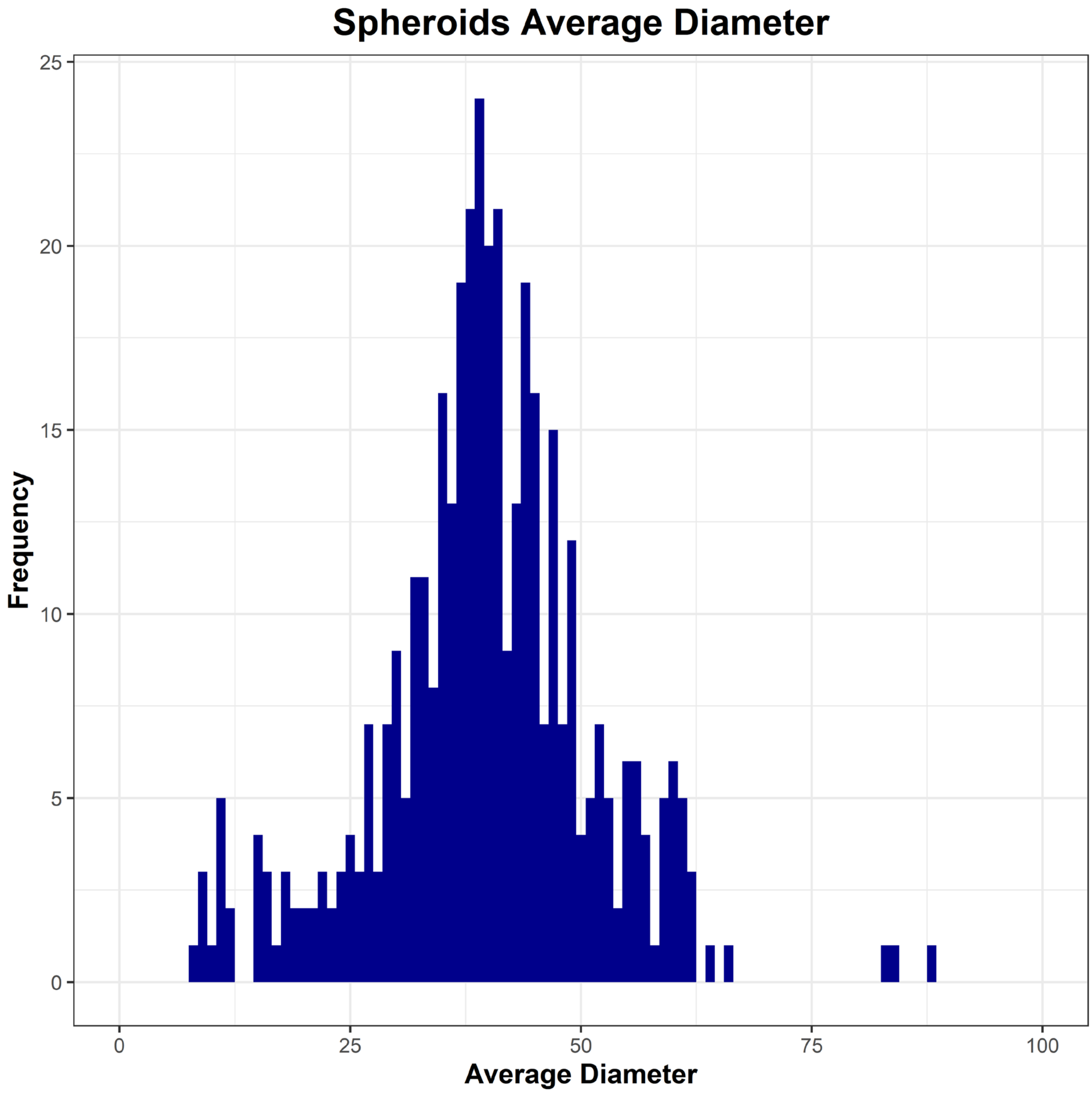


Figure 5.18 Histogram depicting spheroid sizing based on the average diameter. *Partial spheroids were excluded (n=401).

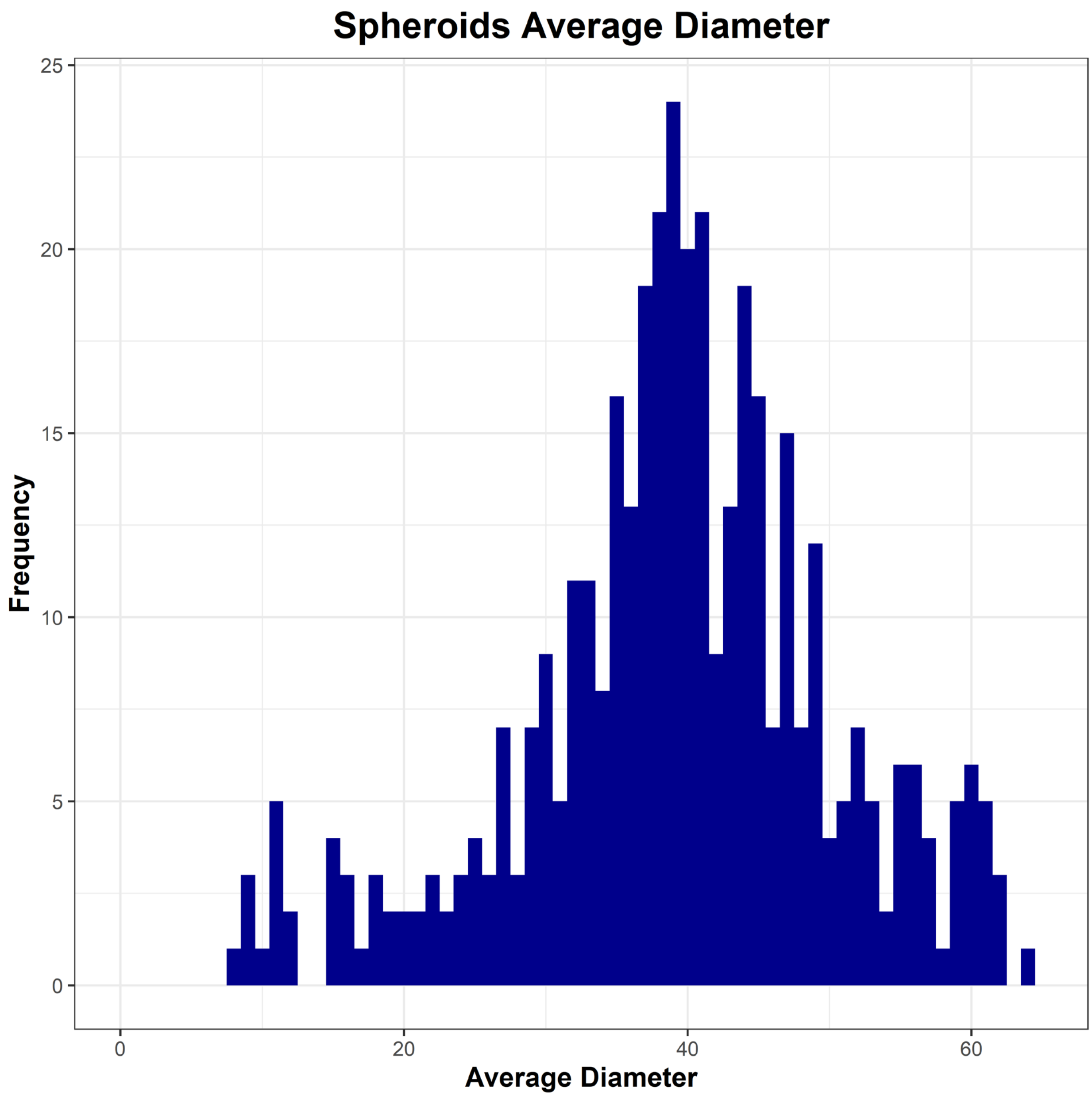


Figure 5.19 View of spheroid average diameter for those below 70 mm. *Partial spheroids were excluded (n=401).

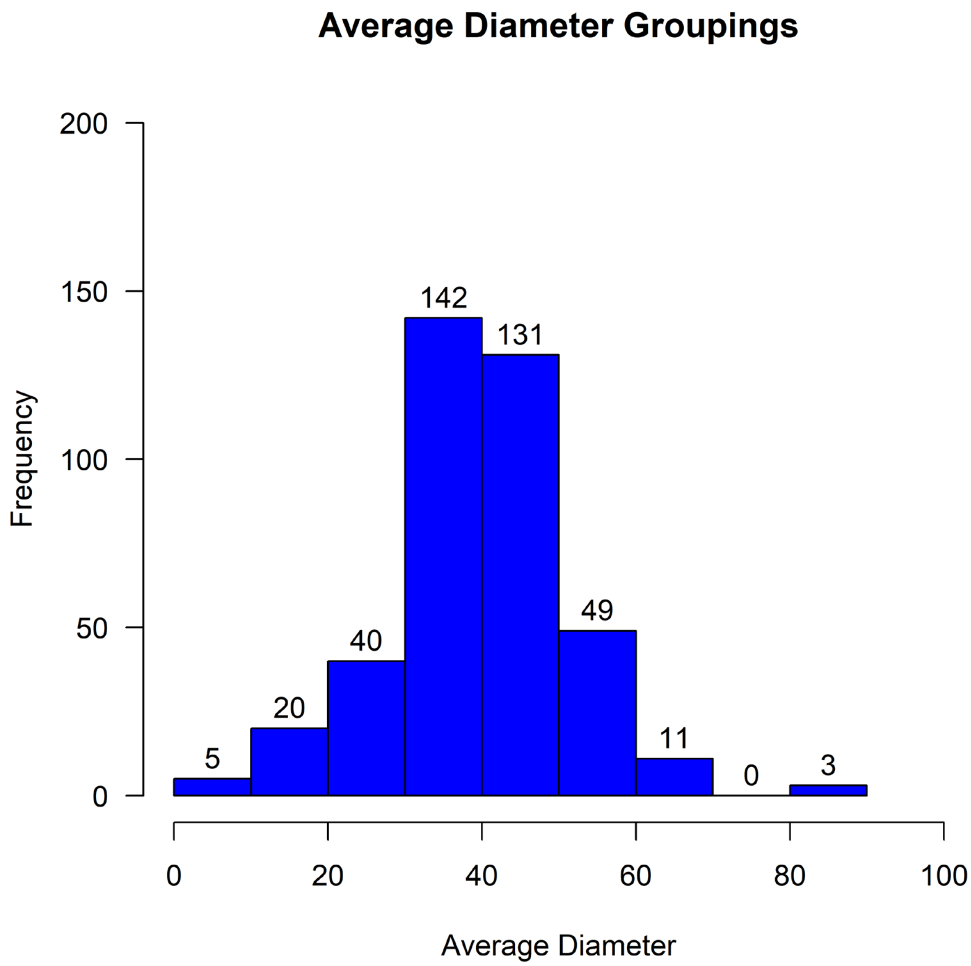


Figure 5.20 Binned histogram showing spheroid sizing according to average diameter. Binned by 10 mm. *Partial spheroids were excluded (n=401).

Another factor in evaluating size ranges would be comparing the average diameter measurement to the subtype of the spheroid. I created a boxplot showing the different subtype categories and their size ranges (Figure 5.21). Natural spheroids (N) had the smallest median measurement for average diameter with a wide range in size. Asymmetrical (A) and oval spheroids (O) had the largest median average diameter measurements, which is to be expected because of the possible discrepancies in diameter measurements. Flat spheroids (spheroids with 1 flat spot and spheroids with 2 or more flat spots) appear to have similar average diameter median measurements that are smaller than asymmetrical (A) and oval spheroids (O). Spheres (S) had the second smallest median average diameter (around 40 mm).

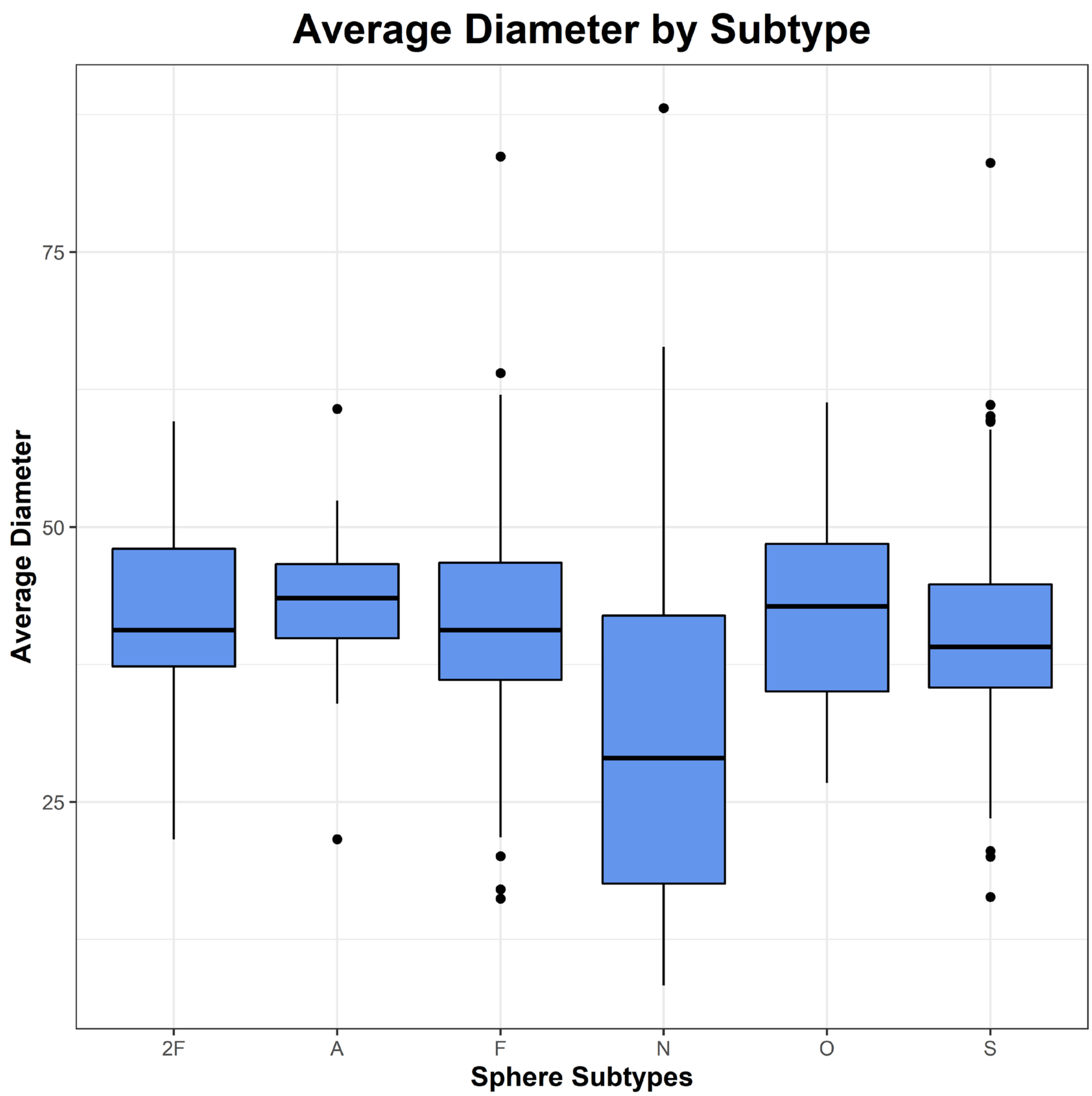


Figure 5.21 Boxplot demonstrating the different size ranges according to spheroid subtypes (two or more flat spots (2F), asymmetrical (A), one flat spot (F), natural (N), oval (O), and spherical (S)). *Partial spheroids were excluded (n=401).

Categorizing Fremont Spheroids by Shape

The categories I utilized to group spheroids into subtype categories and shapes are ones that I derived from Adams (2013). These categories appear to be useful in distinguishing morphological differences among spheroids. The subtypes for spheroids were broken down into the following categories: a flat spot (F), two or more flat spots (2F), natural/concretions (N), ovals (O), spheres (S), partial spheroids (P), and asymmetrical spheroids (A). The summary of spheroid subtypes can be seen in Table 5.1.

Table 5.1 Spheroid Subtype Frequency

Spheroid Subtype	Count	Percentage of Dataset
(S) One Flat Spot	124	28.3%
(2F) Two or More Flat Spots	41	9.4%
(N) Natural/Concretion	69	15.8%
(O) Oval Spheroid	20	4.6%
(S) Spheres	131	29.9%
(A) Asymmetrical	16	3.7%
(P) Partial Spheroid	37	8.5%

Determining the subtype for each spheroid was somewhat subjective, except for spheres (S) which were categorized as spherical if a spheroid had no flat spots and had a degree of roundness smaller than three. Spheroids with flat spots (F and 2F) might also be highly spherical with degrees of roundness smaller than three, which might indicate the secondary use of spheres (S).

I analyzed four spherical cubes that were called stone balls in museum collections (Figure 5.22). I included three of the spherical cubes in the 2 Flat spots or more category, and one spherical cube in the one Flat spot category according to each spherical cube's level of smoothing or flattening. Some natural spheroids are oval, sphere shaped, or they exhibited flat spots, but I chose the category of natural (N) to ultimately describe the spheroid subtype. The category for natural spheroids has a wide range of shape and degree of roundness (Figure 5.16). Partial spheroids (P) represented those spheroids at least 50% complete to 80% complete. Some broken or incomplete spheroids exhibited flat spots, but overall, I felt that these spheroids were best categorized as partial.

Figure 5.22 Stone shaped into a spherical cube with several flat sides. Courtesy of Natural History Museum of Utah (UMNH 42WN286FS1).

Beyond the subtype of spheroids, I also determined how irregular, oval, or spherically shaped a spheroid was. There were 83 irregularly rounded spheroids, 31 oval-like spheroids, and 324 spherical type spheroids (these counts included partial spheroids). The majority of my dataset (74%) were spherically shaped spheroids. Some of my flat spheroids (F and 2F) were represented by the shape designation of spherical because overall the spheroid was round even though it had a flat spot.

Table 5.2 Frequency of Stone Types for Spheroids with Flat Spots

Rock Type/Subtype	Basalt	Gabbro	Granite	Limestone	Quartzite	Sandstone	Tuff	Vesicular Basalt
2F	3	1	5	0	2	23	4	1
F	3	5	18	9	2	58	10	9
% of 2F and F/# of rocks per type	50%	46.2%	40.4%	32.1%	28.6%	35.8%	46.7%	58.8%

A further assessment of rocks with flat spots (those spheroids with the subtype designations of 2F and F) might indicate a rock's specific use (Table 5.2). The percentage given in Table 5.2 denotes the percentage of spheroids in a stone type that exhibit flat spheroids. This percentage is found by adding the number of F and 2F spheroids together and dividing that over the total number of spheroids from that particular stone type. For example, basalt had six spheroids with flat spots (F and 2F) and there were 12 basalt spheroids total. The percentage of flat basalt spheroids was 50%. Most of the flattened spheroids are made from sandstone, but the highest percentage of flat spheroids according to stone type is vesicular basalt (58.8%). Vesicular basalt is a common stone type used in manos and metates (Michael Searcy, personal communication 2020). Despite the fact that both sandstone and granite spheroids had high counts for spheroids exhibiting flat spots, they did not have as high of percentages as Gabbro (46.2%) and Tuff (46.7%). In general, sandstone and granite were the most commonly used stone types for Fremont spheroids, which suggests they were the preferred choice for manufactured spheroids.

Texture Summary

The texture of each spheroid was determined on a scale of 1 to 5 based on how smooth the spheroid felt in my hand (Figure 5.23 and Figure 5.24). Levels 4 and 5 represent the

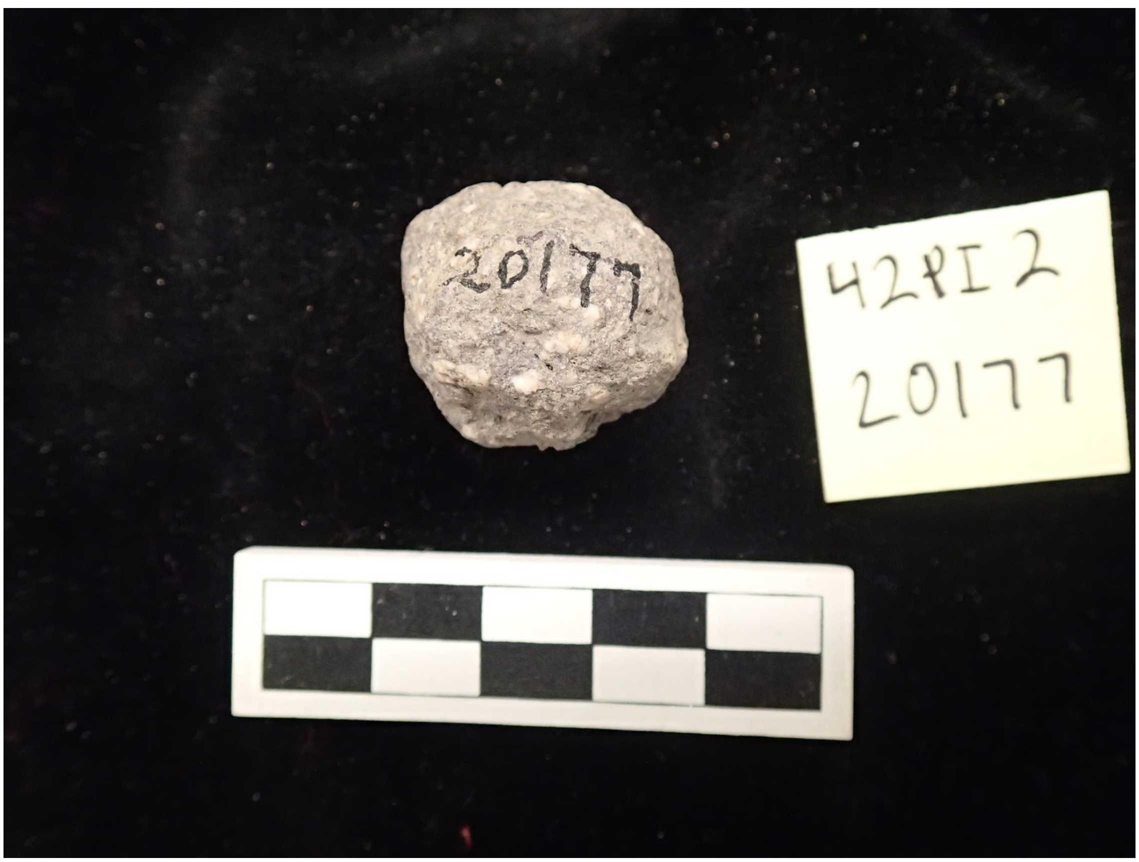


Figure 5.23 A spheroid categorized as texture level 1. Courtesy of Natural History Museum of Utah (UMNH 42PI2 20177).

smoothest textures. Typically, level 5 spheroids exhibited some kind of patination, either a filmy covering or sheen, to separate them from the level 4 spheroids. A summary of the texture levels within the dataset is displayed in Table 5.3 (the texture level counts include partial spheroids). Texture level 3 had both the highest count (n=193) and the highest percentage (44.1%) of spheroids in the dataset.

Figure 5.24 Spheroid categorized as texture level 5. Courtesy of Natural History Museum of Utah (UMNH 42SV7FS77).

Table 5.3 Texture Levels Represented in Data Sample

Texture Level	Count	Percentage of Dataset
1	37	8.5%
2	124	28.3%
3	193	44.1%
4	76	17.4%
5	8	1.8%

Figure 5.25 is a boxplot depicting each texture level by degree of roundness (partial spheroids were excluded from the graph). As the texture levels get higher, the median degree of roundness gets smaller (meaning the spheroids get rounder). The median degree of roundness for each texture level is below 2.5, with texture levels 4 and 5 having a median degree of roundness smaller than the 1.25 mark. Texture level 3 has the widest range of spheroids and a high degree of roundness value. This is an obvious finding because texture level 3 represented the most spheroids.

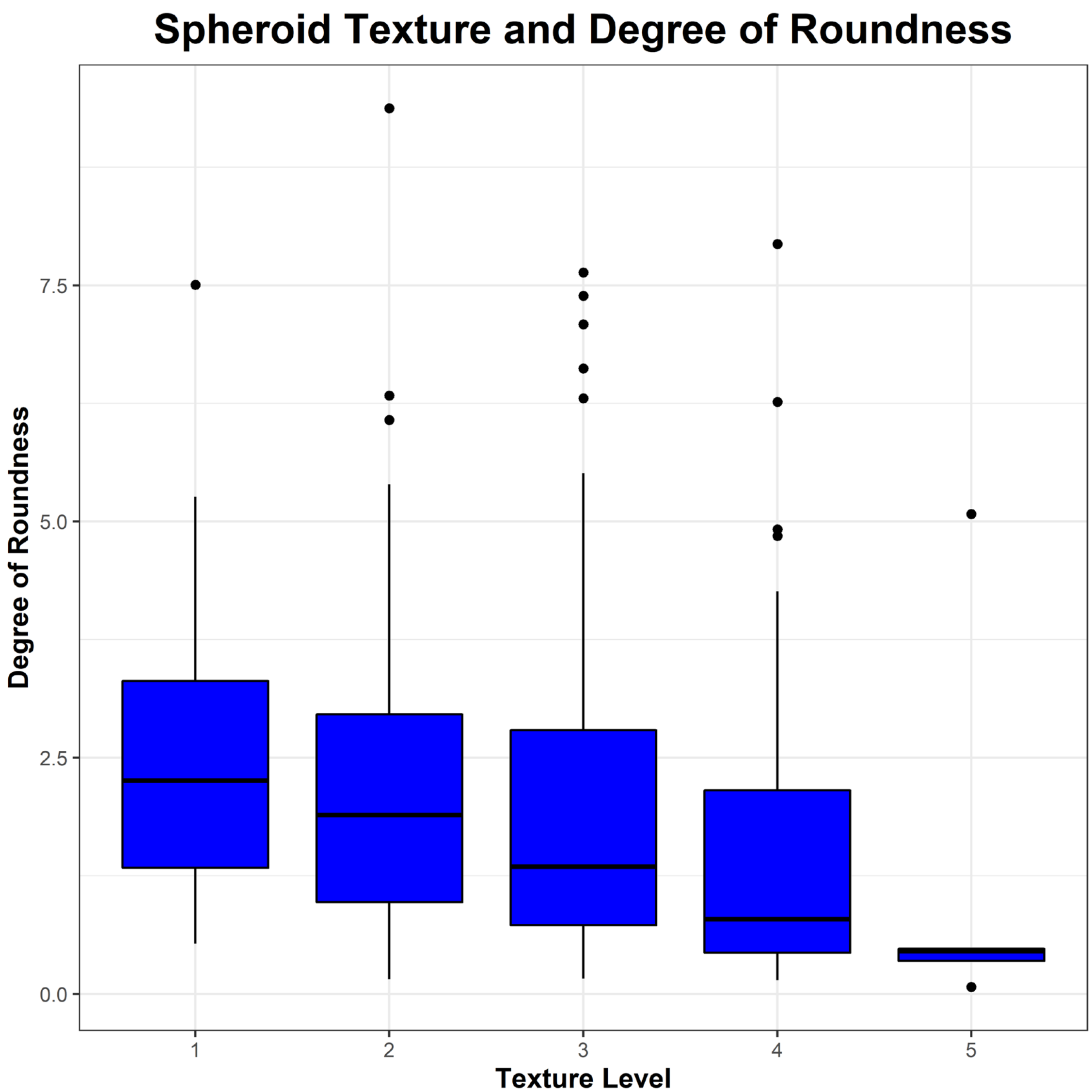


Figure 5.25 Boxplot depicting the texture level and the degree of roundness. *Partial spheroids were excluded (n=401).

While texture was a subjective observation, it was obvious that some rock types were naturally more porphyritic, coarse-grained, abrasive, or friable, such as granite or sandstone, which resulted in those spheroids having lower texture levels. Overall, I tried to include evenness when analyzing spheroid texture as well as how the spheroid felt to the touch. Spheroids, such as sandstone, that had large grain sizes making them rougher were categorized at a level 3 if they exhibited an even surface.

Manufacture and Other Use-Wear

Several spheroids had deep peck spots or natural divots and recesses on their surface (Figure 5.26). I began to note the presence or absence of these recesses on the spheroids. In total, there were 321 spheroids (73.3% of the dataset) showing natural or pecked divots (including partial spheroids).

Figure 5.26 Spheroid with deep recess, also referred to as a divot. Courtesy of Natural History Museum of Utah (UMNH 42UN95 FS66.98).

Several spheroids had flat spots, which, typically, I categorized as subtypes one flat spot (F) and or two or more flat spots (2F) (Figures 5.27- Figures 5.29). Sometimes the flat spots were referred to as a flat side, or I stated that the spheroid had flattening. When viewed at an angle, these flat spots appeared as a flat plane on the surface of the spheroid (Figure 5.28). Striations were observed on some of the spheroids with flat spots (Figure 5.29). Overall, 183 spheroids displayed some form of flattening (41.8% of the dataset). These 183 spheroids include those spheroids referred to as F and 2F (n=165), natural spheroids (n=9), and partial spheroids (n=9).

Some spheroids exhibited a characteristic I refer to as finger holds. Finger holds are recesses or divots of varying depths located on the surface of a spheroid that seem to correlate with a flat spot or a highly pecked area (Figure 5.30 and 5.31). Once I noticed divots and a flat spot, I tested out holding the spheroid in my hand to judge whether the spheroid fit ergonomically into my palm (Figure 5.32). When the flat spot faced out of my hand, as if ready to lie flat against the table, I counted the spheroid as having finger holds. At times, there were a few spheroids that had finger holds with a corresponding highly pecked area (indicating that the spheroid might have functioned as a hammerstone). Most of the time I used my right hand to hold the spheroids, which could possibly exclude spheroids that might have been intended for left-handed people.

There were 101 spheroids categorized as having finger holds, making up 23.1% of the dataset. The subtypes that exhibited finger holds were spheroids with one flat spot (F) (n=72), two or more flat spots (2F) (n=25), asymmetrical (A) (n=1), natural (N) (n=1), partial (P) (n=1), and spherical (S) (n=1). Spheroids with finger holds typically were associated with flat spots, except the asymmetrical spheroid (42SV662FS463.6) which was described as a possible pecking tool with finger holds, and the spheroid (42BE974AR2345) which from the note description had comfortable finger holds and might have been used to crush pigment.

Figure 5.27 Round spheroid exhibiting a flat spot. Courtesy of Natural History Museum of Utah (UMNH 42IN40FS659.8).

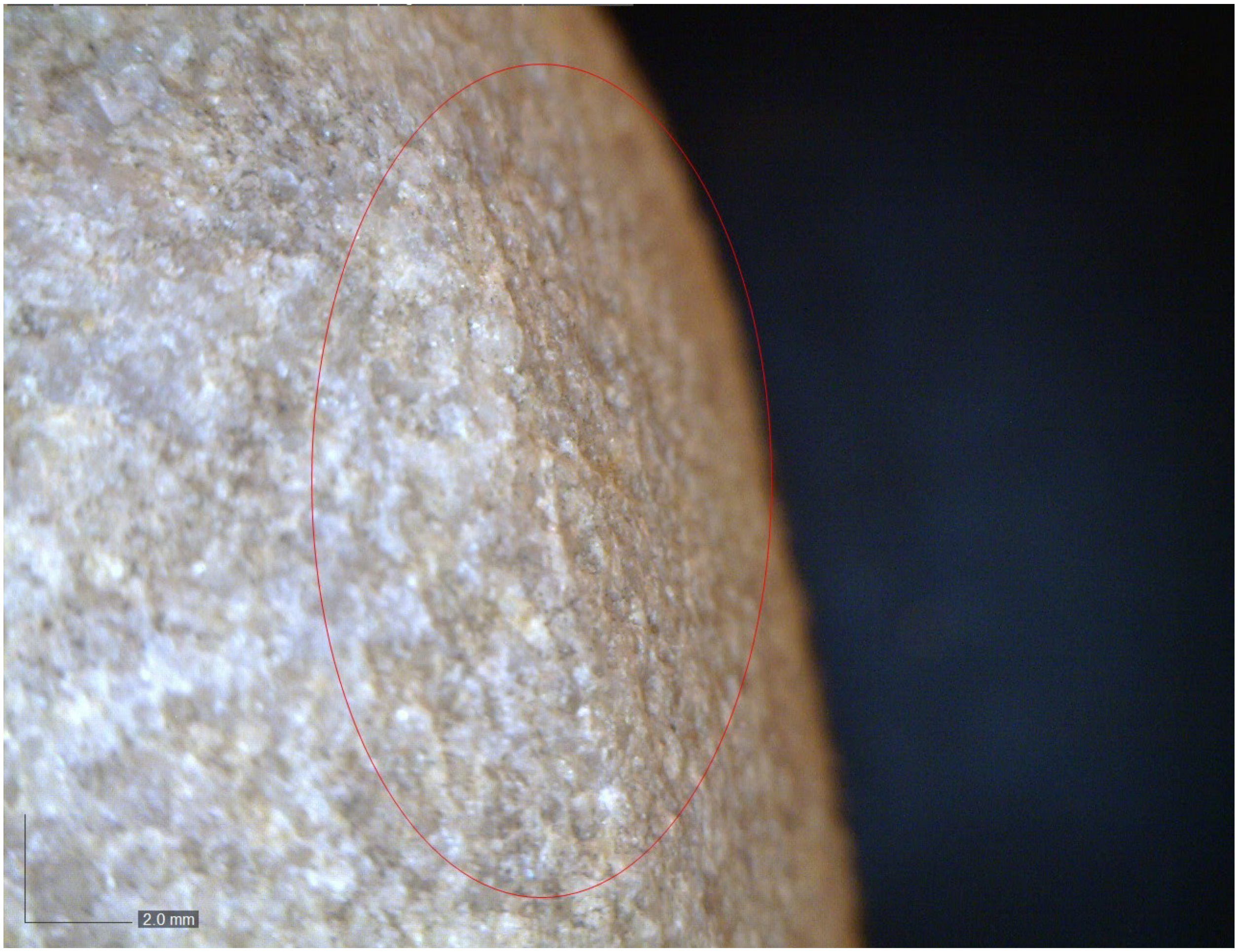


Figure 5.28 Close-up view of two flat spots coming together in an edge on the spheroid's surface. The edge is circled in red. Courtesy of Natural History Museum of Utah (UMNH 42WB34FS740.105).

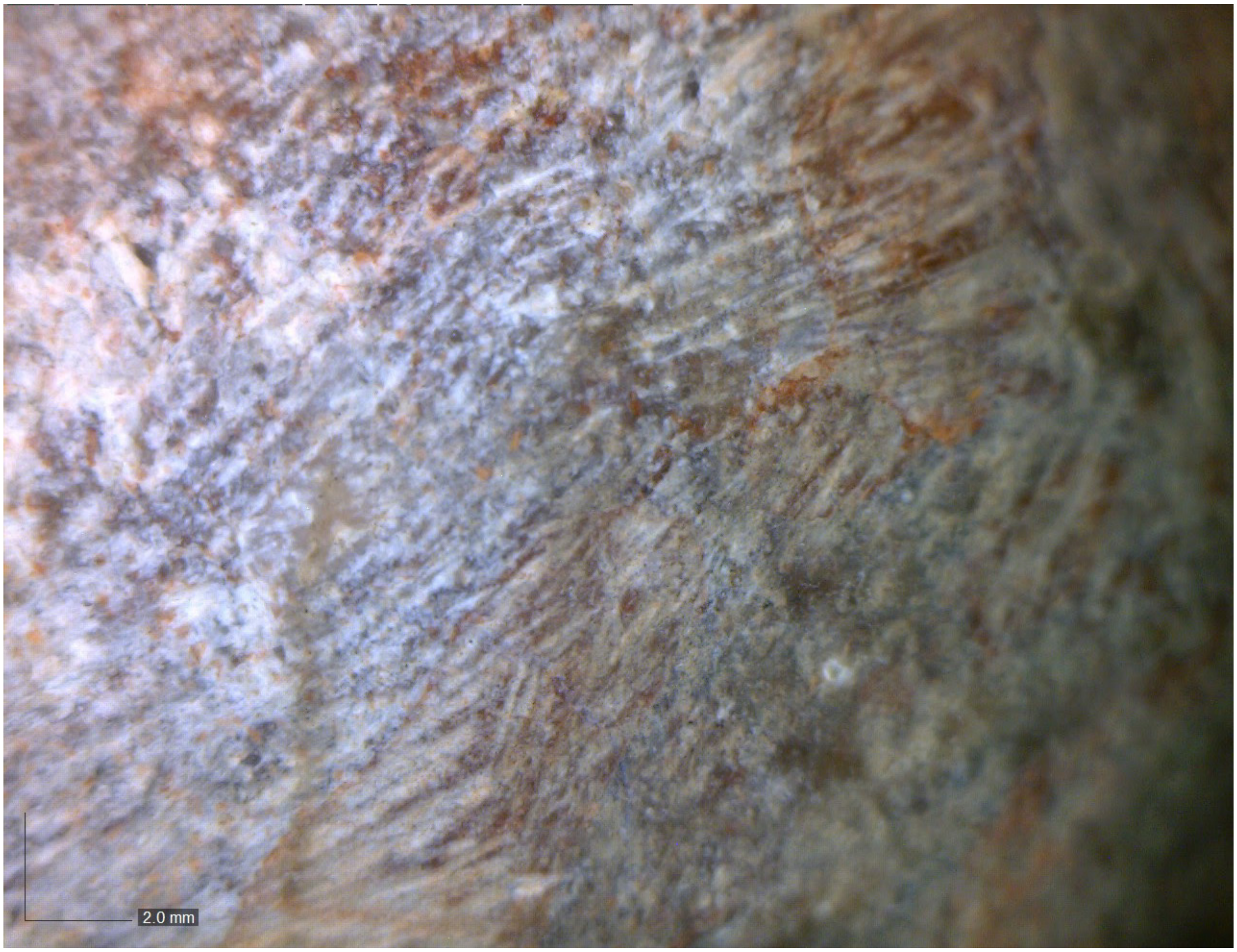


Figure 5.29 Close-up view of striations observed in the flat spots on the spheroid. Courtesy of Natural History Museum of Utah (UMNH 42MD180FS73.41)

Figure 5.30 Close-up view of four pecked divots that act as places to hold the spheroid ergonomically, also known as finger holds. The red arrow drawn across the three circles represents holding the spheroid with your index finger pointing in the direction of the arrow. The solo circle with the arrow represents another finger hold, possibly a thumb hold. Courtesy of Natural History Museum of Utah (UMNH 42MD180FS34.30).

Figure 5.31 Close-up view of a finger hold with a flat spot observed in the left corner of the photo. The red arrow indicates the flat spot, while the red circle shows the finger hold. Courtesy of Natural History Museum of Utah (UMNH 42MD180FS34.30)

Figure 5.32 Author’s hand holding a stone spheroid according to the finger holds with the flat spot facing out. Courtesy of Natural History Museum of Utah (UMNH 42SV23AR1474).

Spheroids with finger holds occur throughout the Fremont region at 32 different sites. Figure 5.33 displays the percentages of spheroids with finger holds at each of the 32 Fremont sites. Several of the large percentages occur around the Sevier River valley and in the central southern Utah region. The large portion of spheroids with finger holds around the Sevier River valley could indicate that a regional pattern existed in that area.

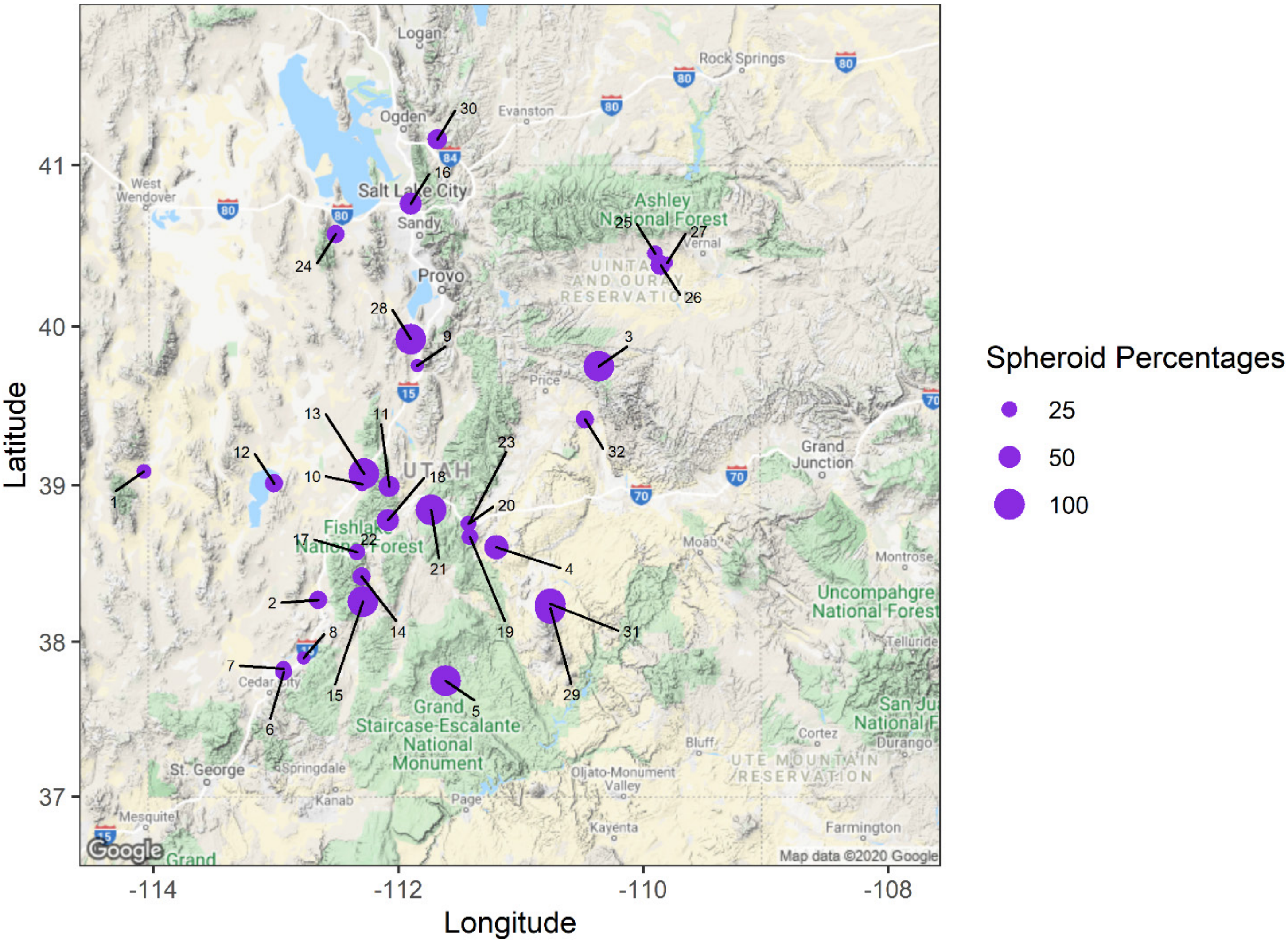


Figure 5.33 Map showing the distribution of spheroids with finger holds throughout the Fremont region.

(1) Garrison Site, (2) Beaver Mounds, (3) Beacon Ridge N.M. 2, (4) 42EM63, (5) Spencer Site, (6) Median Village, (7) Evans Mound, (8) Paragonah Mounds, (9) Nephi Mounds, (10) Kanosh Mounds, (11) Pharo Village, (12) Sevier Lake Site 2, (13) 42MD76, (14) Marysvale 7, (15) 42PI508, (16) Block 49, (17) Five Finger Ridge, (18) Mukwitch Village, (19) Round Spring Site, (20) Fallen Woman Site, (21) Nawthis Village, (22) Backhoe Village, (23) Old Woman Site, (24) Grantsville Mounds, (25) Whiterocks Village, (26) Uinta Basin Mounds, (27) Caldwell Village, (28) Wolf Village, (29) 42WN238, (30) Injun Creek, (31) 42WN267, (32) Cedar Mountain, Ut

Grooving, carved lines of varying depth on the surface of a spheroid, was observed on 19 spheroids (4.3% of the dataset). Some grooved spheroids had one incised ring located either around the middle or slightly off-center (n=9) (Figure 5.34). There were three spheroids that had more than one groove where at least two lines met in an x on the surface of the spheroid (Figure 5.35 and Figure 5.36). Some grooves appeared faintly and did not seem to connect in a complete ring; these types of unconnected grooves made either curved lines or spirals (n=7) (Figure 5.37).

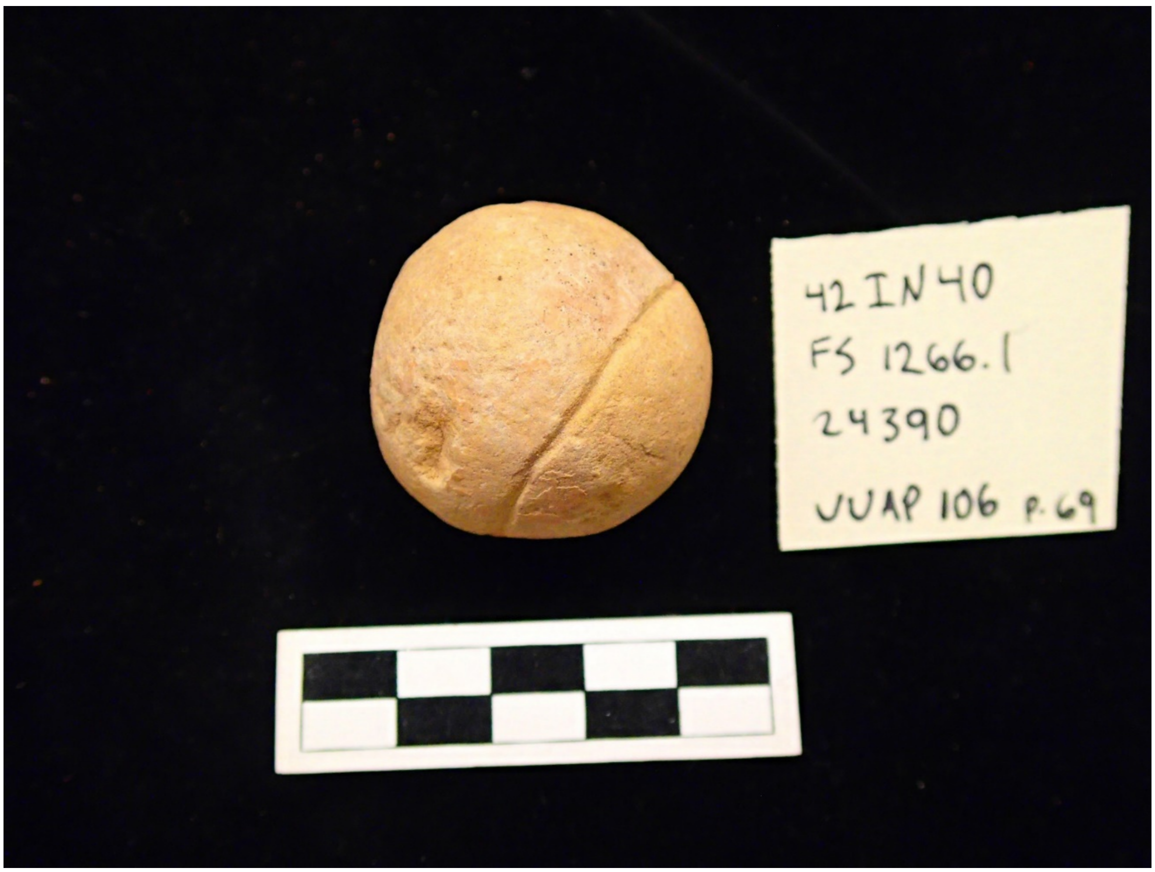


Figure 5.34 Grooved spheroid showing one variation of grooving, a continuous ring that is slightly off-centered. Courtesy of Natural History Museum of Utah (UMNH 42IN40FS1266.1).

Incised lines occurred on almost all subtypes except partial spheroids (P= 0): one flat spot (F=3), two or more flat spots (2F=2), oval (O=3), asymmetrical (A=2), spherical (S=5), and natural (N=4). Partial spheroids are only part of how a spheroid might have originally looked, which likely explains why no grooving was observed. Interestingly, the grooved natural spheroids ranged in diameter size from 8.33 mm to 17.63 mm, which could be an indication that these smaller natural spheroids might have had different functions than the other larger sized spheroids (possibly as beads or weights). The other spheroid subtypes with grooves had average diameters of 26.73 mm to 46.80 mm.

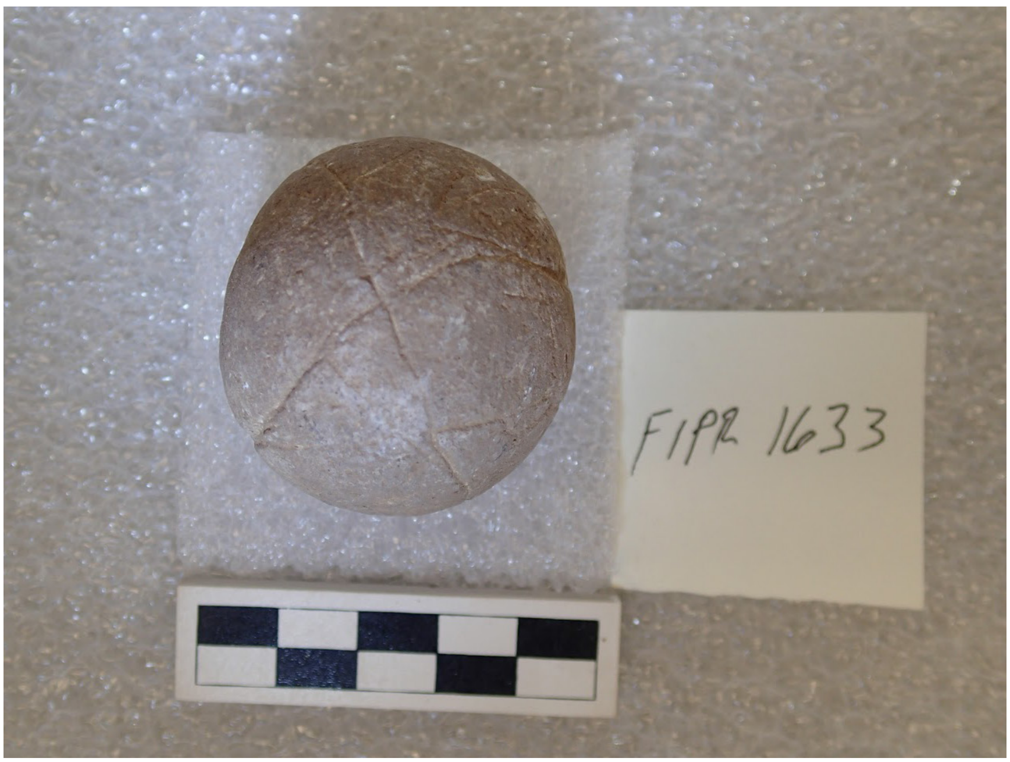


Figure 5.35 Grooved spheroid showing shallowly incised grooves that cross in an x on the spheroid’s surface. Courtesy of Fremont Indian State Park Museum (FIPR 1633).

There is a chance that some grooves could have been natural formed and then utilized for some function. One spheroid, 42SV5 FS27.21, appears to be a natural concretion with a line around the top of the spheroid in a ring (Figure 5.38). There is a possibility that this ring was used to tie fiber to.

Figure 5.36 Deeply carved grooves on the surface of the spheroid that cross several times in an x. Courtesy of Natural History Museum of Utah (UMNH 42BE974 3786).

Figure 5.37 Grooved spheroid carved with a spiral. The spiral is observed behind the label. Courtesy of Natural History Museum of Utah (UMNH 42IN40FS58.100).

Figure 5.38 Natural concretion with a ring around the end of the spheroid. The ring is possibly a natural groove. Courtesy of Natural History Museum of Utah (UMNH 42SV5FS27.21).

Two clay spheroids (one unfired and one fired) had fingernail marks pressed into their surfaces. The fingernails on the surface of the spheroid in Figure 5.39 are reminiscent of fingernail markings found on pottery. One unknown sedimentary spheroid, 42MD180FS184.58, looks incised in some design that somewhat resembles a face (Figure 5.40). This face is reminiscent of other Fremont face depictions, such as a face seen on a petroglyph from the McConkie Ranch (Figure 5.41). One Museum professional told me that the spheroid (42MD180FS184.58) resembled sticks of inorganic pigment from NHMU's collection. She suggested that perhaps white pigment was ground down and wetted to form a ball shape (Glenna Nielsen-Grimm, personal communication 2019).

Figure 5.39 Clay spheroid with nail imprints. Nail marks circled in red. Courtesy of Natural History Museum of Utah (UMNH 42BO98FS243.7).

Figure 5.40 Incised spheroid with a possible face depiction. Courtesy of Natural History Museum of Utah (UMNH 42MD180FS184.48).

Figure 5.41 Fremont rock art at McConkie Ranch with a similar face depiction as spheroid 42MD180FS184.58. Courtesy of gjhikes.com.

Sooting and Pigments

Sooting, burn marks, and smudging with soot were all considered "sooting" during my analysis. Burn marks sometimes appeared as a blackened or brownish black discoloration on the spheroid (Figure 5.42-5.43). At times, when black or dark brown discoloration was present, I would scrape the spot with my fingernail or gloved hand for evidence of a streak or soot. When a spheroid had a blackened appearance with cracks, I observed that the spheroid was likely fire cracked (Figure 5.44-5.45). Some spheroids looked as though they had spots of charcoal smudged on them, which could have been accidental or intentional (Figure 5.46).

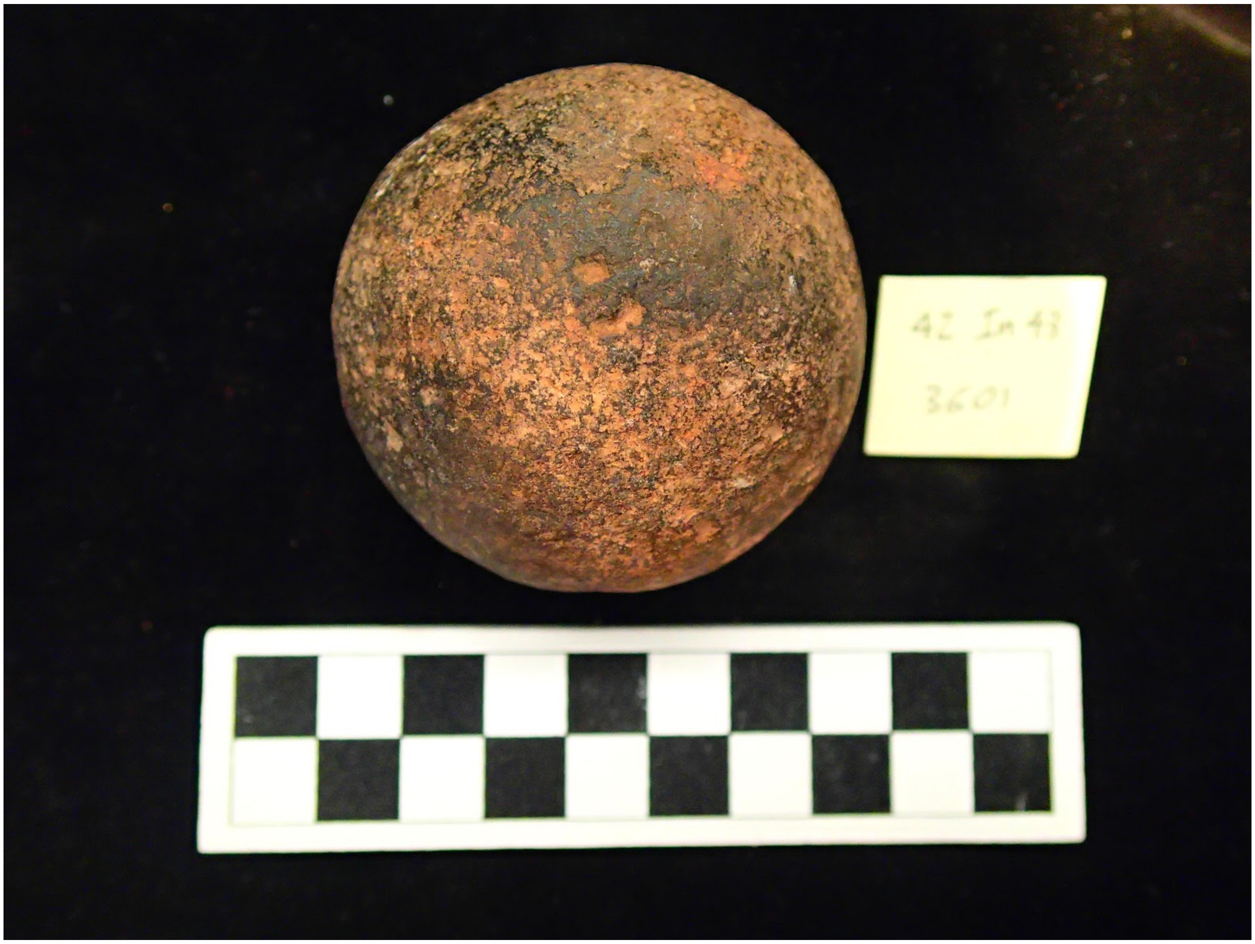


Figure 5.42 Sooted spheroid with black discoloration. Courtesy of Natural History Museum of Utah (UMNH 42IN43 3601).

Figure 5.43 Close-up view of sooting in the crevices of the spheroid. Courtesy of Natural History Museum of Utah (UMNH 42BE974AR2344).

Figure 5.44 Fire cracked spheroid 42IN40FS540.66 that was counted as a sooted spheroid. Courtesy of Natural History Museum of Utah (UMNH 42IN40FS540.66).

Figure 5.45 Close-up view of the cracks and blackening on spheroid 42IN40FS540.66 surface. Courtesy of Natural History Museum of Utah (UMNH 42IN40FS540.66).

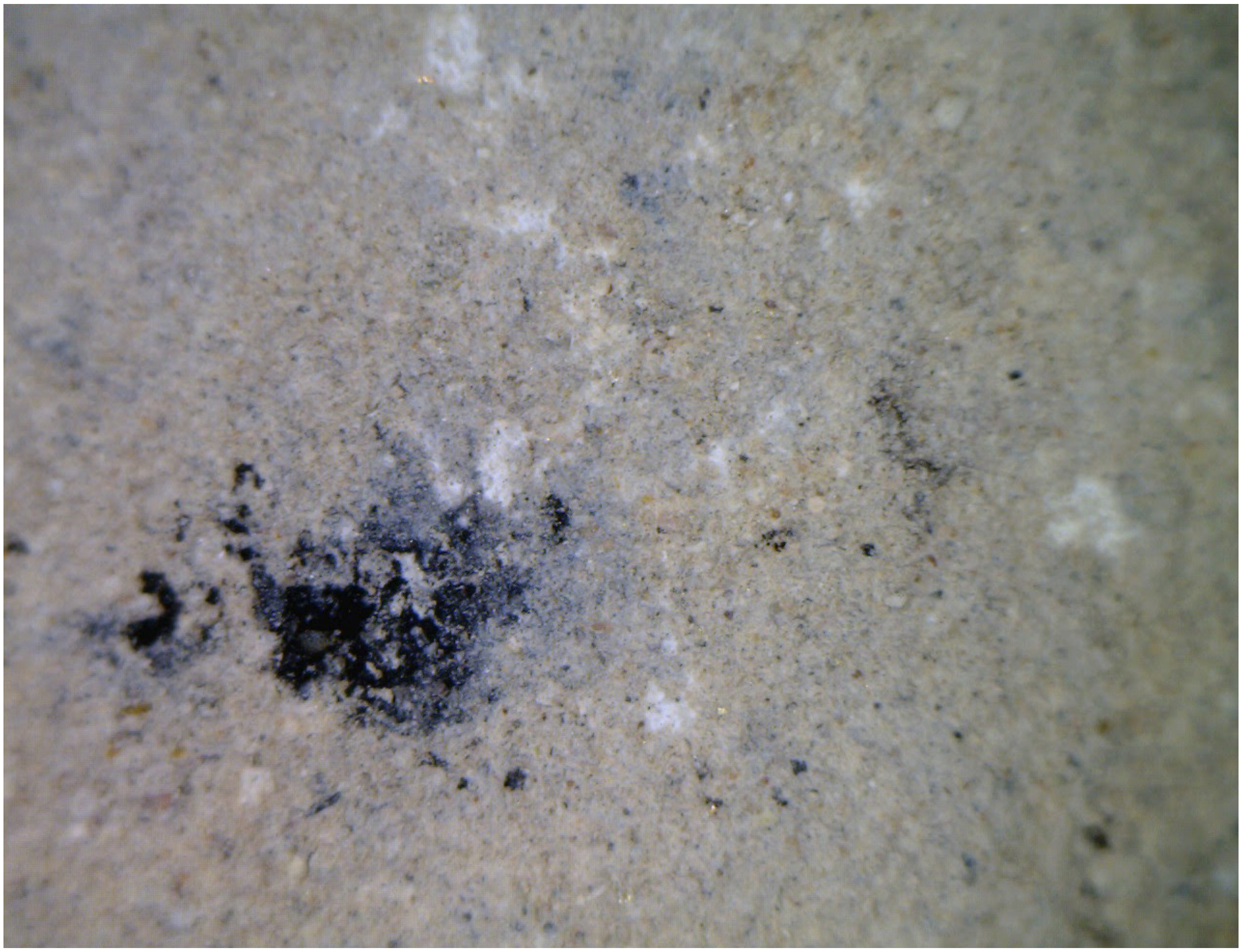


Figure 5.46 Close-up view of soot that resembles charcoal on the spheroids surface. Courtesy of Fremont Indian State Park Museum (FIPR 1615).

There are many ways in which a spheroid could be sooted, smudged with soot, or burned. Spheroids could become sooted during a house fire, by being dropped accidentally into a fire, through heating in a fire and placed in a pot as a boiling stone, etc.

Some spheroids might have been burnt or sooted during the ritual burning down of the structures at a site. This burning down of structures at a site was a ritual process for leaving a site (Bodily 2012). The possibility that soot was used as a source of pigment also cannot be ruled out when considering smudge marks on spheroids. With the various ways for a spheroid to encounter smudging or burn marks, it is difficult to conclude whether the spheroids in the dataset represent intentionally sooted spheroids.

I noted 52 spheroids (11.9% of the dataset) as showing evidence of sooting, nevertheless, in this thesis I do not make conclusions on whether the observed soot was intentional or not. Table 5.4 shows the sites containing sooted spheroids, the frequency of sooted spheroids at a site, and the percentage of sooted spheroids vs normal spheroids at a particular site.

Table 5.4 Frequency and Percentage of Spheroids with Sooting by Site. This table includes the data from Partial spheroids (P) *indicates combined site numbers

Site Name	Count of Sooted Spheroids	Percent Sooted per Site
Garrison Site*	1	5.3%
Huntington Canyon	5	35.7%
Median Village	6	17.1%
Evans Mound	5	17.2%
Paragonah Mounds	5	17.2%
Nephi Mounds	4	16.7%
Pharo Village	1	4.2%
Kanosh Mounds*	2	13.3%
Marysvale 7	1	33.3%
Five Finger Ridge	11	20.4%
Round Spring Site	2	13.3%
Snake Rock Village	2	11.1%
Grantsville Mounds*	3	75%
Deluge Shelter	1	100%
Uintah Basin Mound III	1	20%
Alice Hunt Site	1	100%
Cedar Mountain	1	33.3%

Depending on whether sooting was intentional or accidental, evaluating the subtype categorization for the 52 burnt spheroids might demonstrate trends in possible use-wear (Table 5.5). Most spheroids with sooting were spherical (S), followed by spheroids with one flat spot (F), two or more flat spots (2F), and then partial spheroids (P).

Table 5.5 Sooted Spheroid Subtypes

Subtypes of Sooted Spheroids	**Two or More Flat Spots (2F)**	**Asymmetric (A)**	**One Flat Spot (F)**	**Partial Spheroids (P)**	**Natural (N)**	**Oval (O)**	**Spherical (S)**
Count	7	1	10	7	5	2	20
Percentage of all sooted spheroids	13.5%	1.9%	19.2%	13.5%	9.6%	3.9%	38.5%

Sooting occurred only on stone material types (Table 5.6). Several of the spheroids with soot were made from sandstone, although the highest percentage of sooted spheroid per material type was Basalt (33.3%).

Table 5.6 Sooted Spheroids by Stone Type

Stone Types of Sooted Spheroids	**Basalt**	**Gabbro**	**Granite**	**Limestone**	**Quartzite**	**Sandstone**	**Tuff**	**Unknown**	**Vesicular Basalt**
Count	4	3	7	2	1	29	2	1	3
Percentage of Stone Type	33.3%	23.1%	12.1%	7.1%	7.1%	12.8%	6.7%	10%	17.7%

Stone spheroids might have been shaped and selected for use with fire and heating (assuming the sooting was intentional). The sphericity of a stone affects its ability to hold warmth, the more spherical a stone, the better the stone maintains heat (Neubauer 2018). To test whether Fremont spheroid manufacturers were selecting rounder spheroids for use with fire

I created a boxplot showing the degree of roundness for spheroids without sooting (0) and with sooting (1) (Figure 5.47).

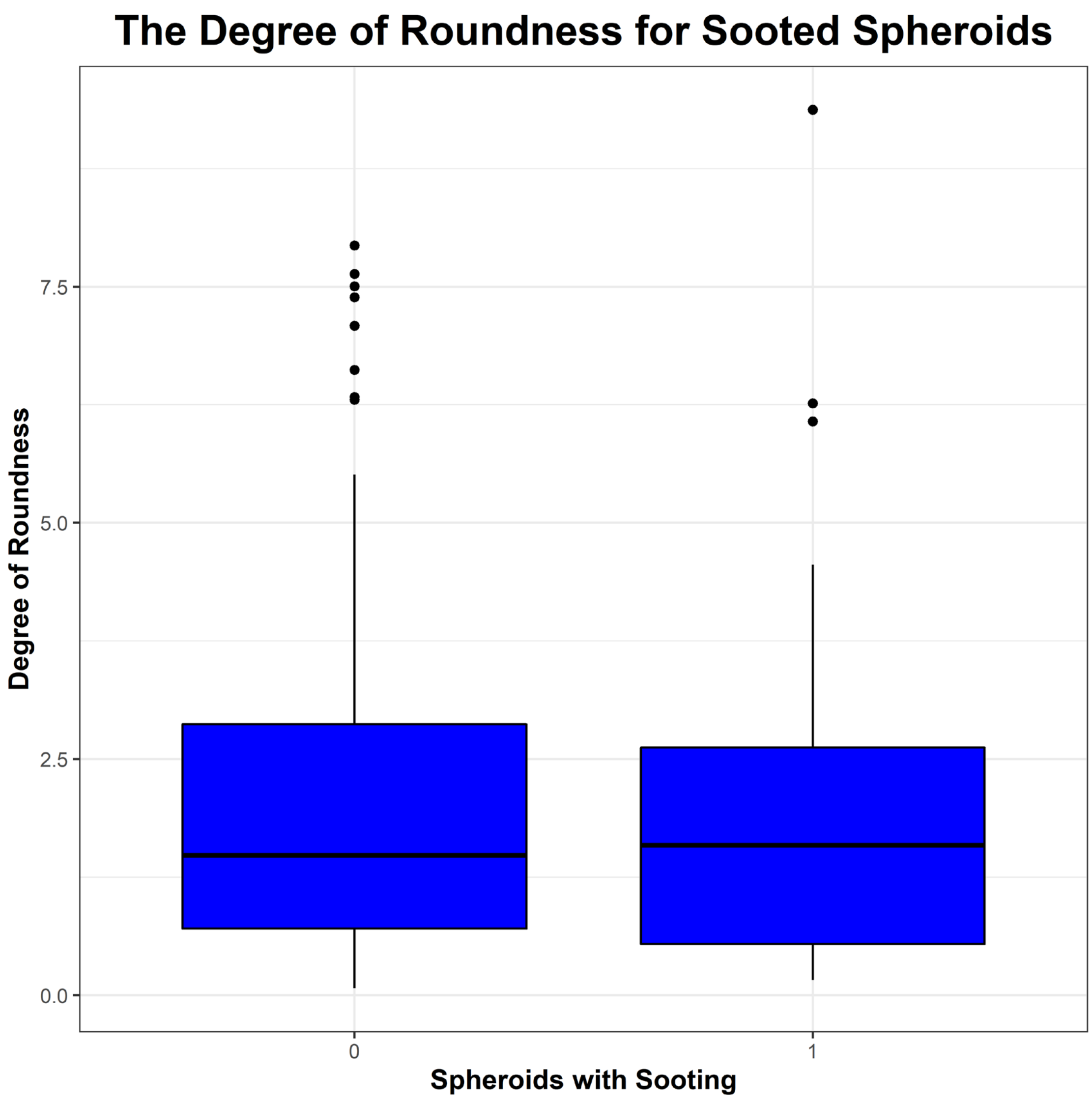


Figure 5.47 Boxplot showing the degree of roundness for spheroids without sooting (0) and spheroids with sooting (1). *Partial spheroids were excluded (n=401).

In Figure 5.47, spheroids without sooting had a slightly lower median degree of roundness than those spheroids with sooting. The higher median degree of roundness for spheroids with sooting would indicate that Fremont spheroids with sooting were not being selected for purposes with heating (although the sample is small for spheroids with sooting). I conducted a significance t-test to confirm that there was no correlation between the degree of roundness and the occurrence of sooting on the spheroids from the sample. The p-value was high (p-value=0.6904), meaning that there was not a strong relationship between the roundness of a spheroid and its likelihood of exhibiting sooting. One possible explanation is that the spheroids do not all exhibit the same kind of fire exposure (something I did not account for with my presence/absence value). Some spheroids might not have encountered fire, but rather became smudged with soot in some way.

The size of a stone is a key contributor to holding and radiating heat as well as the sphericity; small rocks cool at an even rate, whereas large rocks cool at a slower rate (Neubaurer 2018). The average diameter of sooted spheroids might indicate whether Fremont people used smaller stones for heating purposes (assuming that the sooting was intentional on the spheroids). Figure 5.48, shows that spheroids without sooting (0) had a lower median average diameter than the spheroids with sooting (1). When a significance t-test is run, the correlation between size and sooting is significant (a p-value of 0.000076). This significantly low value means that the average diameter may have been related to the size of spheroids chosen for burning. Although, it is difficult to truly conclude that the spheroids with soot were intentionally used with fire.

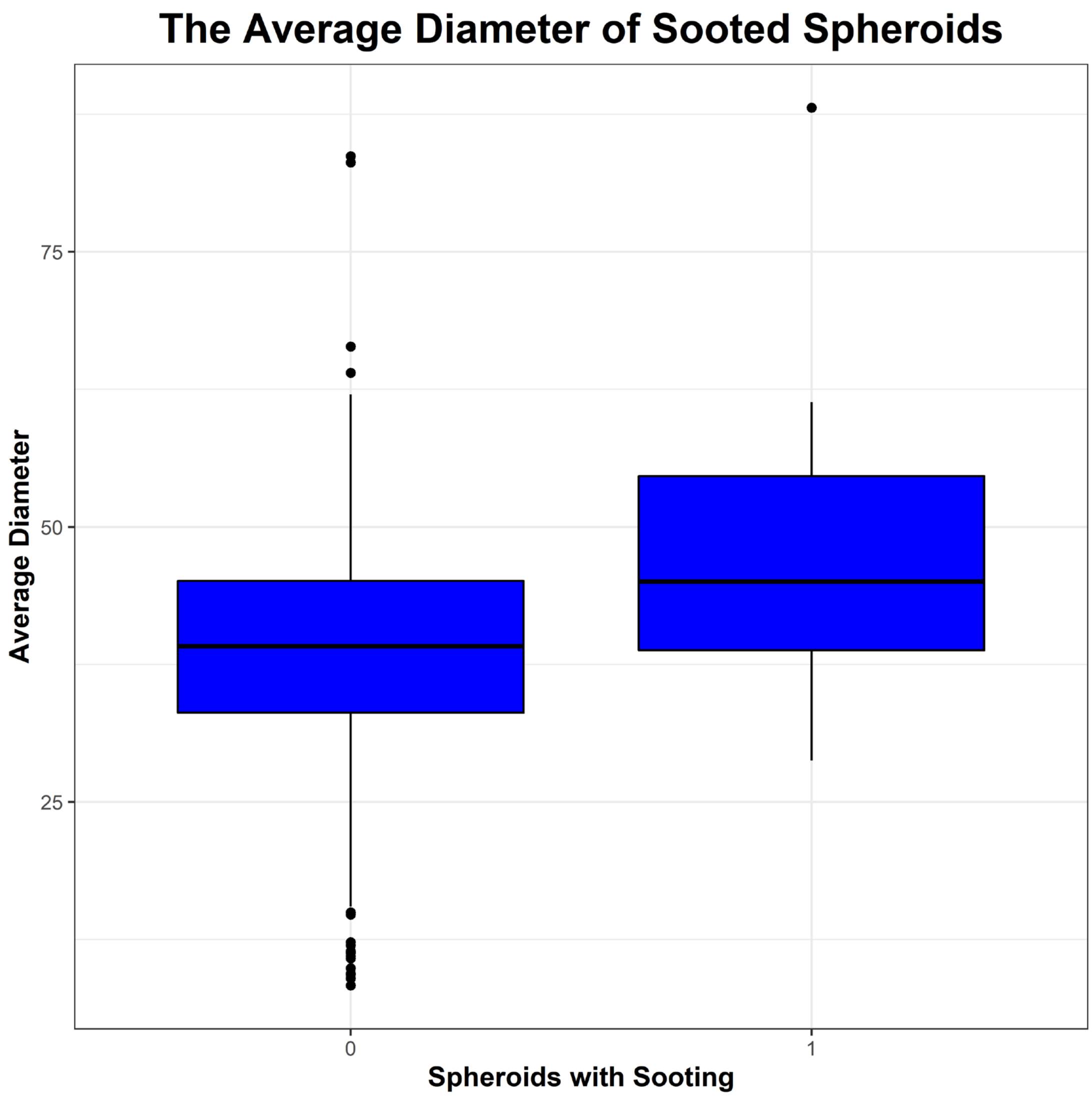


Figure 5.48 Boxplot depicting the average diameter for spheroids without sooting (0) and spheroids with sooting (1). *Partial spheroids were excluded (n=401).

Some spheroids were difficult to differentiate black discoloration from burn marks, which might have caused discrepancies in the sample. Another possibility is that some spheroids were used in cooking, and no trace of ash or burning was left. Experimental archaeology and ethnographic analogies would be the best methods for viewing what spheroids of various stone types might look like after repeated cooking use. As previously mentioned, it is difficult to conclude that all the spheroids categorized as sooted have the same type of sooting. Likely, some spheroids have evidence of heat use-wear, and others got smudged with soot either purposefully or not.

Pigments, such as red powders, appeared on 165 spheroids (37.7% of the dataset). Figures 5.49 through 5.53 show variations in hue of the red coloring observed on spheroids. My observation of pigment was simply to note the presence or absence on a spheroid's surface. Many of the 165 spheroids had only little spots of red on the surface, rather than being completely covered. Some spheroids with orange or pink dirt covering the whole spheroid might have been counted as pigment; the spheroids that were covered in a colored substance usually belonged to a site where all the other spheroids seemed to be covered in the same dust. I tried to look for a substance that really looked imbedded into the spheroid rather than loosely covering the spheroid.

Figure 5.49 Spheroid with red pigment covering the whole surface and a spot of darker red pigment is observed on the center of the spheroid in the photo. Courtesy of Natural History Museum of Utah (UMNH 42MD2 9085).

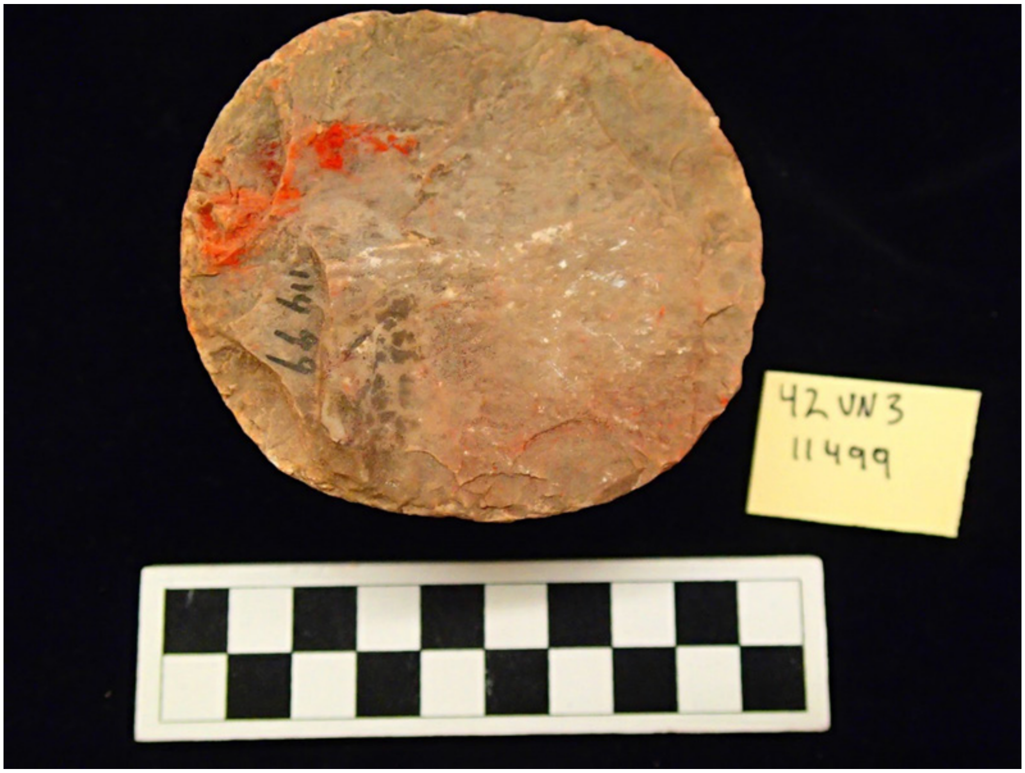


Figure 5.50 Partial spheroid (P) with caked on pigment in one location. Courtesy of Natural History Museum of Utah (UMNH 42UN3 11499).

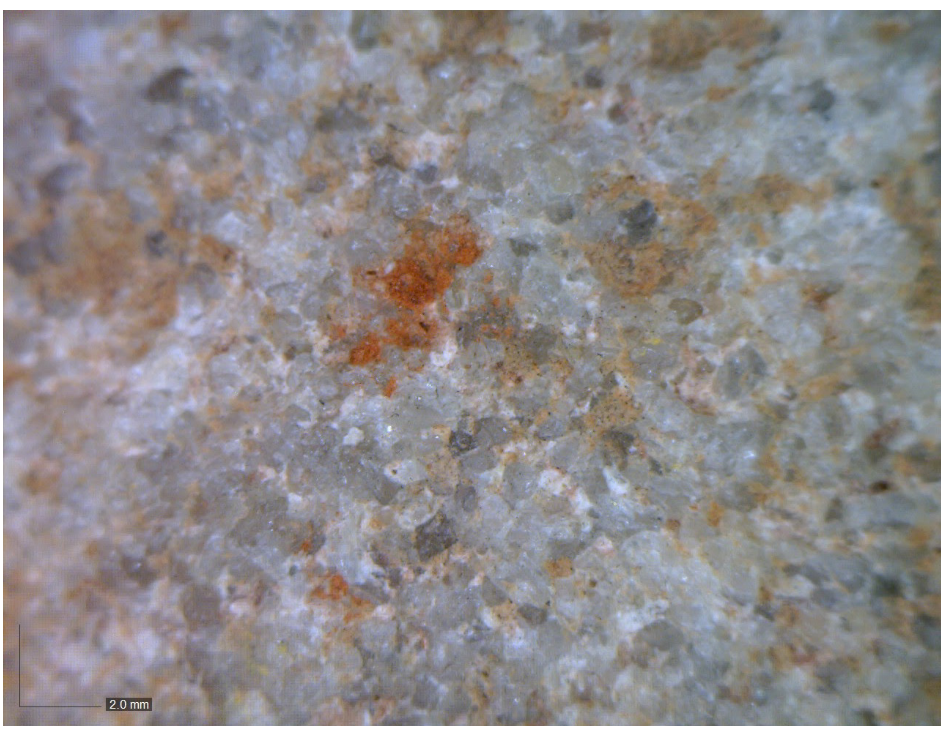


Figure 5.51 Pigment seen in the crevices of sandstone spheroid. Courtesy of Natural History Museum of Utah (UMNH 42IN43 758).

Figure 5.52 Pigment covering the whole spheroid. Courtesy of Natural History Museum of Utah (UMNH 42IN40FS269.4).

Figure 5.53 Sandstone spheroid with flat spots and unequally distributed pigment on the surface. Courtesy of Natural History Museum of Utah (UMNH 42SV662FS236.26).

The presence of pigment on spheroids could be ceremonial, functional, or even accidental. I assumed that if the presence of pigment was an intentional variable, then evaluating the spheroid subtypes might give insights into functionality. If more spheroids with flat spots (F and 2F), had pigment than all the other spheroid types this might indicate that these types of spheroids were either ritually significant or used to grind pigment. The most common spheroid subtypes with pigment were spheres (S=62) and spheroids with one flat spot (F=46) (Table 5.7). This finding was not surprising because both spheres (S) and spheroids with one flat spot (F) represent the majority of spheroids in the dataset. However, I wanted to see if there was a possibility that any of the spheroids with pigment were also noted as having finger holds. This would be a better indicator that some of the spheroids with pigment were used functionally rather than relying on the presence of flat spots (which could be a result of the smoothing process when polishing the spheroid). I realize that a conclusion would be hard to make based solely on the correlation of pigment and finger holds. Spheroids with flat spots or finger holds might have been rubbed with pigment at a separate time and never ground pigment.

Table 5.7 Pigment Spheroid Subtypes and the Percentage of Pigment Spheroids per Subtype

Spheroid Subtype	**Two or More Flat Spots (2F)**	**Asymmetric (A)**	**One Flat Spot (F)**	**Partial Spheroids (P)**	**Natural (N)**	**Oval (O)**	**Spherical (S)**
Count	16	8	46	11	12	10	62
Percent of all Spheroids with pigment	9.7%	4.9%	27.9%	6.7%	7.3%	6.1%	37.6%

There were 35 spheroids that had the presence of pigment and finger holds. The other 130 spheroids with pigment did not have finger holds, likely meaning that spheroids were not used to grind pigments. As an example, I looked at Five Finger Ridge, which had 14 spheroids with pigment and 14 spheroids with finger holds to see if those spheroids overlapped, but most of the spheroids did not overlap.

There were 32 different sites that had spheroids with pigment on them (Figure 5.54). The distribution map in Figure 5.54 depicts the percentages of spheroids with pigment at each of the 32 Fremont sites. Some of the sites that contributed many of the spheroids in this sample had small percentages of spheroids with pigment. Five Finger Ridge had 54 spheroids that I analyzed and 14 spheroids with pigment (25.93% of total spheroids that I analyzed from the site). Paragonah was represented by a 100% dot because all 29 spheroids from that site had pigment, which makes Paragonah seem uncommon.

There does not seem to be a pattern for spheroids with pigment. Pigment occurs in varying percentages among Fremont sites. No distinct regions appear, which would have suggested that pigment use was concentrated in one area. The lack of pattern could be due to the difference in excavation of spheroids at a site. Some sites might have been looted before excavation. There is also a chance that some spheroids had pigment and were washed after being collected or acquisitioned.

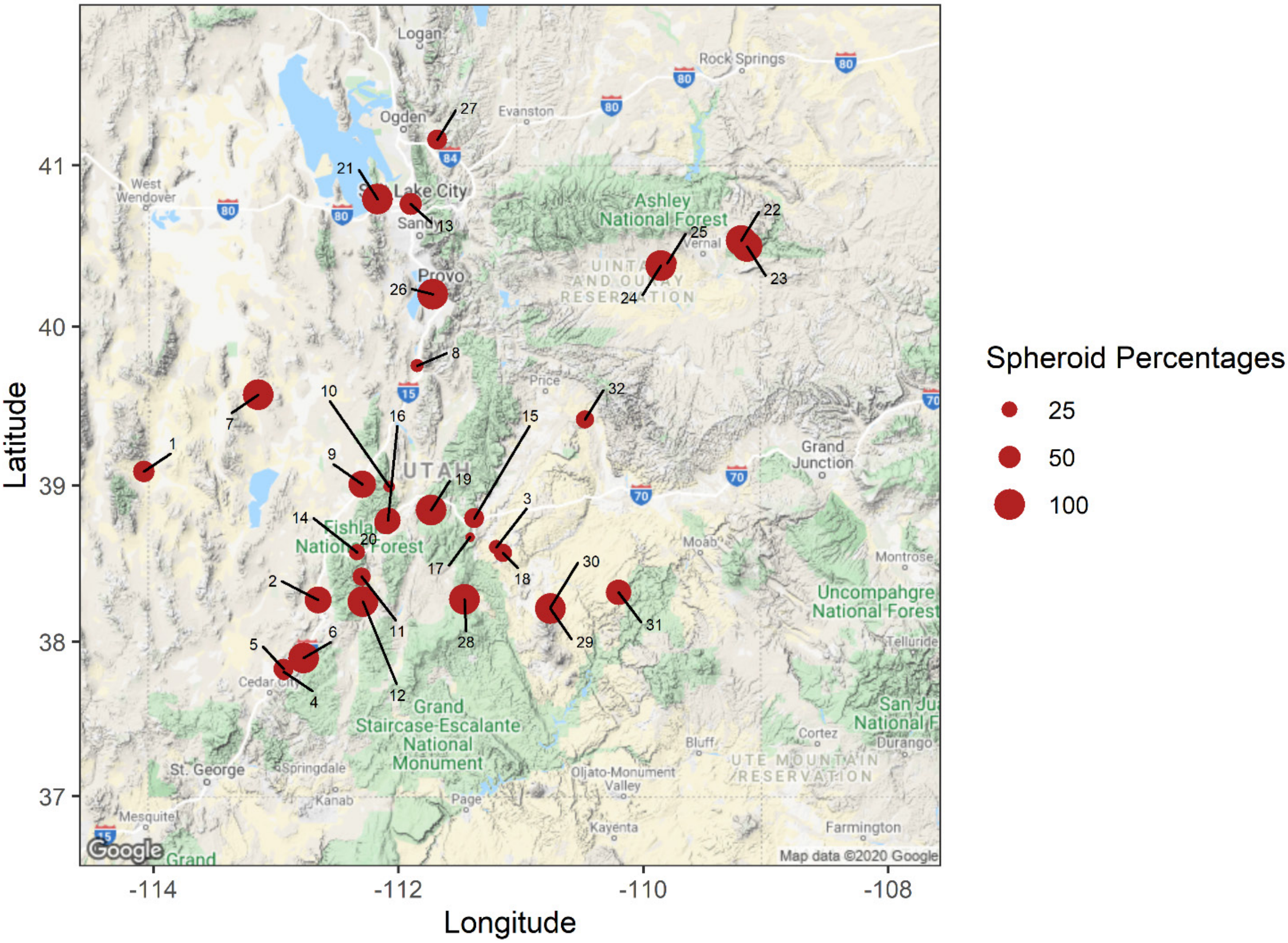


Figure 5.54 Distribution of spheroids with pigment throughout the Fremont region.

(1) Garrison Site, (2) Beaver Mounds, (3) 42EM63, (4) Median Village , (5) Evans Mound, (6) Paragonah Mounds, (7) Fish Springs Man Site, (8) Nephi Mounds, (9) Kanosh Mounds, (10) Pharo Village, (11) Marysvale 7, (12) 42PI508, (13) Block 49, (14) Five Finger Ridge, (15) Popular Knob, (16) Mukwitch Village, (17) Round Spring Site, (18) Snake Rock Village, (19) Nawthis Village, (20) Backhoe Village, (21) Grantsville Mounds, (22) Deluge Shelter, (23) Goodrich Site, (24) Uinta Basin Mounds, (25) Caldwell Village, (26) Benson Mound, (27) Injun Creek, (28) Grumpy George Site, (29) 42WN238, (30) Playa Site, (31) Cow Boy Cave, (32) Cedar Mountain, Ut

Figure 5.55 A likely washed spheroid described in UUAP as having ochre. Possible evidence of ochre observed on the bottom of the spheroid. Courtesy of Natural History Museum of Utah (UMNH 42IN40FS1220.11).

One spheroid, 42IN40FS1220.11, which appeared in a University of Utah Archaeological Papers (UUAP) for the Evans Mound Site was said to have ochre (Dodd 1982:Figure 24). I did not observe any ochre on the spheroid until I took a picture and observed a reddish hue in the picture on the bottom portion of the spheroid (Figure 5.55). This reddish hue was likely the ochre in the crevices of the spheroid that appeared when the lighting reflected off the iron oxide of the ochre. There was another spheroid mentioned in the same publication as having ochre that was not observed, but I did see slight discoloration that I think could have been the remnant of pigment that had been removed. There is the possibility that other spheroids were washed, erasing the evidence of ochre.

There were 25 spheroids with both the presence of pigment and sooting (Figure 5.56) The spheroid depicted in Figure 5.56 is unique, as I did not see any other spheroids like it.

Figure 5.56 Spheroid with pigment and soot. Courtesy of Natural History Museum of Utah (UMNH 42SV5FS416.67).

6. Conclusions

Fremont spheroids widely vary in attributes. The large variation might be due to the spheroids having distinct functions and partly because of the differences in the way spheroids have been categorized in the past.

Spherical objects appear widely throughout the Fremont region, yet they are not abundant (e.g. more than 20 spheroids) at any given site. There is no reason to suggest that spheroids were mass produced by a group of craft specialists or one faction of people, which could have resulted in standardized size categories and other spheroid attributes. These spheroids cannot be summarized as serving one purpose. Spheroids were probably used in numerous ways, although determining function was outside the scope of my thesis.

Spheroids predominantly come from Fremont sites, such as Five Finger Ridge, Backhoe Village, Median Village, Evans Mound, Paragonah Mounds, Nephi Mounds, Pharo Village, Garrison Site, Snake Rock Village, Kanosh Mounds, Round Spring Site, Huntington Canyon, and Beaver Mounds. Many of the listed sites were excavated comprehensively for many years, which could have resulted in more spheroids being collected from these sites. The length of time spent at a site by prehistoric peoples might also have contributed to the large number of spheroids from some of these long-term occupational sites.

Stones constitute the majority of the sample in the dataset, although I analyzed five mineral, one adobe, and one bone spheroid. Softer, more workable stone types were chosen by the Fremont to shape raw material into a spherical shape. A large portion of stone spheroids were made from sandstone. Sandstone seems to be a versatile rock type ranging from large grain to fine grain. Sandstone can be easily breakable, or friable, which would make shaping spheroids from this material type easier than other material types.

The other common rock types included granite, tuff, limestone, vesicular basalt, quartzite, gabbro, basalt, chert, and shale. Steward (1936), Taylor (1957), and Metcalf et al. (1993) similarly listed sandstone, limestone, granite, basalt, lava, chalcedony, quartzite, pumice, obsidian, chert, and flint as several of the rock types observed among stone spheroids in their studies of the Fremont. This sample seems to have confirmed some of those listed stone types by other Fremont archaeologists.

I summarized the measurements weight, volume, density, degree of roundness, and average diameter without a portion of my data; I omitted all partial (P=37) spheroids from my sample because of the discrepancies that these fragmented spheroids caused. The median measurement for weight was 74 grams, whereas the average weight was 94.2 grams. Two large outlying spheroids caused the average weight to be higher. Most spheroids weighed less than 125 grams. The weight range 40 grams to 80 grams encompasses the majority of spheroids, which may suggest that this weight range is related to function. The other spheroid weights might indicate distinct functions as well, such as smaller weights are likely indicative of beads or small gaming stones. When exploring the relationship between weight and average diameter, I found an obvious, positive nonlinear correlation, as spheroids larger in size also appear to be heavier.

The histograms for spheroid volume, density, and average diameter showed a smooth spread indicating that there is a highly variable sample represented. Spheroids typically had a volume size of less than 100 cm^3. The median measurement for volume was 32.5 cm^3, and the average measurement was 41.4 cm^3. Once again, a few outlying spheroids have caused the average for volume to be higher. The correlation between volume and weight was a strong positive linear correlation, which means that the larger the volume the heavier the spheroid. This finding is not surprising; materials with similar densities will weigh more if they are larger in size. Overall, the spheroids had a median density of 2.4 g/cm^3 and an average measurement of 2.3 g/cm^3. Many spheroids had densities ranging between 1.3 g/cm^3 and 3.6 g/cm^3. The volume measurement and the density measurements were likely impacted by the placement of my six diameter measurements and the resulting average diameter measurement. These measurements might have slightly skewed the spread of the histograms representing volume, density, degree of roundness, and average diameter.

The degree of roundness ranged from 0.08 to 9.37. The median measurement for degree of roundness was 1.52 and the average degree of roundness measurement was 1.96. Asymmetrical (A), oval (O), and spheroids with flat spots (F and 2F) might have altered these measurements to be higher. Most spheroids had a degree of roundness measurement of less than 5 with the bulk of spheroids falling in the range of 0 to 1.25. Looking at the degree of roundness for each spheroid subtype (one flat spot (F), two or more flat spots (2F), natural or concretion (N), asymmetrical (A), oval (O), and sphere (S)) indicated that oval (O) and asymmetric spheroids (A) had the largest medians for degree of roundness (partial spheroids (P) were excluded). Asymmetrical (A) and oval spheroids (O) had the most varied diameter measurements, which it is not surprising that these subtypes would have high degrees of roundness because of their asymmetry. The lowest median for degree of roundness was spheres (S). The subtypes one flat spot (F) and two or more flat spots (2F) had low medians for degree of roundness, which may suggest that those spheroids with flat spots are generally rounder than asymmetrical (A) or oval spheroids (O). In order to resolve some of the discrepancies that may have resulted in the calculating of degree of roundness, more than six diameter measurements could be made.

Anderson (1967:79) mentioned that Fremont spheroids were “very nearly spherical.” When I tried grouping the degree of roundness to find the highly spherical spheroids, I found that 147 spheroids had the lowest degree of roundness grouping of 0-1. There were 92 spheroids in the second lowest degree of roundness group of 1-2. Together, those spheroids with a degrees of roundness value less than 2 comprise 59.6% of all the whole spheroids in the dataset (n=401). These degree of roundness groups do not represent categories that Fremont people intended to create when they manufactured the spheroids. These categories are useful in distinguishing the variances in roundness for the spheroids in the data sample.

As mentioned previously in this chapter, the average mean diameter histogram had a symmetrical spread suggesting that spheroid sizing was highly variable. The range in average diameter spanned from 8.33- 88.10 mm (partial spheroids (P) were not included in my assessment of average diameter). The average mean diameter was 39.69 mm and the median was 39.60 mm. I created a histogram with binned sizes to evaluate possible size categories and to look for any modal distribution. There does not seem to be any inherent size categories. The majority of spheroids ranged from 31 to 50 mm in average diameter.

Comparing the average diameter range in this thesis to other ranges specified by Fremont archaeologists, I found that Madsen’s and Lindsay’s (1977) range of 34 mm to 54 mm corresponds to the range for the bulk of this data. Anderson’s (1967) range of 25.4 mm to 101.6 expands the size categories for Fremont spheroids, but includes some larger spheroids than were observed in this dataset.

Each subtype of spheroids (excluding partial spheroids (P)) had unique average diameter medians; asymmetrical spheroids (A) had the highest median. Natural spheroids (N) had the smallest median for average diameter (around 30 mm). Spheres (S) had the second smallest median average diameter (around 40 mm). Many archaeologists have suggested that spheroids which functioned as gaming implements were equal to or smaller than 40 mm in average diameter; perhaps the low medians for natural spheroids (N) and spheres (S) support this notion (Adams 2013; Allchin 1957).

Analyzing the spheroids and assigning them subtype categories has proved a useful way to create and compare roundness and size ranges. These subtype categories (one flat spot (F), two or more flat spots (2F), natural or concretion (N), asymmetrical (A), partial (P), oval (O), and spheres (S)) are recommended for future use when evaluating Fremont spheroids. Spheres (S) seemed to be the subtype with the most spheroids (n=131), followed closely behind by spheroids with one flat spot (n=124). Many of the spheroids with flat spots had subtle flat spots (not highly ground flat spots), which may indicate that these flat spots were passively formed, perhaps during the smoothing process.

I found that most spheroids with flattening in the dataset (subtypes 2F and F) were made from sandstone or granite. Sandstone also seems to have an abrasive texture, depending on the size of the grain matrix. This rough texture might have been used to grind with, which might explain the high number of flattened spheroids made from sandstone. Although, the percentage of flattened sandstone spheroids to all spheroids made of sandstone was one of the lower percentages. The highest percentage of flattened spheroids per stone type was vesicular basalt with a 58.8% of vesicular basalt spheroids exhibiting flat spots. Vesicular basalt also happens to be a common material type for manos. Vesicular basalt might also be a desirable grinding tool because it does not precipitate as much as some types of sandstone.

I rated the level of smoothing and shaping each spheroid had by feeling the surface of the spheroid. The smoothest texture level was 5 and the roughest texture level was 1. Most spheroids in the dataset had a texture level of 2 or 3. I did find that as the texture level got smoother (closer to 5), the degree of roundness got smaller. The naturally abrasive or coarse-grained rock types might have received lower texture level scores. I tried to include evenness of surface as part of the texture level. I had no sure way of determining a spheroid's potential for smoothness, which makes these texture determinations subjective.

Adams (2013) mentioned spheroids showing evidence of being wrapped in hides or from holding that exhibited a sheen. Spheroids that I determined to be a texture level of 5 might fit that description, although differentiating between patination and sheen was not something I recorded. From my notes I mentioned 29 spheroids that had some kind of sheen (which included some of the spheroids that were categorized as a texture level of 5).

Recesses, which I referred to as divots on the spheroids surface, flat spots, and finger holds were likely indicators of use-wear. There were 321 spheroids with divots on their surface. I did not distinguish natural versus human-made divots in my presence/absence value. Spheroids with flattening, which is another way I referred to flat spots in my analysis, were observed on subtypes one flat spot (F), two or more flat spots (2F), natural (N) and partial spheroids (P). Overall, 183 spheroids displayed some form of flattening. When spheroids had recesses or divots in combination with a flat spot or a pecked area, I checked if I could hold the spheroid by the divots with the flat spot facing out so that it would be positioned to grind. There were 101 spheroids categorized as having finger holds.

I assumed that these divots and flat spots were used for grinding because Adams (2013:103) indicated that "strategically designed manos are pecked and ground into specific shapes" and that sometimes those strategically designed manos have "finger grips (roughened areas to make a smooth stone easier to hold)." It is possible that flat spots or divots might be a natural part of the spheroid-making process and therefore these qualities alone do not represent function. Typically, I viewed the correlation of recesses and adjacent or opposite flat spots as indicative of spots to hold onto the spheroid for grinding by the user.

Most of the spheroids with finger holds occur in the Sevier River valley. The Round Spring Site and Evans Mound had spheroids that were described as flattened or ground in some manner (Metcalf et al. 1993; Dodd 1982). I did find that there were four spheroids that had finger holds from the Round Spring Site, and seven spheroids with finger holds from the Evans Mound Site. Pharo Village had a percentage of 45.8% of spheroids with finger holds to spheroids at the site. Marwitt (1968) did not indicate in the Pharo Village site report that there were spheroids exhibiting flat spots or evidence of grinding.

Grooving (carved lines of varying depth) was observed on 19 spheroids (4.3% of spheroids in the dataset [n=438]). Grooves appeared as either one groove around the spheroid, two or more grooves that crossed in an x, or grooves that did not connect and sometimes made curved lines or spirals. Grooved lines appeared on all subtypes of spheroids except partial spheroids (P). Some of the natural spheroids with grooves could have had different functions from the rest of the grooved spheroids, which I assumed based on their small size. Grooving likely indicates a functional use for these spheroids, although since some of the grooving resembled spirals it is possible that some grooves might have been a form of self-expression or a design element relating to rituals. Other forms of alteration to a spheroid's surface were nail imprints on clay spheroids and incised designs, such as the design observed on 42MD180FS184.58 that resembled a face.

Sooting, burn marks, and smudging with soot, were characteristics I observed on 52 spheroids in the dataset. The presence of soot on these spheroids does not indicate intentional sooting. There are various ways a spheroid might have encountered soot, such as being burned in a house fire, accidentally being dropped into a fire, or through heating a stone for cooking or stone boiling. I do not try to conclude whether a spheroid was intentionally sooted or accidentally sooted, but I do explore various patterns that might be present if a spheroid was intentionally sooted.

Some spheroids might have become sooted during what Bodily (2012) referred to as ritual abandonment, a ceremony in which the Fremont burned down site structures as a form of leaving an area. Five Finger Ridge had several structures that were burned after being abandoned (Talbot et al. 2000). Some of the spheroids from Five Finger Ridge appeared to have ash on them. The 11 sooted spheroids from Five Finger Ridge might be a possible link to recognizing whether the sooting observed on some spheroids comes from ritual burning, but more research would need to be done to make that conclusion.

I evaluated the subtypes for spheroids with sooting and found that the majority of these spheroids were spheres (S=20). The second most common subtype for sooted spheroids was one flat spot spheroids (F=10). Sooting only occurred on spheroids made of stone. Several sandstone spheroids were sooted, but basalt had the highest percentage (33.3%) of sooted spheroids per type of spheroid.

Neubaurer (2018) indicated that rounder spheroids hold heat more effectively. I tested whether the spheroids from the sample that were sooted had high levels of degree of roundness.

The significance t-test between the degree of roundness and spheroids with sooting resulted in a high p-value of 0.2233 (a significant p-value must be less than 0.05) suggesting that there was no correlation between sooted spheroids and their degree of roundness.

The size of the stone has also been noted as an important factor in holding and distributing heat (Neubaurer 2018). Neubaurer (2018) suggested that smaller spheroids would have cooled at an even rate. To gauge whether the smaller spheroids were sooted, I conducted a significance t-test. The sooted spheroids in the dataset had higher median average diameters than the non-sooted spheroids. A significance t-test resulted in a p-value of 0.000076, which is a low value meaning the relationship between average diameter and sooting is significant. My findings were contrary to smaller spheroids being sooted, contradicting the likelihood that the sooted spheroids could have been used as heating stones according to the criteria mentioned by Neubaurer (2018). I realize that I cannot assume all the sooted spheroids were used in the same way or became sooted in the same manner.

Since I did not distinguish the type of soot that occurred on spheroids, it would be hard to determine that these spheroids would have been used for heating (such as in stone boiling) instead of just encountering soot. Experimental archaeology and ethnographic analogies might prove to be the best methods of explaining sooting on spheroids.

The presence of pigments, such as red powder, was observed on 165 spheroids (37.7% of the spheroids [n=438]). Many spheroids had spots of pigment instead of being covered in pigment. When a spheroid was found covered in pigment, most of the other spheroids from that site also had pigment covering them (e.g. Kanosh Mounds). Some spheroids might have been unintentionally smudged with pigment, but for this thesis I assume that some spheroids were covered in pigment intentionally, either functionally as grinding stones or for ceremonial use.

The most common spheroid subtypes with pigment were spheres (S=62) and one flat spot spheroids (F=46). These subtypes are also the most common subtypes in the sample. To further determine if spheroids with pigment may have acquired their pigment through a functional use, I analyzed which of these spheroids had finger holds. There were 35 spheroids with the presence of finger holds, which is a low percentage (21.2% of pigment spheroids). Spheroids exhibiting pigment were likely not widely used to grind pigment, but it is plausible that this is one of their uses.

There were 32 different Fremont sites that had spheroids with pigment on them. The percentage of spheroids with pigment at the 32 different sites varies and does not seem to fit into a pattern. This suggests that the use of pigment on spheroids occurred widely throughout the Fremont region. One interesting site is Paragonah because the 29 spheroids from that site that I analyzed all exhibited pigment. Paragonah was reported as having 77 spheroids, which if the other spheroids did not have pigment might make the large number of pigment spheroids seem less incredible (Judd 1919). More spheroids could have the presence of pigment but were possibly washed erasing any traces of added color.

The presence of both sooting and pigment occurred on 25 spheroids. Spheroids were likely made by individuals, which would explain the wide variety seen in the sample.

Summary of Spheroid Distribution Map

Spheroids appear throughout the Fremont region, indicating their ubiquity among Fremont people (Figure 5.1). Janetski (2017) affirmed that spheroids differ in frequencies throughout the region, but that there is a wide range of sites containing spheroids. Spheroid numbers seem to increase towards the south end of the Wasatch Mountains and to the southwest portion of Utah. The large numbers of spheroids from these regions may be correlated with the amount of excavation that took place at those sites as mentioned previously in this thesis. Based on the widespread occurrence of spheroids, manufacturing spherical objects was common among many Fremont communities.

In order to establish the extent of this south west aggregation of spheroids, I contacted several museums outside of Utah. I wanted to know if spheroids might have been found in Nevada and continued towards California. I knew that spheroids had been found in Nevada, Oregon, and California, but from an earlier time period (Sutton and Koerper 2009). There was a possibility that some contemporary spheroids existed in these areas as well.

The Arizona Museum of Natural History, Mesa, had 16 spheroids in their collection of various sizes. All the provenienced spheroids came from Hohokam contexts, which overlaps chronologically with part of the Fremont culture period. The Lost City Museum in Nevada had seven spheroids. Two spheroids came from Overton, Nevada, and the other five spheroids likely came from the Moapa Valley and are attributed to the Virgin Branch Ancestral Puebloan culture. When I contacted museums in the Great Basin Region of Nevada, they did not have any spheroids to report. I did hear from one museum professional at the Northern Nevada Museum that she had encountered a site with about five or so clay spheroids during a survey in northern Nevada.

I did end up contacting some museums in Idaho to see if spheroids had been found there. There were at least two places where spheroids had been found in Idaho. Six spheroids came from Hagerman Valley in south eastern Idaho at a site that dated to AD 1250. These spheroids were described as polished, and then further characterized as possibly being “milling stones” (Murphey and Crutchfield 1985:53). Two other Idahoan spheroids came from Owyhee County, Idaho. When I received the photo of these spheroids, I noted that the spheroids were oval and disk shaped. The one museum I contacted in Colorado, the Denver Museum of Nature and Science, did not have any spheroids that came from the Colorado area.

The fact that so many spheroids existed around southern Nevada and Arizona makes me think that stone balls were trending in the south and west parts of this region in the U.S. It is possible that spherical objects, such as spheroids, were more of a southwestern cultural trait than a hunter-gatherer type trait, which is why little to no spheroids exist in northern Nevada.

Looking Forward

The next step in analyzing Fremont spheroids would be to focus on use-wear and residue analysis studies in order to determine possible spheroid function. Ethnographic analogies and experimental archaeology would contribute important functional possibilities for these objects when conducting use-wear analyses. During my initial research, I practiced making spheroids in a very informal exercise (Figure 6.1). I made a spheroid from gabbro using another rounded rock of similar or more hardness. I was surprised by how quickly I was able to create a spherical shape in a little over an hour. The spheroid was crude and further polishing would have shaped the spheroid better, but I learned that even a novice could make a spheroid without too much effort. I believe that the hardness of a rock would determine the timing and effort put into the shaping process. Finding rocks that were already round also helped speed up the shaping process so that I only needed to refine the rock slightly to form it into a spheroid.

It is likely that the spheroids in my dataset with a high texture level (such as 3, 4, or 5) took longer to make as they were likely subjected to polishing or smoothing of some kind. Reproducing a spheroid through experimental archaeology could help identify the amount of time needed to make and polish a spheroid. Experimental archaeology and further examination of the ethnographic literature might also help to establish the appearance of a spheroid after being heated for food production.

Figure 6.1 Author engaged in making a stone spheroid.

Residue analysis could also shed light on some of the functions of these spheroids. Although some spheroids may have been washed, other unwashed spheroids could have residues that might indicate function (e.g. food residue from grinding or cooking or blood protein from hunting with the spheroids as sling stones). Several spheroids from Kanosh Mounds and the Sevier Lake Site had a pinkish coating of some kind, and these residues could be assessed to determine which components make up that pigment.

Another fascinating direction for Fremont spheroid research would be to compare Archaic spheroids with the spheroids from the Fremont or historic periods. There could be some similarities between the two types, which might help lead to conclusions on whether Fremont people descended from a certain Archaic group. I found some archaic examples of pecked spheroids while analyzing the spheroids from Cowboy Cave. There might be a link in spheroids from archaic times to Fremont times supporting a continuous occupation of the Fremont region by those Archaic peoples who adopted Fremont cultural traditions. It could be that spheroids that are Archaic were related to those Californian and Oregon spheroids Sutton and Koerper (2009) mentioned, which would suggest interaction between Archaic peoples of Utah and California. Studying spheroids among Archaic and Fremont groups might also contribute to the discussion on Fremont interaction with people to the south, if Fremont spheroids are unique and resemble southwestern spheroids over the Archaic spheroids.

Possible Purposes for Spheroids

To repeat, the purpose of this research was to examine variation among Fremont spheroids not to determine function. But, considering some of my findings in light of ethnographic studies and the research of other archaeologists, I explore possible uses for these tools, but these will require more research in the realms of use-wear, experimental archaeology, and residue analysis to provide better conclusions.

Truly burned spheroids, not sooted spheroids, might indicate use-wear from processing food. Beck et al. (2017), mentioned how a Piaute informant suggested that stone balls may have been heated and then rolled around in baskets to process seeds. Another method of cooking is stone boiling which involves dropping a heated stone into a basket to cook stews and other foods in containers. Lowie (1924:226) wrote about an Uintah Ute who said that the Utes used "stone-boiling with baskets." These ethnographic accounts suggest that stones were used to process food, and based on what Neubauer (2018) stated, rounder stones (such as spheroids) may have been the most effective for use with heat. From personal observation, there seemed to be more sooting than true fire cracking or burning on most of the spheroids (although I did not make the distinction in the recording of this characteristic). It appears that many of the sooted spheroids I analyzed were simply smudged with soot.

The large number of spheroids with flat spots, and the presence of finger holds on spheroids could mean that some spheroids were manos. Adams (2013:103) wrote that "[expediently] designed manos have one or more grinding surfaces." An example of an expediently designed object would be taking a round river cobble and using it to grind on a netherstone. I did notice that several of the spheroids had flat spots, including some natural spheroids. Adams (2013:103) also related that strategically designed manos have "finger grips." Most of the spheroids in the dataset that had finger holds were intentionally shaped spheroids of the subtypes one flat spot (F) and two flat spots (2F). I believe that a portion of the spheroids represented in the sample were used as manos in some form of grinding. Residue analysis on these flat spot spheroids might help determine whether food was being ground. Madsen and

Lindsay's (1977) findings at Backhoe Village agree with the possibility that some stone spheroids functioned as manos. There were at least eight spheroids that had finger marks on them from Backhoe Village.

Some spheroids were likely used in ceremonies or rituals. Covering a spheroid in pigment might be evidence of ceremonial use. Although, I did not differentiate whether a spheroid was covered or just had the presence of pigment. It is difficult to determine whether a spheroid was ceremonially used. Taylor (1957) insinuated that the spheroid's placement in the floor of the shrine house likely paralleled Ancestral Puebloan rituals surrounding a ritual hole in the floor. Spheroids have been cited as being found in the floor of structures at Five Finger Ridge (Talbot et al. 2000). Archaeologists have thought that larger spheroids functioned as ceremonial objects (Sutton and Koerper 2009; Adams 2013). It is possible that the larger spheroids in my dataset, such as the outlying spheroids depicted on several of my graphs, functioned as ritual items. The sooted spheroids might also be indirect evidence of rituals, such as ritual abandonment.

Fingernail marks and incised designs on the spheroids could be evidence of intentional design or part of ceremonial use. The grooved spheroids might have been weights, although not for scales like Mann (1913) suggested as a use for the Scottish spheroids. These grooved Fremont spheroids could have been used to weigh down nets or could have been tied on as bolas. More ethnographic studies and possibly residue analysis might help prove this idea.

Kubikova's (2015) proposition that many spheroids are actually missiles might explain some of the spheroids in the sample. Egg shaped or oval stones have been described as throwing missiles, and perhaps some of my natural or oval spheroids functioned as throwing or sling missiles. Residue analysis might give insight into the possibility that slings were used in hunting.

Similar to what some have indicated, smaller spheroids could have been gaming stones (Yaeger 1986, Adams 2013; Allchin 1957). The size ranges some have cited for gaming spheroid is less than 38 mm or between 30 and 40 mm (Allchin 1957; Adams 2013). Russell (1908) told of a game played by Piman women with natural pebbles that were 30 mm to 40 mm in diameter where the women toss a stone in the air and then try to pick up one or more spheroids depending on her previous progress. Another game with natural pebbles that involves throwing is the juggling game Anderson (1967) described. He stated that ethnographic accounts of Paiute, Shoshone, Ute, and other tribes mention the use of mud and occasionally stone balls for a juggling game (Anderson 1967). Many spheroids in the dataset fit into the given size range of 30 to 40 mm in diameter. Janetski (2017) mentioned that his personal leaning was that Fremont spheroids were used in some kind of kicking race.

The Pima played a kick ball game with a ball that "resembles a croquet ball in size" (Russell 1908:172). The racers would kick a ball in front of them as they raced. Russell (1908) found that these balls were 60 mm in diameter. The spheroids in the dataset that had average diameters around 60 mm were not as numerous as those spheroids with diameters around 30 to 40 mm. Russell (1908) also related that these kick balls were made of wood.

The intent of this thesis was to analyze several hundred Fremont spheroids, many of which had never been analyzed in depth. Before this thesis, few pictures and measurements existed of Fremont spheroids, but now hundreds of spherical objects have been photographed and analyzed for future research. Residue analysis, experimental archaeology, and ethnographic analogies will help guide future studies on Fremont spheroids. Another facet for future Fremont spheroid research would be to compare spherical objects against Archaic and/or historic spherical objects.

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Appendix A: Sample Analysis

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
67.047.002.1	MPC	Nephi Mounds	42JB2	s	sandstone	N	s	3
72.042.008.001	MPC		42SV128	m	quartzite	N	o	4
92.1.1.2	MPC	Hinckley Mounds	42UT110	i	gabbro	A	i	3
72.42.5	MPC		42SV128	i	vesicular basalt	S	s	1
67.036.017	MPC	Nephi Mounds	42JB2	s	talc	F	s	4
73.478.003	MPC	Wolf Village	42UT273	i	tuff	F	s	1
2003.9.4.1	MPC	Smoking Pipe Site	42UT150	s	sandstone	N	o	2
86.12.2505	MPC	Block 49	42SL98	s	sandstone	F	i	1
86.12.2992	MPC	Block 49	42SL98	s	sandstone	O	o	3
88.131.005.001	MPC		Bee Site #64	i	basalt	N	s	1
98.20.231	MPC	Durfey Site	42WN2129	s	shale	N	s	3
2016.4.6.1	MPC		Tridell, Ut	s	sandstone	S	s	4
2016.4.6.2	MPC		Tridell, Ut	s	sandstone	S	s	3
73.464.001	MPC	White Farm	42UT295	s	sandstone	O	s	1
73.464.003	MPC	White Farm	42UT295	i	gabbro	O	i	1
86.5.343	MPC	Mukwitch Village	42SV2114	s	limestone	S	s	3
86.5.509	MPC	Mukwitch Village	42SV2114	s	sandstone	F	s	2
86.5.826	MPC	Mukwitch Village	42SV2114	s	limestone	F	s	3
86.005.884	MPC	Mukwitch Village	42SV2114	s	sandstone	F	s	2
86.005.076	MPC	Mukwitch Village	42SV2114	s	sandstone	H	i	3
86.5.1000	MPC	Mukwitch Village	42SV2114	s	limestone	H	s	2
67.043.062	MPC	Nephi Mounds	42JB2	i	tuff	F	s	3
67.043.063	MPC	Nephi Mounds	42JB2	i	basalt	F	s	3
67.043.064	MPC	Nephi Mounds	42JB2	i	vesicular basalt	S	s	1
67.043.065	MPC	Nephi Mounds	42JB2	i	tuff	2F	i	2
67.043.066	MPC	Nephi Mounds	42JB2	i	gabbro	F	s	2
67.043.068	MPC	Nephi Mounds	42JB2	i	rhyolite	F	s	4
67.043.069	MPC	Nephi Mounds	42JB2	mineral	galena	F	s	4

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
67.043.070	MPC	Nephi Mounds	42JB2	i	vesicular basalt	O	o	1
42BE974 3793	NHMU	Beaver Mounds	42BE974	s	sandstone	N	s	4
42BE974 3786	NHMU	Beaver Mounds	42BE974	i	tuff	S	s	3
42BE974 3787	NHMU	Beaver Mounds	42BE974	i	unknown	S	s	3
42CB3 15000	NHMU	Beacon Ridge N.M. 2	42CB3	s	sandstone	F	s	2
42BO57FS425.1	NHMU	Bear River No. 2	42BO57	m	quartzite	S	s	3
42BO57FS12.24	NHMU	Bear River No. 2	42BO57	s	sandstone	F	s	3
42BO57FS428.2	NHMU	Bear River No. 2	42BO57	i	granite	N	o	4
42BO57 FS99.50	NHMU	Bear River No. 2	42BO57	s	sandstone	2F	s	1
42UN95 FS66.98	NHMU	Caldwell Village	42UN95	i	basalt	S	s	4
42UN95 FS131.223	NHMU	Caldwell Village	42UN95	s	chert	S	s	4
42UN95 FS289.85	NHMU	Caldwell Village	42UN95	i	unknown	S	s	4
42UN95 FS410.9	NHMU	Caldwell Village	42UN95	s	sandstone	2F	s	4
42UN95 FS138.4	NHMU	Caldwell Village	42UN95	s	chert	F	s	4
42UN95 FS172.6	NHMU	Caldwell Village	42UN95	s	limestone	F	s	4
42SV662FS14.9	NHMU	Backhoe Village	42SV662	s	sandstone	F	s	1
42SV662FS377.5	NHMU	Backhoe Village	42SV662	s	clay	H	s	3
42UT3 11452	NHMU	Benson Mound	42UT3	s	sandstone	O	o	3
42BO98FS153.33	NHMU	Bear River No. 3	42BO98	s	fired clay	S	s	4
42WN261FS44.1	NHMU	Alice Hunt Site	42WN261	i	basalt	S	s	3
42UN95FS223.18	NHMU	Caldwell Village	42UN95	i	sandstone	2F	i	4
42UN95FS289.237	NHMU	Caldwell Village	42UN95	s	sandstone	2F	i	1
42SV662FS51.9	NHMU	Backhoe Village	42SV662	s	sandstone	S	s	4
42SV662FS169.5	NHMU	Backhoe Village	42SV662	s	sandstone	F	s	1
42SV662FS15.17	NHMU	Backhoe Village	42SV662	s	sandstone	2F	s	3
42SV662FS93.12	NHMU	Backhoe Village	42SV662	s	sandstone	S	s	2
42SV662FS452.4	NHMU	Backhoe Village	42SV662	s	limestone	S	s	3
42SV662FS452.6	NHMU	Backhoe Village	42SV662	i	tuff	2F	i	1

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
42SV662FS463.6	NHMU	Backhoe Village	42SV662	s	sandstone	A	i	2
42SV662FS236.26	NHMU	Backhoe Village	42SV662	s	sandstone	2F	s	3
42SV662FS379.50	NHMU	Backhoe Village	42SV662	s	sandstone	F	s	3
42IN40FS73.140	NHMU	Evans Mound	42IN40	s	limestone	F	s	4
42IN40FS26.2	NHMU	Evans Mound	42IN40	i	unknown	S	s	5
42IN40FS26.1	NHMU	Evans Mound	42IN40	s	sandstone	S	s	4
42EM47AR1524	NHMU	Emery Site	42EM47	i	tuff	S	s	1
42EM47AR1525	NHMU	Emery Site	42EM47	i	tuff	S	s	2
42SV5FS353.15	NHMU	Snake Rock Village	42SV5	m	quartzite	S	s	5
42IN40FS269.4	NHMU	Evans Mound	42IN40	s	sandstone	S	s	3
42IN40FS32.1	NHMU	Evans Mound	42IN40	s	sandstone	F	s	2
42IN40FS77.100	NHMU	Evans Mound	42IN40	m	chert	F	s	2
42IN40FS237.51	NHMU	Evans Mound	42IN40	s	sandstone	S	s	2
42IN40FS256.26	NHMU	Evans Mound	42IN40	s	sandstone	S	s	4
42IN40FS237.50	NHMU	Evans Mound	42IN40	i	gabbro	2F	s	3
42IN40FS96.1	NHMU	Evans Mound	42IN40	s	sandstone	2F	s	4
42SV7FS77	NHMU	Old Woman Site	42SV7	s	sandstone	S	s	5
42IN124FS124.86	NHMU	Median Village	42IN124	i	tuff	S	s	3
42IN124FS60.34	NHMU	Median Village	42IN124	i	limestone	S	s	3
42SV662FS102.166	NHMU	Backhoe Village	42SV662	i	tuff	A	i	1
42SV662FS166.16	NHMU	Backhoe Village	42SV662	s	sandstone	A	i	3
42JB179FS17.1	NHMU	Fish Springs Man Site	42JB179	mineral	iron concretion	H	i	4
42UN271FS29.22	NHMU	Goodrich Site	42UN271	i	tuff	S	s	2
42DC48FS12.1	NHMU	Flattop Butte	42DC48	s	slate	H	s	4
42IN40FS1085.28	NHMU	Evans Mound	42IN40	s	sandstone	N	i	3
42IN40FS71.37	NHMU	Evans Mound	42IN40	i	tuff	F	s	3
42IN40FS182.37	NHMU	Evans Mound	42IN40	s	sandstone	F	s	4
42IN40FS58.100	NHMU	Evans Mound	42IN40	i	basalt	S	s	4

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
42IN40FS1220.11	NHMU	Evans Mound	42IN40	s	sandstone	S	s	3
42IN40FS410.201	NHMU	Evans Mound	42IN40	s	sandstone	2F	s	2
42IN40FS540.66	NHMU	Evans Mound	42IN40	i	gabbro	S	s	2
42IN40FS557.23	NHMU	Evans Mound	42IN40	i	sandstone	S	s	4
42IN40FS341.1	NHMU	Evans Mound	42IN40	i	unknown	S	s	3
42IN40FS341.2	NHMU	Evans Mound	42IN40	s	sandstone	F	s	3
42IN40FS1147.32	NHMU	Evans Mound	42IN40	s	sandstone	N	o	4
42IN40FS1326.3	NHMU	Evans Mound	42IN40	s	sandstone	F	s	3
42IN40FS1266.1	NHMU	Evans Mound	42IN40	s	sandstone	A	s	4
42SV455FS35.4	NHMU	Fallen Woman Site	42SV455	s	limestone	H	i	2
42SV455FS43.23	NHMU	Fallen Woman Site	42SV455	m	metamorphic	N	s	3
42SV455FS79.3	NHMU	Fallen Woman Site	42SV455	s	sandstone	F	i	2
42SV455FS82.19	NHMU	Fallen Woman Site	42SV455	s	sandstone	S	s	2
26WP6 23484.2	NHMU	Garrison Site	26WP6	i	granite	O	o	3
26WP6 23484.36	NHMU	Garrison Site	26WP6	i	granite	S	s	3
26WP6 23484.37	NHMU	Garrison Site	26WP6	i	granite	F	i	3
26WP6 23485.2	NHMU	Garrison Site	26WP6	i	granite	A	i	2
26WP6 23495.5	NHMU	Garrison Site	26WP6	i	granite	S	s	2
26WP6 23495.6	NHMU	Garrison Site	26WP6	s	sandstone	S	s	1
26WP6 23495.7	NHMU	Garrison Site	26WP6	i	granite	F	s	3
26WP6 23516.33	NHMU	Garrison Site	26WP6	i	granite	F	s	3
26WP6 23522.2	NHMU	Garrison Site	26WP6	i	granite	S	s	3
26WP6FS23529.1	NHMU	Garrison Site	26WP6	i	granite	H	s	3
26WP7 23544.16	NHMU	Garrison Site	26WP7	i	granite	S	s	3
26WP7 23578.2	NHMU	Garrison Site	26WP7	i	granite	2F	i	3
26WP7 23597.1	NHMU	Garrison Site	26WP7	i	granite	S	s	4
26WP7 23599.5	NHMU	Garrison Site	26WP7	i	pumice	S	s	2
26WP7 23599.6	NHMU	Garrison Site	26WP7	s	sandstone	S	s	2

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
26WP7_23541.1	NHMU	Garrison Site	26WP7	i	granite	O	o	3
26WP7_23544.17	NHMU	Garrison Site	26WP7	i	granite	N	i	3
26WP7_23555.19	NHMU	Garrison Site	26WP7	i	granite	F	i	3
26WP7_23632.3	NHMU	Garrison Site	26WP7	i	granite	O	s	3
42MD2 9312	NHMU	Kanosh Mounds	42MD2	i	granite	O	s	3
42MD2 9293	NHMU	Kanosh Mounds	42MD2	s	sandstone	2F	s	4
42MD2 9235	NHMU	Kanosh Mounds	42MD2	i	unknown	N	o	3
42MD2 9085	NHMU	Kanosh Mounds	42MD2	i	granite	S	s	3
42MD2 9086	NHMU	Kanosh Mounds	42MD2	s	sandstone	F	o	3
42MD2 9048	NHMU	Kanosh Mounds	42MD2	s	sandstone	2F	s	3
42MD2 9089	NHMU	Kanosh Mounds	42MD2	s	sandstone	H	i	3
42MD1 9848	NHMU	Kanosh Mounds	42MD1	i	diorite	F	i	1
42MD4 9877	NHMU	Sevier Lake Site #2	42MD4	m	quartzite	F	i	2
42MD4 9876	NHMU	Sevier Lake Site #2	42MD4	m	quartzite	S	s	4
42MD4 9878	NHMU	Sevier Lake Site #2	42MD4	i	pumice	F	s	1
42MD1 9031	NHMU	Kanosh Mounds	42MD1	s	sandstone	S	s	3
42MD1 9311	NHMU	Kanosh Mounds	42MD1	s	sandstone	N	s	4
42MD1 9084	NHMU	Kanosh Mounds	42MD1	s	sandstone	O	o	3
42MD1 9381	NHMU	Kanosh Mounds	42MD1	s	sandstone	S	s	3
42MD1 9403	NHMU	Kanosh Mounds	42MD1	s	sandstone	A	i	2
42MD1 9083.1	NHMU	Kanosh Mounds	42MD1	s	sandstone	N	i	3
42MD1 9083.2	NHMU	Kanosh Mounds	42MD1	i	obsidian	N	s	3
42TO10 11286	NHMU	Grantsville Mounds	42TO10	i	granite	F	s	2
42TO8 11230	NHMU	Grantsville Mounds	42TO8	s	sandstone	N	o	3
42TO8 11664.1	NHMU	Grantsville Mounds	42TO8	i	granite	2F	s	2
42TO8 11664.2	NHMU	Grantsville Mounds	42TO8	i	granite	N	o	3
42WB34FS740.105	NHMU	Injun Creek	42WB34	m	quartzite	2F	s	4
42WB34FS740.95	NHMU	Injun Creek	42WB34	i	granite	F	i	1

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
42WB34FS740	NHMU	Injun Creek	42WB34	i	granite	N	s	1
42WB34FS559.10	NHMU	Injun Creek	42WB34	i	granite	F	i	1
42WN420FS11.2	NHMU	Cow Boy Cave	42WN420	s	sandstone	S	s	3
42WN420FS397.3	NHMU	Cow Boy Cave	42WN420	s	sandstone	S	s	3
42WN420FS842.7	NHMU	Cow Boy Cave	42WN420	s	sandstone	N	o	3
42UN3 11476	NHMU	Uinta Basin Mounds	42UN3	s	sandstone	2F	i	3
42UN3 11496.1	NHMU	Uinta Basin Mounds	42UN3	s	sandstone	F	s	3
42UN3 11496.2	NHMU	Uinta Basin Mounds	42UN3	s	sandstone	F	s	3
42UN3 11499	NHMU	Uinta Basin Mounds	42UN3	s	chert	H	i	3
42UN3 11477	NHMU	Uinta Basin Mounds	42UN3	s	sandstone	S	s	3
7387	NHMU	Nephi Mounds	42JB2	s	sandstone	S	s	4
7388	NHMU	Nephi Mounds	42JB2	s	sandstone	S	s	4
7365	NHMU	Nephi Mounds	42JB2	s	sandstone	O	o	2
42IN43 722	NHMU	Paragonah Mounds	42IN43	i	granite	S	s	2
42IN43 723	NHMU	Paragonah Mounds	42IN43	s	sandstone	2F	s	3
42IN43 739	NHMU	Paragonah Mounds	42IN43	s	sandstone	F	s	3
42IN43 758	NHMU	Paragonah Mounds	42IN43	s	sandstone	S	s	4
42IN43 796	NHMU	Paragonah Mounds	42IN43	s	sandstone	S	s	2
42IN43 902	NHMU	Paragonah Mounds	42IN43	s	sandstone	S	s	4
42IN43 913	NHMU	Paragonah Mounds	42IN43	s	sandstone	S	s	3
42IN43 2089	NHMU	Paragonah Mounds	42IN43	i	granite	S	s	3
42IN43 2170	NHMU	Paragonah Mounds	42IN43	i	granite	S	s	3
42IN43 2172	NHMU	Paragonah Mounds	42IN43	i	granite	S	s	2
42IN43 2459	NHMU	Paragonah Mounds	42IN43	i	granite	S	s	4
42IN43 3366	NHMU	Paragonah Mounds	42IN43	m	quartzite	N	s	3
42IN43 3601	NHMU	Paragonah Mounds	42IN43	s	sandstone	S	s	4
42IN43 3367	NHMU	Paragonah Mounds	42IN43	s	sandstone	F	s	3
42IN43 3424	NHMU	Paragonah Mounds	42IN43	i	granite	S	s	2

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
42IN43 2239	NHMU	Paragonah Mounds	42IN43	s	sandstone	S	s	2
42IN43 3423	NHMU	Paragonah Mounds	42IN43	i	granite	F	s	3
42IN43 2438	NHMU	Paragonah Mounds	42IN43	i	granite	F	s	3
42IN43 2171	NHMU	Paragonah Mounds	42IN43	i	gabbro	F	s	3
42IN43 2240	NHMU	Paragonah Mounds	42IN43	s	sandstone	S	s	4
42IN43 2169	NHMU	Paragonah Mounds	42IN43	i	granite	S	s	4
42IN43 2088	NHMU	Paragonah Mounds	42IN43	i	granite	F	s	4
42IN43 799	NHMU	Paragonah Mounds	42IN43	s	sandstone	H	s	3
42IN43 1102	NHMU	Paragonah Mounds	42IN43	s	sandstone	S	s	3
42IN43 1103	NHMU	Paragonah Mounds	42IN43	s	sandstone	S	s	2
42IN43 738	NHMU	Paragonah Mounds	42IN43	m	quartzite	F	s	3
42IN43 923	NHMU	Paragonah Mounds	42IN43	i	granite	S	s	3
42IN43 915	NHMU	Paragonah Mounds	42IN43	s	sandstone	F	s	4
42IN43 837	NHMU	Paragonah Mounds	42IN43	i	granite	2F	s	4
42EM73FS18.17	NHMU	Windy Ridge Village	42EM73	mineral	iron concretion	N	s	2
42JB2FS593.3	NHMU	Nephi Mounds	42JB2	s	sandstone	F	i	3
42WN267FS1	NHMU		42WN267	i	granite	F	s	2
42WN286FS1	NHMU		42WN286	s	sandstone	2F	i	2
42WN337FS1	NHMU	Playa Site	42WN337	i	granite	H	i	2
42WN238FS1	NHMU		42WN238	s	sandstone	S	s	3
42IN124FS451.30	NHMU	Median Village	42IN124	s	sandstone	F	i	3
42IN124FS62.142	NHMU	Median Village	42IN124	s	sandstone	F	i	2
42IN124FS345.105	NHMU	Median Village	42IN124	s	sandstone	H	s	3
42IN124FS52.20	NHMU	Median Village	42IN124	s	sandstone	N	i	3
42IN124FS309.96	NHMU	Median Village	42IN124	s	sandstone	2F	s	2
42IN124FS497.90	NHMU	Median Village	42IN124	s	sandstone	F	s	2
42IN124FS67.64	NHMU	Median Village	42IN124	s	sandstone	S	s	2
42IN124FS176.99	NHMU	Median Village	42IN124	i	vesicular basalt	F	s	1

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
42IN124FS281.57	NHMU	Median Village	42IN124	s	sandstone	S	s	2
42IN124FS209.199	NHMU	Median Village	42IN124	s	sandstone	F	s	2
42IN124FS366.4	NHMU	Median Village	42IN124	s	sandstone	S	s	2
42IN124FS353.23	NHMU	Median Village	42IN124	i	tuff	F	s	3
42IN124FS252.151	NHMU	Median Village	42IN124	s	sandstone	N	i	3
42IN124FS28.12	NHMU	Median Village	42IN124	s	sandstone	F	s	4
42IN124FS213.55	NHMU	Median Village	42IN124	s	sandstone	N	o	3
42IN124FS522.197	NHMU	Median Village	42IN124	s	sandstone	N	o	3
42IN124FS62.47	NHMU	Median Village	42IN124	s	sandstone	F	i	2
42IN124FS171.53	NHMU	Median Village	42IN124	i	tuff	S	i	1
42IN124FS201.45	NHMU	Median Village	42IN124	i	tuff	S	s	2
42IN124FS140.158	NHMU	Median Village	42IN124	i	gabbro	F	s	2
42IN124FS96.66	NHMU	Median Village	42IN124	i	vesicular basalt	2F	i	2
42IN124FS158.86	NHMU	Median Village	42IN124	i	vesicular basalt	F	s	2
42IN124FS58.42	NHMU	Median Village	42IN124	i	vesicular basalt	A	i	1
42IN124FS302.91	NHMU	Median Village	42IN124	s	sandstone	F	s	3
42IN124FS214.191	NHMU	Median Village	42IN124	i	basalt	N	s	4
42IN124FS213.68	NHMU	Median Village	42IN124	i	tuff	F	i	2
42IN124FS187.32	NHMU	Median Village	42IN124	s	limestone	H	i	3
42IN124FS433.10	NHMU	Median Village	42IN124	m	quartzite	H	i	3
42IN124FS166.46	NHMU	Median Village	42IN124	s	sandstone	H	i	2
42IN124FS310.27	NHMU	Median Village	42IN124	s	sandstone	F	s	2
42IN124FS363.6	NHMU	Median Village	42IN124	s	sandstone	H	s	2
42IN124FS233.92	NHMU	Median Village	42IN124	s	sandstone	H	i	2
42IN124FS294.25	NHMU	Median Village	42IN124	s	chert	H	i	3
42SV5FS128.85	NHMU	Snake Rock Village	42SV5	i	gabbro	N	s	3
42SV5FS240.3	NHMU	Snake Rock Village	42SV5	s	sandstone	N	i	3
42SV5FS414.1	NHMU	Snake Rock Village	42SV5	i	limestone	S	s	2

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
42SV5FS416.67	NHMU	Snake Rock Village	42SV5	i	tuff	S	s	5
42SV5FS137.1	NHMU	Snake Rock Village	42SV5	s	sandstone	N	s	4
42SV5FS193.124	NHMU	Snake Rock Village	42SV5	s	sandstone	N	o	4
42SV5FS168.27	NHMU	Snake Rock Village	42SV5	s	sandstone	N	o	4
42SV5FS400.27	NHMU	Snake Rock Village	42SV5	s	limestone	S	s	3
42SV5FS199.47	NHMU	Snake Rock Village	42SV5	s	sandstone	N	s	2
42SV5FS199.46	NHMU	Snake Rock Village	42SV5	s	sandstone	N	s	3
42SV5FS27.21	NHMU	Snake Rock Village	42SV5	s	sandstone	N	i	3
42SV5FS221.36	NHMU	Snake Rock Village	42SV5	s	sandstone	N	s	4
42SV5FS155.60	NHMU	Snake Rock Village	42SV5	m	quartzite	N	i	4
42JB2FS451.31	NHMU	Nephi Mounds	42JB2	s	sandstone	S	s	4
42JB2FS759.19	NHMU	Nephi Mounds	42JB2	s	sandstone	O	i	3
42JB2FS727.14	NHMU	Nephi Mounds	42JB2	i	rhyolite	S	i	3
42JB2FS627.5	NHMU	Nephi Mounds	42JB2	i	gabbro	A	i	3
42JB2FS619.59	NHMU	Nephi Mounds	42JB2	s	sandstone	A	i	2
42JB2FS750.40	NHMU	Nephi Mounds	42JB2	i	vesicular basalt	F	i	1
42JB2FS665.184	NHMU	Nephi Mounds	42JB2	s	sandstone	N	i	3
42JB2FS743.51	NHMU	Nephi Mounds	42JB2	i	granite	N	o	2
42JB2FS694.87	NHMU	Nephi Mounds	42JB2	s	sandstone	N	i	3
42JB2FS714.175	NHMU	Nephi Mounds	42JB2	s	sandstone	N	s	4
42MD180FS371.3	NHMU	Pharo Village	42MD180	s	limestone	F	s	3
42MD180FS333.52	NHMU	Pharo Village	42MD180	s	limestone	S	s	3
42MD180FS333.63	NHMU	Pharo Village	42MD180	s	sandstone	F	i	1
42MD180FS133.83	NHMU	Pharo Village	42MD180	s	sandstone	S	s	2
42MD180FS234.118	NHMU	Pharo Village	42MD180	s	limestone	H	s	4
42MD180FS184.58	NHMU	Pharo Village	42MD180	s	unknown	2F	s	3
42MD180FS209.1	NHMU	Pharo Village	42MD180	s	limestone	S	s	3
42MD180FS73.41	NHMU	Pharo Village	42MD180	s	sandstone	F	s	3

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
42MD180FS337.17	NHMU	Pharo Village	42MD180	s	sandstone	2F	s	2
42MD180FS248.41	NHMU	Pharo Village	42MD180	s	limestone	F	s	3
42MD180FS187.50	NHMU	Pharo Village	42MD180	s	sandstone	2F	s	3
42MD180FS255.61	NHMU	Pharo Village	42MD180	s	sandstone	N	o	2
42MD180FS333.66	NHMU	Pharo Village	42MD180	s	chert	O	s	3
42MD180FS333.37	NHMU	Pharo Village	42MD180	s	limestone	F	s	2
42MD180FS108.60	NHMU	Pharo Village	42MD180	s	limestone	S	s	3
42MD180FS352.48	NHMU	Pharo Village	42MD180	s	sandstone	F	s	2
42MD180FS305.1	NHMU	Pharo Village	42MD180	s	sandstone	F	s	2
42MD180FS300.24	NHMU	Pharo Village	42MD180	s	sandstone	2F	s	2
42MD180FS333.60	NHMU	Pharo Village	42MD180	s	limestone	N	s	2
42MD180FS92.112	NHMU	Pharo Village	42MD180	s	sandstone	F	i	2
42MD180FS34.30	NHMU	Pharo Village	42MD180	s	sandstone	F	i	2
42MD180FS160.140	NHMU	Pharo Village	42MD180	s	sandstone	O	i	2
42MD180FS347.39	NHMU	Pharo Village	42MD180	s	sandstone	F	s	2
42MD180FS278.62	NHMU	Pharo Village	42MD180	m	quartzite	2F	s	3
42EM3426FS6	NHMU	Range Creek	42EM34	s	sandstone	S	s	4
42UN170FS98.183	NHMU	Whiterocks Village	42UN170	s	sandstone	H	i	4
42UN170FS144.20	NHMU	Whiterocks Village	42UN170	s	sandstone	F	i	1
42UN170FS43.16	NHMU	Whiterocks Village	42UN170	s	sandstone	F	i	1
42UN170FS121.3	NHMU	Whiterocks Village	42UN170	s	sandstone	O	o	2
42MD76FS9.25	NHMU		42MD76	s	sandstone	F	s	1
42SV633FS832	NHMU	Nawthis Village	42SV633	s	mudstone	F	s	3
42WN2151FS256.2	NHMU	Grumpy George Site	42WN2151	s	sandstone	F	s	3
42WN2401FS165	NHMU		42WN2401	s	sandstone	N	s	2
42WN337FS14	NHMU	Playa Site	42WN337	s	sandstone	H	s	3
42WN231FS76.1	NHMU	North Point	42WN231	s	sandstone	S	s	3
42WN337FS67.17	NHMU	Playa Site	42WN337	s	sandstone	H	s	2

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
42UN1FS11469	NHMU	Deluge Shelter	42UN1	s	sandstone	H	s	2
42PI2 20220	NHMU	Marysvale 7	42PI2	i	basalt	N	i	3
42PI2 20177	NHMU	Marysvale 7	42PI2	i	granite	S	s	1
42PI2 20098	NHMU	Marysvale 7	42PI2	i	vesicular basalt	F	s	3
20081	NHMU		Price and Hiwatha, UT	s	sandstone	S	s	3
42EM63AR1618	NHMU		42EM63	s	sandstone	2F	s	2
42EM63AR1619	NHMU		42EM63	i	vesicular basalt	S	s	2
42EM63AR1625	NHMU		42EM63	s	sandstone	A	i	3
42EM63AR1626	NHMU		42EM63	i	vesicular basalt	F	s	1
42EM63AR1627	NHMU		42EM63	s	sandstone	2F	i	2
42IN40FS820.42	NHMU	Evans Mound	42IN40	s	sandstone	S	s	5
42IN40FS659.8	NHMU	Evans Mound	42IN40	s	sandstone	F	s	5
42IN40FS842.6	NHMU	Evans Mound	42IN40	s	sandstone	F	s	3
42IN40FS821.28	NHMU	Evans Mound	42IN40	s	sandstone	S	s	2
42IN40FS947.12	NHMU	Evans Mound	42IN40	s	sandstone	O	o	3
42IN40FS808.13	NHMU	Evans Mound	42IN40	s	sandstone	S	s	3
42SV21AR5574	NHMU	Popular Knob	42SV21	s	sandstone	H	i	4
42SV21FS3.1	NHMU	Popular Knob	42SV21	s	sandstone	S	s	2
42SV21FS3.2	NHMU	Popular Knob	42SV21	s	limestone	S	s	3
42SV21FS41.2	NHMU	Popular Knob	42SV21	s	sandstone	H	i	3
42SV21FS22	NHMU	Popular Knob	42SV21	s	sandstone	F	s	3
42BE974AR2339	NHMU	Beaver Mounds	42BE974	i	vesicular basalt	F	s	2
42BE974AR2341	NHMU	Beaver Mounds	42BE974	i	tuff	F	s	1
42BE974AR135	NHMU	Beaver Mounds	42BE974	s	sandstone	F	s	2
42BE974AR2344	NHMU	Beaver Mounds	42BE974	i	basalt	2F	s	3
42BE974AR2343	NHMU	Beaver Mounds	42BE974	i	granite	S	s	4
42BE974AR2342	NHMU	Beaver Mounds	42BE974	i	granite	F	s	4
42BE974AR2345	NHMU	Beaver Mounds	42BE974	i	tuff	S	s	3

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
42BE974AR2338	NHMU	Beaver Mounds	42BE974	s	limestone	F	s	2
42BE974AR2340	NHMU	Beaver Mounds	42BE974	m	quartzite	S	s	4
42SV805FS246.1	NHMU	Wild Bill Knoll	42SV805	s	sandstone	F	s	3
42SV805FS150.1	NHMU	Wild Bill Knoll	42SV805	s	siltstone	F	s	3
42SV5 AR2179	NHMU	Snake Rock Village	42SV5	i	gabbro	F	s	2
42SV5 AR2180	NHMU	Snake Rock Village	42SV5	s	sandstone	H	s	3
42SV5 AR2181	NHMU	Snake Rock Village	42SV5	s	limestone	F	s	2
42SV5 AR2178	NHMU	Snake Rock Village	42SV5	s	limestone	H	s	2
42SV23AR1474	NHMU	Round Spring Site	42SV23	s	sandstone	2F	s	2
42SV28F2	NHMU	Last Chance	42SV28	s	sandstone	F	s	3
42SV7FS81.9	NHMU	Old Woman Site	42SV7	s	sandstone	F	s	2
42SV7FS57.1	NHMU	Old Woman Site	42SV7	s	sandstone	S	s	3
42SV7FS57	NHMU	Old Woman Site	42SV7	s	sandstone	F	s	3
42GA43F4	NHMU	Rattlesnake Point	42GA43	s	sandstone	N	o	4
42GA51FS34	NHMU	Spencer Site	42GA51	i	granite	F	s	2
42WB318FS25	NHMU		42WB318	i	basalt	F	s	3
42PI508FS31.1	NHMU		42PI508	i	gabbro	F	s	2
42WB34FS584.20	NHMU	Injun Creek	42WB34	s	sandstone	N	s	4
42EM2095 1782	NHMU	Huntington Canyon	42EM2095	s	sandstone	N	s	3
42EM2095 1867.1	NHMU	Huntington Canyon	42EM2095	s	sandstone	N	s	3
42EM2095 1361.1	NHMU	Huntington Canyon	42EM2095	s	sandstone	N	s	4
42EM2095 1877.000	NHMU	Huntington Canyon	42EM2095	mineral	iron concretion	H	i	3
42EM2095 933.1	NHMU	Huntington Canyon	42EM2095	s	sandstone	S	s	2
42EM2095 1878.1	NHMU	Huntington Canyon	42EM2095	mineral	iron concretion	N	o	4
42EM2095 2442.1	NHMU	Huntington Canyon	42EM2095	s	sandstone	N	s	2
42EM2095 2407.1	NHMU	Huntington Canyon	42EM2095	s	sandstone	H	s	2
42EM2095 2411.1	NHMU	Huntington Canyon	42EM2095	s	sandstone	S	s	2
42EM2095 297.1	NHMU	Huntington Canyon	42EM2095	s	sandstone	H	i	3

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
42EM2095 674.1	NHMU	Huntington Canyon	42EM2095	s	sandstone	N	o	3
42EM2095 2352.1	NHMU	Huntington Canyon	42EM2095	i	basalt	2F	s	3
42EM2095 942.1	NHMU	Huntington Canyon	42EM2095	s	sandstone	N	i	3
42EM2095 993.1	NHMU	Huntington Canyon	42EM2095	s	sandstone	N	i	3
CEUM1805 SS CB12 D8	USUEPM		Cedar Mountain	s	sandstone	N	s	2
CEUM1806 SS CB12 D8	USUEPM		Cedar Mountain	s	sandstone	F	s	3
CEUM302 SS CB12 D8	USUEPM		Cedar Mountain	s	sandstone	S	s	4
CEUM 39369	USUEPM	Crazy Bird Shelter	42SV896	s	sandstone	F	s	2
CEUM 39370	USUEPM	Crazy Bird Shelter	42SV896	s	sandstone	2F	s	3
CEUM 39367	USUEPM	Crazy Bird Shelter	42SV896	s	sandstone	N	s	2
CEUM08366	USUEPM	Round Spring Site	42SV23	bone	bone	S	s	3
CEUM9925 892	USUEPM	Round Spring Site	42SV23	s	sandstone	F	s	2
CEUM9925 608	USUEPM	Round Spring Site	42SV23	s	sandstone	S	s	2
CEUM9925 620	USUEPM	Round Spring Site	42SV23	i	gabbro	S	s	2
CEUM9925 522	USUEPM	Round Spring Site	42SV23	i	vesicular basalt	S	s	2
CEUM9925 451	USUEPM	Round Spring Site	42SV23	s	limestone	S	s	3
CEUM9925 828	USUEPM	Round Spring Site	42SV23	s	sandstone	H	i	2
CEUM9925 13571	USUEPM	Round Spring Site	42SV23	s	sandstone	H	i	2
CEUM9925 602	USUEPM	Round Spring Site	42SV23	s	sandstone	N	s	4
CEUM9925 651	USUEPM	Round Spring Site	42SV23	s	sandstone	F	s	1
CEUM9925 473	USUEPM	Round Spring Site	42SV23	s	limestone	S	s	3
CEUM9925 23	USUEPM	Round Spring Site	42SV23	s	sandstone	F	s	2
CEUM9925 562	USUEPM	Round Spring Site	42SV23	s	sandstone	H	i	2
CEUM31S63	USUEPM	Backhoe Village	42SV662	s	sandstone	S	s	3
CEUM31S66	USUEPM	Backhoe Village	42SV662	s	chalkstone	F	s	3
CEUM31567.2	USUEPM	Backhoe Village	42SV662	s	sandstone	A	i	2
CEUM31567.1	USUEPM	Backhoe Village	42SV662	i	granite	F	s	2

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
CEUM31S64	USUEPM	Backhoe Village	42SV662	i	tuff	F	s	2
CEUM33973	USUEPM	Backhoe Village	42SV662	i	vesicular basalt	F	s	2
CEUM31S60	USUEPM	Backhoe Village	42SV662	s	sandstone	2F	s	1
CEUM31565	USUEPM	Backhoe Village	42SV662	s	limestone	H	i	3
CEUM31561.2	USUEPM	Backhoe Village	42SV662	s	sandstone	N	s	3
CEUM31562	USUEPM	Backhoe Village	42SV662	i	granite	H	s	2
CEUM31559	USUEPM	Backhoe Village	42SV662	s	sandstone	H	s	2
CEUM31557	USUEPM	Backhoe Village	42SV662	i	granite	S	s	4
CEUM31556	USUEPM	Backhoe Village	42SV662	i	granite	2F	s	3
CEUM31558	USUEPM	Backhoe Village	42SV662	m	quartzite	N	s	5
CEUM31587	USUEPM	Backhoe Village	42SV662	s	sandstone	S	s	4
CEUM31573	USUEPM	Backhoe Village	42SV662	s	sandstone	F	s	3
CEUM31571	USUEPM	Backhoe Village	42SV662	i	vesicular basalt	F	s	1
CEUM31575.1	USUEPM	Backhoe Village	42SV662	s	sandstone	S	s	3
CEUM31575.2	USUEPM	Backhoe Village	42SV662	s	limestone	F	s	2
CEUM31641	USUEPM	Backhoe Village	42SV662	s	adobe	A	i	3
CEUM31589	USUEPM	Backhoe Village	42SV662	s	sandstone	N	s	2
CEUM31574	USUEPM	Backhoe Village	42SV662	i	granite	H	i	3
CEUM8487	USUEPM	Round Spring Site	42SV23	s	unfired clay	S	s	3
CEUM13521	USUEPM	Bryson Canyon	42GR1525	s	sandstone	S	s	3
FIPR574	FISPM	Five Finger Ridge	42SV1686	s	sandstone	O	o	4
FIPR70	FISPM	Five Finger Ridge	42SV1686	i	tuff	2F	s	3
FIPR67	FISPM	Five Finger Ridge	42SV1686	i	granite	S	s	3
FIPR71	FISPM	Five Finger Ridge	42SV1686	i	basalt	2F	i	2
FIPR73	FISPM	Five Finger Ridge	42SV1686	s	sandstone	S	s	3
FIPR65	FISPM	Five Finger Ridge	42SV1686	i	tuff	S	s	3
FIPR59	FISPM	Five Finger Ridge	42SV1686	s	sandstone	N	s	4
FIPR68	FISPM	Five Finger Ridge	42SV1686	i	tuff	S	s	3

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
FIPR66	FISPM	Five Finger Ridge	42SV1686	i	tuff	S	s	3
FIPR69	FISPM	Five Finger Ridge	42SV1686	i	tuff	S	s	3
FIPR72	FISPM	Five Finger Ridge	42SV1686	i	tuff	S	s	2
FIPR60	FISPM	Five Finger Ridge	42SV1686	i	gabbro	S	s	3
FIPR61	FISPM	Five Finger Ridge	42SV1686	i	tuff	S	s	2
FIPR64	FISPM	Five Finger Ridge	42SV1686	s	sandstone	N	s	5
FIPR63	FISPM	Five Finger Ridge	42SV1686	s	sandstone	N	s	4
FIPR1536	FISPM	Icicle Bench	42SV1372	s	sandstone	N	s	4
FIPR1637	FISPM	Five Finger Ridge	42SV1686	s	shale	O	o	4
FIPR1636	FISPM	Five Finger Ridge	42SV1686	i	granite	F	s	2
FIPR1611 FS3681	FISPM	Five Finger Ridge	42SV1686	i	granite	S	s	2
FIPR1613 FS5599	FISPM	Five Finger Ridge	42SV1686	i	vesicular basalt	F	s	2
FIPR1616 FS7263	FISPM	Five Finger Ridge	42SV1686	s	sandstone	F	s	2
FIPR1617 84.9.5356.5	FISPM	Five Finger Ridge	42SV1686	s	sandstone	2F	s	3
FIPR1618 FS7417	FISPM	Five Finger Ridge	42SV1686	i	unknown	O	o	3
FIPR1620 FS8425	FISPM	Five Finger Ridge	42SV1686	s	sandstone	S	s	1
FIPR1621 FS8511	FISPM	Five Finger Ridge	42SV1686	i	granite	A	i	2
FIPR1625 FS9554	FISPM	Five Finger Ridge	42SV1686	i	granite	F	s	3
FIPR1627 FS9557	FISPM	Five Finger Ridge	42SV1686	i	granite	F	s	3
FIPR1631 FS9618	FISPM	Five Finger Ridge	42SV1686	s	sandstone	F	s	3
FIPR1632 FS9618	FISPM	Five Finger Ridge	42SV1686	s	sandstone	O	o	4
FIPR1633 FS9618	FISPM	Five Finger Ridge	42SV1686	s	sandstone	S	s	4
FIPR1605 FS2843	FISPM	Five Finger Ridge	42SV1686	i	tuff	F	s	2
FIPR1606 FS2920	FISPM	Five Finger Ridge	42SV1686	i	granite	2F	s	3
FIPR1609 FS2971	FISPM	Five Finger Ridge	42SV1686	i	unknown	2F	s	1
FIPR1610 3138	FISPM	Five Finger Ridge	42SV1686	s	sandstone	S	s	3
FIPR1615 6711	FISPM	Five Finger Ridge	42SV1686	s	sandstone	S	s	3
FIPR1619 7802	FISPM	Five Finger Ridge	42SV1686	s	sandstone	S	s	3

Artifact Number	Museum	Site Name	Site Number	Rock Identification	Rock Type	Subtype	Shape	Texture
FIPR1623 854	FISPM	Five Finger Ridge	42SV1686	s	shale	A	i	4
FIPR1624 8723	FISPM	Five Finger Ridge	42SV1686	s	sandstone	S	s	3
FIPR1628 6910	FISPM	Five Finger Ridge	42SV1686	i	basalt	F	s	3
FIPR1630 9606	FISPM	Five Finger Ridge	42SV1686	i	unknown	S	s	3
FIPR1734 3929	FISPM	Five Finger Ridge	42SV1686	s	limestone	N	s	3
FIPR1737 4081	FISPM	Five Finger Ridge	42SV1686	m	quartzite	S	s	3
FIPR1755 4353	FISPM	Five Finger Ridge	42SV1686	i	tuff	F	s	3
FIPR1756 4397	FISPM	Five Finger Ridge	42SV1686	s	sandstone	F	s	3
FIPR1769 4761	FISPM	Five Finger Ridge	42SV1686	i	vesicular basalt	S	s	2
FIPR1770 4818	FISPM	Five Finger Ridge	42SV1686	s	sandstone	N	s	4
FIPR1771 4839	FISPM	Five Finger Ridge	42SV1686	s	sandstone	N	s	3
FIPR1772 4849	FISPM	Five Finger Ridge	42SV1686	i	unknown	N	s	2
FIPR1780 5356	FISPM	Five Finger Ridge	42SV1686	s	sandstone	F	s	3
FIPR1781 5356	FISPM	Five Finger Ridge	42SV1686	s	sandstone	F	s	3
FIPR1782 5356	FISPM	Five Finger Ridge	42SV1686	i	granite	F	s	3
FIPR1783 5367	FISPM	Five Finger Ridge	42SV1686	s	sandstone	A	i	3
FIPR1785 5367	FISPM	Five Finger Ridge	42SV1686	i	tuff	F	s	3
FIPR1786 5367	FISPM	Five Finger Ridge	42SV1686	i	tuff	2F	s	3
FIPR1792 5709	FISPM	Five Finger Ridge	42SV1686	s	sandstone	N	s	3

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
67.047.002.1	84.64	89.71	88.94	86.36	89.91	89.03	88.09833333	2.118390112	396.893
72.042.008.001	55.1	75.2	55.2	63.2	65.2	56	61.65	7.937694879	316.2
92.1.1.2	64.3	61.5	51.1	64.3	63.5	59.8	60.75	5.046880224	275.5
72.42.5	60.3	58.8	59.3	59.1	60.4	59.5	59.56666667	0.650128193	245.2
67.036.017	50.1	50.3	50.1	49.3	50.7	50.7	50.2	0.517687164	110.1
73.478.003	36.2	38.2	37.4	38.1	39.3	38.3	37.91666667	1.038107252	59.6
2003.9.4.1	50.1	46.7	36.6	48.5	50.7	37.5	45.01666667	6.331640125	92.2
86.12.2505	45.3	44.7	29.5	46.2	44.2	31.9	40.3	7.50439871	73.3
86.12.2992	44.1	45.8	36.6	41.4	48.6	37.4	42.31666667	4.743170529	85.1
88.131.005.001	27.8	31.2	29.8	30.3	29.6	29.6	29.71666667	1.117884908	34.8
98.20.231	9.4	9.6	9.3	9.2	9.7	8.7	9.316666667	0.354494946	1.3
2016.4.6.1	56.5	57.1	56.7	56.8	56.8	56.6	56.75	0.207364414	248.9
2016.4.6.2	48.7	48.5	48.8	48.8	48.3	49.1	48.7	0.275680975	152.4
73.464.001	41.8	49	43.4	43.9	45.6	43.3	44.5	2.52031744	96.7
73.464.003	41.8	52.2	46.6	46.8	47.8	45.6	46.8	3.365709435	129.3
86.5.343	46.3	47.1	48.6	46.8	47.5	45.9	47.03333333	0.954288566	136.7
86.5.509	47.1	50.3	48.5	50.4	52.4	48	49.45	1.94190628	164
86.5.826	39.5	42.1	37.7	41.4	41.2	40.4	40.38333333	1.589234617	81.8
86.005.884	36.1	40.9	40.3	40.1	40.3	38.3	39.33333333	1.812916619	74.6
86.005.076	35.4	34.9	17.1	34.7	34.7	16.2	28.83333333	9.444928092	28.5
86.5.1000	32.8	46.6	45.3	46.8	45.8	46.5	43.96666667	5.499333293	94.7
67.043.062	38.8	39.7	37.9	40.8	40.6	38.5	39.38333333	1.175443179	69.5
67.043.063	44.4	44.1	45.9	45.4	44.7	45.3	44.96666667	0.68019605	117
67.043.064	47.8	47.7	44.2	47.7	47.6	45.9	46.81666667	1.471620422	117.6
67.043.065	47.6	46.5	46.7	51.9	51.2	51.3	49.2	2.521904043	134.4
67.043.066	50.8	55.8	49.8	55.1	55.5	52.2	53.2	2.606913884	180
67.043.068	21.7	22.8	13.9	22.1	22.9	17.1	20.08333333	3.718288137	11
67.043.069	17.9	19.1	13.3	19.1	18.4	14.6	17.06666667	2.490515342	18.2

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
67.043.070	28.8	37	29.9	34.6	35.5	29.3	32.51666667	3.587431765	32.9
42BE974 3793	9.7	12	13.4	10.7	10.9	11.9	11.43333333	1.283225104	2
42BE974 3786	37.5	36.7	33.3	35.1	37	33.6	35.53333333	1.805177738	37
42BE974 3787	34.2	34.8	30.2	34.8	33.9	33.5	33.56666667	1.725881417	45
42CB3 15000	40.2	48.1	47.9	44.3	46.6	47.8	45.81666667	3.096718693	101
42BO57FS425.1	48.5	57.1	53.2	55.5	54.2	55.4	53.98333333	2.991599349	227
42BO57FS12.24	57.9	58.2	56.6	60.1	58.3	58.5	58.26666667	1.125462868	270
42BO57FS428.2	22	29.8	31.7	24.1	27.2	25.8	26.76666667	3.591471379	31
42BO57 FS99.50	22.9	23.1	17.3	22.5	22.9	20.9	21.6	2.254772716	13
42UN95 FS66.98	24.7	28.4	28.3	27.8	27.4	26.6	27.2	1.389964028	30
42UN95 FS131.223	29.8	32.2	31.5	31.8	32.3	31.6	31.53333333	0.907009739	46
42UN95 FS289.85	19.8	20.3	20.1	19.9	20.1	20	20.03333333	0.175119007	11
42UN95 FS410.9	50.5	52.6	53.4	53.1	51.3	51.9	52.13333333	1.111155555	189
42UN95 FS138.4	38.2	38.5	36.9	38.6	38.7	38.2	38.18333333	0.661563804	79
42UN95 FS172.6	38.9	39.6	39.2	38.6	39.4	38.9	39.1	0.368781778	84
42SV662FS14.9	17.2	16.9	14.2	16.2	17.5	15.3	16.21666667	1.263988397	4
42SV662FS377.5	25.1	27.2	21.1	26.2	25.5	25.5	25.1	2.094755356	16
42UT3 11452	33.6	38.9	32.6	37.1	37.2	34.6	35.66666667	2.436117129	50
42BO98FS153.33	25.5	25.1	25.4	25.8	25.2	25.6	25.43333333	0.25819889	15
42WN261FS44.1	46.7	46.9	46.9	46.9	46.9	47.2	46.91666667	0.160208198	132
42UN95FS223.18	32.9	41.8	41.6	40.4	34.2	37	37.98333333	3.862857319	86
42UN95FS289.237	33.7	42.7	35.5	40.2	39.9	40.5	38.75	3.410425193	74
42SV662FS51.9	41.7	42.8	42.3	42.3	41.5	42.8	42.23333333	0.54283208	90
42SV662FS169.5	40.9	41.5	38.2	40.4	42.4	40.5	40.65	1.409609875	84
42SV662FS15.17	43.1	43.3	40.9	42.9	42.2	43	42.56666667	0.898146239	81
42SV662FS93.12	40.3	45.7	46	44.1	45.6	45.6	44.55	2.186092404	111
42SV662FS452.4	35.7	34.1	35.2	35.8	36.1	34.6	35.25	0.771362431	61
42SV662FS452.6	45.9	48.8	36.4	49.3	46.8	43.3	45.08333333	4.770499624	90

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
42SV662FS463.6	46.1	47.6	47.1	45.5	48.2	44.6	46.51666667	1.358553152	119
42SV662FS236.26	47.7	46.6	47.8	48.3	48.9	48.8	48.01666667	0.851860709	122
42SV662FS379.50	42.9	40.9	35.3	42.4	42.1	41.3	40.81666667	2.798868819	92
42IN40FS73.140	33	33.9	33.8	33.4	33.5	33.6	33.53333333	0.320416396	46
42IN40FS26.2	35.3	35.2	35.6	35.9	34.6	35.4	35.33333333	0.436653944	63
42IN40FS26.1	36.1	37.6	37.2	36.6	37	37.2	36.95	0.528204506	69
42EM47AR1524	43.2	44.7	44.9	43.1	44.6	43.7	44.03333333	0.799166232	90
42EM47AR1525	40.7	40.5	38.4	39.9	39.9	38.8	39.7	0.918694726	72
42SV5FS353.15	56	56.5	55.3	56.1	55.9	55.3	55.85	0.472228758	251
42IN40FS269.4	36.9	37	36	37.3	36.9	36.1	36.7	0.525357022	66
42IN40FS32.1	46.2	44.7	39.4	46.7	44.8	42.4	44.03333333	2.719313639	105
42IN40FS77.100	57.2	56.5	51.2	57.1	57.6	55	55.76666667	2.415505468	236
42IN40FS237.51	38.2	38.4	36.8	38.2	38.5	38.7	38.13333333	0.68019605	64
42IN40FS256.26	37.6	37.4	36.5	38.4	38.3	37.9	37.68333333	0.696897888	70
42IN40FS237.50	41.4	42.3	39.2	41.2	41.7	40.3	41.01666667	1.105290309	96
42IN40FS96.1	39.4	39.7	38.6	39.8	39.7	40.3	39.58333333	0.563619257	73
42SV7FS77	83.35	83.12	82.93	82.27	83.62	83.39	83.11333333	0.476263233	838
42IN124FS124.86	61	59.5	60.2	60.5	60.3	59.1	60.1	0.689927532	245
42IN124FS60.34	55	55.6	55.1	55.7	54.4	54.7	55.08333333	0.50365332	213
42SV662FS102.166	50.2	47.6	38.5	49.9	51.1	43.9	46.86666667	4.849192373	93
42SV662FS166.16	44.1	36	34.4	43.4	39.1	43.5	40.08333333	4.213035327	81
42JB179FS17.1	26.5	26.4	17.9	26.5	26.7	20.3	24.05	3.909859333	33
42UN271FS29.22	36.1	36.5	32.8	36.6	36.2	34.6	35.46666667	1.493541652	48
42DC48FS12.1	59.1	59.3	37.3	59.4	59.5	47	53.6	9.385520763	198
42IN40FS1085.28	55.3	61	49.9	58.3	59.8	51.6	55.98333333	4.511947104	215
42IN40FS71.37	59	55.9	51.9	58.8	58.8	55.6	56.66666667	2.792609294	189
42IN40FS182.37	33.9	34	32.7	33.7	33.3	33	33.43333333	0.520256347	49
42IN40FS58.100	30.5	30.8	29.7	31.1	30.5	30.9	30.58333333	0.49159604	44

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
42IN40FS1220.11	32	33.1	33.3	31.9	33	32.9	32.7	0.596657356	45
42IN40FS410.201	29.4	33.8	32.2	31.6	31.9	31.1	31.66666667	1.438981121	39
42IN40FS540.66	38.1	37.8	38	37.8	37.5	38.4	37.93333333	0.307679487	66
42IN40FS557.23	37.3	37.5	37.4	37.8	37.5	37.8	37.55	0.207364414	78
42IN40FS341.1	40.6	40.5	40.4	40.3	41	40.1	40.48333333	0.306050105	87
42IN40FS341.2	41	40.7	39.9	40.2	38.5	40.7	40.16666667	0.907009739	86
42IN40FS1147.32	49.9	56.1	48.4	52.2	53	48.8	51.4	2.942787794	195
42IN40FS1326.3	37.3	38.5	32.7	36.5	37.3	37.7	36.66666667	2.049064827	63
42IN40FS1266.1	35.2	35.5	28	35.8	36.1	33.1	33.95	3.102740724	52
42SV455FS35.4	37.2	37.7	19.1	38.6	37.5	22.4	32.08333333	8.8528903	33
42SV455FS43.23	44.1	43.1	34.1	42.1	43.6	36	40.5	4.315089802	86
42SV455FS79.3	45.2	47.2	36.6	44.7	46.4	40	43.35	4.15102397	96
42SV455FS82.19	42	43.2	40.5	45.9	44.1	44.3	43.33333333	1.893849695	89
26WP6 23484.2	45.5	48.8	36.2	44.4	50	42.7	44.6	4.935990276	116
26WP6 23484.36	40.3	41.5	42.5	41.3	41.3	41.9	41.46666667	0.731209044	99
26WP6 23484.37	39.2	45.5	50.6	42.1	44	49.2	45.1	4.295113503	136
26WP6 23485.2	40.2	39.5	30.5	38.7	41.5	33.8	37.36666667	4.273484137	67
26WP6 23495.5	33.4	32.7	33.5	33.3	31.8	33.6	33.05	0.689202438	48
26WP6 23495.6	33.4	38.2	32.8	36.5	37.5	38.6	36.16666667	2.487301081	50
26WP6 23495.7	38.9	38.8	33.8	39.1	39.2	37.3	37.85	2.102141765	73
26WP6 23516.33	37.2	35.5	34.8	35.8	37.6	36.3	36.2	1.056409012	63
26WP6 23522.2	30.3	33.8	31.4	31.6	32.1	32.1	31.88333333	1.147896627	44
26WP6FS23529.1	46.4	42.9	33.2	45.8	46	36.2	41.75	5.680052817	96
26WP7 23544.16	26.7	31.5	31.8	29.8	31.6	31.5	30.48333333	1.991398169	40
26WP7 23578.2	38.3	40.5	32.2	38.8	39.1	33.2	37.01666667	3.437101492	67
26WP7 23597.1	39.2	39.6	39.1	38.6	39.1	39.1	39.11666667	0.318852108	82
26WP7 23599.5	37.4	37.7	37.2	38.1	36.9	37.7	37.5	0.424264069	44
26WP7 23599.6	26.9	29.5	29.1	27.9	28.5	28.7	28.43333333	0.926642686	28

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
26WP7_23541.1	40.9	44.8	33.1	43.3	41.7	38.7	40.41666667	4.144594874	89
26WP7_23544.17	35.2	37.4	43.5	37.3	34.1	38.7	37.7	3.289376841	78
26WP7_23555.19	32.6	34.3	26.4	33.7	33.1	29.3	31.56666667	3.074844169	41
26WP7_23632.3	57.3	58.7	48.2	56.3	58.4	50.7	54.93333333	4.40302926	215
42MD2 9312	45.4	42.9	50.2	46.3	45.6	51	46.9	3.098386677	110
42MD2 9293	40.5	40.4	39.7	40.1	40.5	39.4	40.1	0.460434577	71
42MD2 9235	51.4	57.3	39.1	53.3	53	42.3	49.4	7.086324858	103
42MD2 9085	44.1	43.9	44.9	42.8	44.5	44.3	44.08333333	0.716705425	105
42MD2 9086	50.5	58.5	41.4	51.6	53	42.1	49.51666667	6.618584944	160
42MD2 9048	48.4	51.1	50.7	50.2	51	50.4	50.3	0.991967741	160
42MD2 9089	44.9	45.6	25.2	45	43.6	30.8	39.18333333	8.865758099	57
42MD1 9848	52.2	58.7	51	57.5	54.7	51.3	54.23333333	3.28734949	223
42MD4 9877	47.7	40.2	50.5	47.4	46.7	51.4	47.31666667	3.949388138	141
42MD4 9876	35	40.8	39.3	38.5	39.2	39.9	38.78333333	2.007402966	89
42MD4 9878	47.9	53.9	54.8	51.8	55.1	52.3	52.63333333	2.668082957	58
42MD1 9031	35.4	35.6	35.9	35.6	36.2	35.5	35.7	0.29664794	54
42MD1 9311	29.7	30.6	25.9	29.4	30.5	27.6	28.95	1.844722201	33
42MD1 9084	52.1	62.8	42.5	57.2	58.1	46.6	53.21666667	7.634505005	176
42MD1 9381	51.4	50.6	51.2	50.7	51.3	50.6	50.96666667	0.372379735	158
42MD1 9403	41.4	42	44	42.3	37.3	46.8	42.3	3.131772661	70
42MD1 9083.1	42.5	45.9	33.9	43.7	43.1	39	41.35	4.281004555	89
42MD1 9083.2	31.6	32.3	31.1	32.7	31.8	31.3	31.8	0.606630036	43
42TO10 11286	38.6	40.7	37.7	38.5	40.6	36.7	38.8	1.587450787	54
42TO8 11230	47.7	54.8	45.3	48.4	52.4	44.7	48.88333333	3.98367502	159
42TO8 11664.1	51.8	58.8	60.4	54	57.5	58.1	56.76666667	3.224076095	243
42TO8 11664.2	37.2	54.3	45.5	46.5	44.5	43.5	45.25	5.51280328	86
42WB34FS740.105	52	62.8	57.8	59.7	61.2	60.1	58.93333333	3.778712303	294
42WB34FS740.95	29.2	34.8	25.4	31.2	33.1	29.3	30.5	3.313004679	35

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
42WB34FS740	26.5	23.4	23.6	26.3	29.4	24.4	25.6	2.28122774	10
42WB34FS559.10	20.4	22.2	22.9	20.3	21.8	23.2	21.8	1.228006515	13
42WN420FS11.2	39.6	43.3	39.1	40.2	42.5	39.9	40.76666667	1.710750323	93
42WN420FS397.3	20.4	19.9	20.4	20.7	21	20.9	20.55	0.403732585	7
42WN420FS842.7	25.2	31.3	20.7	27.9	28.7	24.9	26.45	3.680081521	22
42UN3 11476	54.2	54.5	54.9	58.9	58	56.5	56.16666667	1.959251558	257
42UN3 11496.1	39.9	40.4	37.4	39.6	40.2	38.3	39.3	1.189957982	82
42UN3 11496.2	48.3	48.4	45	47.6	48.3	46.2	47.3	1.4	145
42UN3 11499	70.2	76.1	38.6	71.7	76.5	48.9	63.66666667	15.95552151	300
42UN3 11477	56.2	56.7	55.4	56.4	56.3	53.3	55.71666667	1.260819839	243
7387	55.9	55.1	50.4	56.2	56.1	54.1	54.63333333	2.219609575	216
7388	54.4	57.5	50.4	55.3	57.4	52.8	54.63333333	2.744206018	198
7365	53.3	73.6	52.9	68.7	66.6	52.9	61.33333333	9.372868647	201
42IN43 722	45	45.5	40.6	45.4	46.6	43	44.35	2.181513236	97
42IN43 723	37	38.2	38.1	38.1	38.3	34.2	37.31666667	1.599270667	65
42IN43 739	38.4	39.6	36.3	38.9	39.9	38.2	38.55	1.284912448	77
42IN43 758	32.9	33.2	33.2	33	33	32.8	33.01666667	0.160208198	46
42IN43 796	35.2	38.5	37.1	37.3	37.4	36.8	37.05	1.074709263	57
42IN43 902	36.9	37	34.7	36.8	36.9	35.8	36.35	0.922496613	64
42IN43 913	38.7	38.9	39.2	38.9	39.3	39.6	39.1	0.328633535	74
42IN43 2089	47.8	48.5	49.7	47.7	49.7	49.2	48.76666667	0.902588869	130
42IN43 2170	39.7	39.6	38.1	39.2	39.6	38.9	39.18333333	0.611282804	70
42IN43 2172	44.3	44.7	42.7	45.2	44.9	44.8	44.43333333	0.898146239	106
42IN43 2459	39.3	38.7	39.8	39.6	39.5	39.5	39.4	0.379473319	72
42IN43 3366	62.3	65.1	56.3	62.3	65.5	58.2	61.61666667	3.690212279	321
42IN43 3601	55.9	56.9	52.2	56.7	57	53.2	55.31666667	2.087502495	230
42IN43 3367	64.3	62.1	56.5	63.9	63.7	57.1	61.26666667	3.544949459	327
42IN43 3424	58.6	57.5	53.9	57.8	56.4	55.1	56.55	1.778482499	209

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
42IN43 2239	51.9	52.2	50.4	52.2	53.1	51.5	51.88333333	0.897589364	178
42IN43 3423	45.7	51.6	48.8	49.4	49.7	49.2	49.06666667	1.915898397	146
42IN43 2438	48.2	48.7	46.1	48.4	48.5	48	47.98333333	0.953764471	130
42IN43 2171	45.9	45.5	46.2	45.5	46.2	46.2	45.91666667	0.343025752	127
42IN43 2240	42.9	42.2	43.2	43.1	43.3	43.1	42.96666667	0.398329847	103
42IN43 2169	41.5	41.6	41.3	41.6	42.1	41.1	41.53333333	0.338624669	88
42IN43 2088	40.9	40.4	40.4	40.2	41.5	40.7	40.68333333	0.470814896	81
42IN43 799	41.9	42.8	28	39.3	42.4	35.2	38.26666667	5.774310926	67
42IN43 1102	38.7	38.3	34.6	38.5	38.7	38.1	37.81666667	1.593005545	58
42IN43 1103	37.7	37.6	37.6	37.4	38.3	37.4	37.66666667	0.332665999	59
42IN43 738	34.6	36.6	32.2	36.4	36.2	32.8	34.8	1.926655133	62
42IN43 923	35.3	35.6	30.2	35.4	35.9	34.7	34.51666667	2.151666021	48
42IN43 915	34	33.5	31.7	33.6	34.2	33.3	33.38333333	0.888631907	57
42IN43 837	28.2	29.9	28.1	28.2	29.6	28.5	28.75	0.791833316	31
42EM73FS18.17	15.4	16.1	14.1	15.9	16.2	15.2	15.48333333	0.783368794	5
42JB2FS593.3	63.4	68.3	48.4	65.7	67.1	59.4	62.05	7.389925575	267
42WN267FS1	59.3	60.2	60.5	59.1	60.2	58.7	59.66666667	0.728468714	281
42WN286FS1	52.3	53.3	51.5	59.1	58.8	57.7	55.45	3.45702184	230
42WN337FS1	34.4	60.2	57.5	58.4	59.3	34.8	50.76666667	12.55558309	141
42WN238FS1	35.5	34.8	35.9	35.7	36	35.9	35.63333333	0.445720391	56
42IN124FS451.30	34.5	33.7	28.9	35.9	35.8	33.2	33.66666667	2.57578467	48
42IN124FS62.142	42.7	47.4	39.2	46.8	46.8	40.8	43.95	3.526896653	93
42IN124FS345.105	30.7	42.4	42.5	41	37	38.7	38.71666667	4.479025192	77
42IN124FS52.20	31.7	42.4	46.7	39.1	40.5	38	39.73333333	4.983439241	89
42IN124FS309.96	33.8	33.5	32.5	32.8	33	33.2	33.13333333	0.47187569	45
42IN124FS497.90	30.5	36.4	37.2	33.7	36.4	35.7	34.98333333	2.497532115	49
42IN124FS67.64	37.5	37.9	31.3	38.1	36.7	35.2	36.11666667	2.584892003	56
42IN124FS176.99	37	37.5	37.6	36.2	37.9	36.5	37.11666667	0.667582704	45

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
42IN124FS281.57	36.6	36.1	39.5	34.6	41.1	40.1	38	2.584569597	70
42IN124FS209.199	34.6	41.1	36.7	41.6	40.8	35.1	38.31666667	3.208374459	73
42IN124FS366.4	38.5	37.3	38.5	37.8	38.1	38.4	38.1	0.477493456	79
42IN124FS353.23	38	41.4	41.7	40.2	40.7	41.8	40.63333333	1.429218901	77
42IN124FS252.151	33.4	32.3	27.9	31.3	37.8	29.5	32.03333333	3.441898701	42
42IN124FS28.12	40.8	40.1	43.6	40.5	38.9	42.4	41.05	1.686119806	94
42IN124FS213.55	22.2	27.4	22.5	24.4	26	23.5	24.33333333	2.039280919	20
42IN124FS522.197	66.2	76.1	59.8	67	69.8	59.4	66.38333333	6.302512726	329
42IN124FS62.47	48	54.5	54.9	50.5	49.3	56.3	52.25	3.415113468	185
42IN124FS171.53	51.2	54.5	50.5	53.6	48.5	51.4	51.61666667	2.164640078	148
42IN124FS201.45	49.6	51.2	52.2	49.5	50.8	52.2	50.91666667	1.194012842	124
42IN124FS140.158	49.2	52.1	48.4	50.6	53.1	53.3	51.11666667	2.048820799	130
42IN124FS96.66	53.9	52.3	39.8	52.4	53.6	43.3	49.21666667	6.074015695	118
42IN124FS158.86	49.7	45.8	45.2	48.5	48.8	47.4	47.56666667	1.771628253	74
42IN124FS58.42	38.9	50.2	46.1	43.5	44	43.8	44.41666667	3.690754214	90
42IN124FS302.91	41.4	42.6	42.4	42.4	41.8	41.8	42.06666667	0.467618078	89
42IN124FS214.191	34.8	42.4	48.9	38.1	40.4	43.6	41.36666667	4.848367423	100
42IN124FS213.68	30.6	41.9	45.3	38.7	42.2	42.1	40.13333333	5.116509227	67
42IN124FS187.32	44.4	44.2	27	44.3	44.4	28.4	38.78333333	8.596840505	76
42IN124FS433.10	44.6	43.9	22.6	44.9	44.5	34.2	39.11666667	9.081281114	56
42IN124FS166.46	45.9	43.2	30.5	45.3	45	32.8	40.45	6.913971362	76
42IN124FS310.27	35.1	43.6	42.3	37.7	43.6	38.3	40.1	3.559213396	78
42IN124FS363.6	43.4	43.3	33.5	43.7	42.6	37.9	40.73333333	4.155317878	79
42IN124FS233.92	44.5	43.4	28.6	44.4	44.7	42.7	41.38333333	6.309173216	76
42IN124FS294.25	23.7	39.6	32	30.9	32.6	30.1	31.48333333	5.103495534	48
42SV5FS128.85	43.4	40.8	46.2	43.1	44.2	46.4	44.01666667	2.099920633	121
42SV5FS240.3	38.8	46.4	39.2	43.6	46.8	42.4	42.86666667	3.426173765	108
42SV5FS414.1	40.8	40.8	40.2	40.9	40.7	39.9	40.55	0.403732585	87

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
42SV5FS416.67	40.4	40.3	40.5	40.7	40.9	41.2	40.66666667	0.338624669	87
42SV5FS137.1	39.7	40.2	35.4	41.3	40.4	35.5	38.75	2.608256122	79
42SV5FS193.124	27.5	35.3	27.7	29.7	30.9	27.5	29.76666667	3.048059492	39
42SV5FS168.27	27.9	36.5	29.2	30.4	31.1	28.7	30.63333333	3.096880151	41
42SV5FS400.27	29.9	30.3	29.6	29.8	29.9	29.8	29.88333333	0.231660671	33
42SV5FS199.47	32	26.7	28.9	28.4	28.8	29.3	29.01666667	1.719786808	31
42SV5FS199.46	26.7	27.3	24.4	25.8	27	26.5	26.28333333	1.05340717	25
42SV5FS27.21	18.1	18.2	16.6	18.5	17.6	16.8	17.63333333	0.781451641	8
42SV5FS221.36	17.7	19.7	16.5	18.9	18.5	17.3	18.1	1.15931014	9
42SV5FS155.60	12.6	13.5	9.7	13.2	13.8	10.7	12.25	1.667033293	2
42JB2FS451.31	44.3	44.2	44.1	44.9	43.5	44.6	44.26666667	0.476095229	92
42JB2FS759.19	32.2	32	26.5	32.7	32.7	28.8	30.81666667	2.57325993	29
42JB2FS727.14	29.3	27.8	26.6	30	29.3	27.5	28.41666667	1.310597828	23
42JB2FS627.5	38.8	50.3	41.6	42.3	43.7	39.4	42.68333333	4.152790227	103
42JB2FS619.59	41	42.2	32.2	41.4	43.1	36.1	39.33333333	4.261298707	57
42JB2FS750.40	28.3	31.9	26.3	29.6	30.8	26.6	28.91666667	2.258686934	21
42JB2FS665.184	22.5	26.1	28.7	24.6	24.5	26.1	25.41666667	2.084626265	20
42JB2FS743.51	18.2	20.3	24.1	19.9	20.3	21.4	20.7	1.962651268	9
42JB2FS694.87	17.1	19.1	19.6	18.9	18.5	18.7	18.65	0.847938677	10
42JB2FS714.175	9.4	10	8.7	9.5	9.4	9.4	9.4	0.414728827	1
42MD180FS371.3	36.6	38.5	37.7	37	36.1	37.9	37.3	0.892188321	74
42MD180FS333.52	35.2	37	38.8	37.4	36.7	37.4	37.08333333	1.170327589	74
42MD180FS333.63	37.8	39.6	27.6	36.2	37.7	35.2	35.68333333	4.236232603	54
42MD180FS133.83	33.6	33.6	35.9	34.1	35.5	36.6	34.88333333	1.285949714	59
42MD180FS234.118	35.8	36.4	26.2	36.5	35.5	29.7	33.35	4.342695016	54
42MD180FS184.58	32.5	34.5	35.3	35.7	34.3	34.7	34.5	1.109954954	59
42MD180FS209.1	34.9	35.2	35.4	35.3	35.4	34.9	35.18333333	0.231660671	62
42MD180FS73.41	31.6	30	31.3	32.3	30.7	28.9	30.8	1.216552506	41

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
42MD180FS337.17	32.3	33.7	31.3	32.4	32.5	30.5	32.11666667	1.099848474	38
42MD180FS248.41	31.2	33.1	31	32.2	33.2	30.2	31.81666667	1.213946731	46
42MD180FS187.50	27.9	32.8	30.5	28.8	29.2	30.2	29.9	1.706458321	37
42MD180FS255.61	24.2	29.5	18	27.2	27.6	21.2	24.61666667	4.360007645	17
42MD180FS333.66	34.9	41.6	41.4	40.5	40.1	40.7	39.86666667	2.49693145	89
42MD180FS333.37	44.9	44.8	40.3	44.1	44.8	43	43.65	1.791926338	105
42MD180FS108.60	42.9	44.6	44.8	44.3	44.6	45.4	44.43333333	0.835862828	120
42MD180FS352.48	43.7	46.2	41.8	45.1	45.4	43.4	44.26666667	1.604576787	95
42MD180FS305.1	39.9	46.5	47.8	43.6	42.7	44.1	44.1	2.803569154	111
42MD180FS300.24	49.2	49.1	37.9	47.9	49.2	43.6	46.15	4.581157059	121
42MD180FS333.60	43.7	53	49.1	50.5	49.1	48.6	49	3.050245892	166
42MD180FS92.112	49.4	51.8	44.6	50.9	48.3	47.2	48.7	2.61380948	140
42MD180FS34.30	45.3	47.6	46.2	50.7	48.3	52.4	48.41666667	2.697715083	143
42MD180FS160.140	57.4	54.9	45.5	58.4	55.9	47.6	53.28333333	5.393854528	212
42MD180FS347.39	48.1	46.4	42.3	48.6	47.3	42.2	45.81666667	2.861759366	114
42MD180FS278.62	59.7	52.7	62.1	60.9	57.5	64.7	59.6	4.146806	285
42EM3426FS6	44.7	45.7	45.2	45.7	45.1	45.9	45.38333333	0.457893729	133
42UN170FS98.183	32.5	32.3	20.1	32.3	32.6	25.3	29.18333333	5.285609394	32
42UN170FS144.20	33.8	46.8	49.2	42.1	42.6	43	42.91666667	5.262097174	110
42UN170FS43.16	27.9	30.6	25	28.9	29	27.7	28.18333333	1.869135272	27
42UN170FS121.3	30	29.8	41.7	32.6	29.3	35.8	33.2	4.824520702	49
42MD76FS9.25	78.77	86.66	85.93	85.71	84.29	80.77	83.68833333	3.194109683	759
42SV633FS832	36.7	38.3	36.8	38.7	38.4	36.7	37.6	0.959166305	64
42WN2151FS256.2	22.5	22.5	22.7	22.7	23	23.2	22.76666667	0.280475786	16
42WN2401FS165	10.7	10.7	10.9	10.6	10.9	11	10.8	0.154919334	2
42WN337FS14	57.9	59.1	45.2	59.1	59.3	55.3	55.98333333	5.492692115	222
42WN231FS76.1	61.1	58.5	59.2	59.6	59.1	60.8	59.71666667	1.02257844	270
42WN337FS67.17	63.8	63.7	39.2	63.9	64.1	59.1	58.96666667	9.871102606	204

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
42UN1FS11469	41.2	41.2	28	41.3	41.9	32.5	37.68333333	5.9368061	69
42PI2 20220	47.8	57.4	50.7	50.9	56.3	49.9	52.16666667	3.806135398	184
42PI2 20177	23.6	24.3	23.8	23.9	23.7	22.7	23.66666667	0.531664054	20
42PI2 20098	34.2	34.4	33.3	33.5	34.7	33.8	33.98333333	0.541910202	26
20081	56.3	56.4	55.2	55.9	56.3	55	55.85	0.609097693	162
42EM63AR1618	37.9	38.9	39.3	38.5	37.8	39	38.56666667	0.61210021	78
42EM63AR1619	39.7	38.8	39.4	39.7	39.6	39.5	39.45	0.339116499	68
42EM63AR1625	50.5	44.1	41.6	50.9	48.7	43.5	46.55	3.973789124	131
42EM63AR1626	48.2	49.4	47.4	47.5	51.7	50.6	49.13333333	1.75233178	144
42EM63AR1627	39.2	46.9	48.6	43.2	46.3	47.3	45.25	3.465688965	115
42IN40FS820.42	30.7	30.8	30.9	30.8	30.9	30.8	30.81666667	0.075277265	43
42IN40FS659.8	32.5	32.5	32.5	32.8	31.4	32.4	32.35	0.484767986	53
42IN40FS842.6	38.5	38.2	39.5	38.7	39.3	39.7	38.98333333	0.601387285	82
42IN40FS821.28	39.4	44.1	44.3	44.4	44.9	45.7	43.8	2.230694959	107
42IN40FS947.12	48.6	39.7	37.3	47.2	45.6	41.2	43.26666667	4.515602581	104
42IN40FS808.13	44.3	47.5	41.6	49.6	47.9	45.3	46.03333333	2.882822691	117
42SV21AR5574	56.8	56.3	30.6	56.1	57.2	36.8	48.96666667	11.99310913	148
42SV21FS3.1	42.8	43.4	43.3	44.3	42.9	42.7	43.23333333	0.592171146	98
42SV21FS3.2	39	39.5	38.8	39.4	39.1	38.8	39.1	0.29664794	74
42SV21FS41.2	26.9	25.9	15.3	26.2	26.5	18.5	23.21666667	5.007361248	15
42SV21FS22	36	38.6	33	37.1	38.5	38.1	36.88333333	2.142350734	59
42BE974AR2339	55.4	61.2	59.6	60.2	58.6	60.7	59.28333333	2.105627381	217
42BE974AR2341	47.2	46.4	41.6	46.5	47.9	45.2	45.8	2.245885126	96
42BE974AR135	45.2	42.8	44.9	44.6	45.7	44.9	44.68333333	0.994819917	111
42BE974AR2344	40.5	40.5	39.3	39.5	39.8	38.7	39.71666667	0.705454936	84
42BE974AR2343	41.9	41.4	42.1	41.9	41.9	41.4	41.76666667	0.294392029	91
42BE974AR2342	38.4	38.4	38	38.4	38.3	38	38.25	0.197484177	70
42BE974AR2345	34.4	35.1	35.1	34.7	34.6	34.3	34.7	0.340587727	39

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
42BE974AR2338	34.8	34.4	34.2	35.1	36.2	35.1	34.96666667	0.706163343	45
42BE974AR2340	34.3	35.3	35.2	34.2	34.4	33.4	34.46666667	0.703325434	58
42SV805FS246.1	46.1	46.8	47.1	46.3	46.6	46.5	46.56666667	0.355902608	135
42SV805FS150.1	60.9	60.2	61.2	60.4	60.9	61.6	60.86666667	0.512510163	313
42SV5 AR2179	58.9	58.2	58.4	59.6	58.9	58.5	58.75	0.500999002	271
42SV5 AR2180	45.4	45.9	25.6	45.8	45.8	44.5	42.16666667	8.13256827	73
42SV5 AR2181	38.5	40.6	39.6	41	41	39.9	40.1	0.971596624	78
42SV5 AR2178	51.4	50.3	33.6	51.2	49.6	42	46.35	7.16484473	129
42SV23AR1474	40.3	42.5	40.2	41.2	42	40.6	41.13333333	0.945868208	84
42SV28F2	36.3	36.9	35.4	36.5	38.6	37.4	36.85	1.085817664	50
42SV7FS81.9	41.1	40.7	39.2	42.3	40.7	39.7	40.61666667	1.08888322	71
42SV7FS57.1	34.2	38.9	38.3	36.7	37.4	38.9	37.4	1.791089054	53
42SV7FS57	38.6	40.1	40.6	39.3	38.7	40.3	39.6	0.85322916	66
42GA43F4	40.8	54.9	44.1	48.1	48.2	43.9	46.66666667	4.916367223	142
42GA51FS34	43.6	50.6	50.2	48.5	48.3	48.2	48.23333333	2.490515342	141
42WB318FS25	39.3	46.9	44.6	45.1	44.1	44.4	44.06666667	2.538240861	112
42PI508FS31.1	54.5	66	69.1	63.7	63.1	67.6	64	5.179189126	317
42WB34FS584.20	16.3	17.3	15.5	15.8	17.1	15.8	16.3	0.745654075	4
42EM2095 1782	10.8	11.6	10.1	11.4	11.4	10.6	10.98333333	0.581090928	2
42EM2095 1867.1	11.2	11	11.2	11.3	11.5	11.7	11.31666667	0.24832774	2
42EM2095 1361.1	11.4	12.3	10.1	11.5	11.9	10.4	11.26666667	0.854790423	1
42EM2095 1877.000	30.5	30.6	15.9	30.5	31.8	23	27.05	6.319731007	22
42EM2095 933.1	29.4	31.2	27.7	30.2	29.5	28.9	29.48333333	1.182229532	31
42EM2095 1878.1	24.7	32	23.7	27.3	29.1	25.3	27.01666667	3.116675579	30
42EM2095 2442.1	32.5	39.8	32.6	35.5	36.8	33.9	35.18333333	2.812412962	49
42EM2095 2407.1	65.6	64.1	42.8	66.8	67.4	49.3	59.33333333	10.55304064	258
42EM2095 2411.1	61.3	59.8	61.1	61.2	61.1	62.2	61.11666667	0.767897563	209

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
42EM2095 297.1	38.1	50.8	50.3	41.2	46.5	49.4	46.05	5.268301434	133
42EM2095 674.1	39.6	49.1	42.4	45.8	48.3	39.4	44.1	4.260516401	90
42EM2095 2352.1	37	38.4	38.9	34.7	38.1	38.6	37.61666667	1.571517314	51
42EM2095 942.1	31.7	40.1	28.9	37.4	38.5	31.5	34.68333333	4.555619241	48
42EM2095 993.1	42.6	37.2	30.7	39.7	39.4	35.1	37.45	4.160168266	60
CEUM1805 SS CB12 D8	44.8	48.6	39.5	47.2	46.8	42.3	44.86666667	3.420916057	92.4
CEUM1806 SS CB12 D8	39.8	37.3	37.3	37.5	40.2	38.8	38.48333333	1.307542224	62
CEUM302 SS CB12 D8	58.7	59.7	60.7	60.4	58.1	60.3	59.65	1.038749248	308.9
CEUM 39369	25.2	23.9	25.1	23.6	25.7	24	24.58333333	0.856543441	17.5
CEUM 39370	26.3	27.5	26.7	26.2	26.1	27.2	26.66666667	0.575036231	22.6
CEUM 39367	15.3	13.8	16.1	14.1	14.6	15.9	14.96666667	0.950087715	3.9
CEUM08366	18	18	11.3	17.9	17.9	15.1	16.36666667	2.731788181	2.9
CEUM9925 892	46.2	45.7	43.7	43.7	44.2	44.6	44.68333333	1.0496031	96.7
CEUM9925 608	43.7	43.4	42.5	43.6	44.6	43.3	43.51666667	0.67946057	86.1
CEUM9925 620	52.4	53.2	48.8	52.9	52.6	51.2	51.85	1.64408029	172
CEUM9925 522	37.5	36.7	37.8	37.3	38.3	38.1	37.61666667	0.581090928	58
CEUM9925 451	37.8	38.1	37.4	38.2	38.6	38.5	38.1	0.447213596	71.2
CEUM9925 828	52	53.1	30.7	53.3	52.7	42.5	47.38333333	9.159130235	123.8
CEUM9925 13571	46.3	48	21.4	47.7	46.4	35.7	40.91666667	10.61459687	65.5
CEUM9925 602	15.2	15.3	13.4	15.8	15.4	14.5	14.93333333	0.861781101	5.1
CEUM9925 651	45.2	41.2	43.5	43.8	43.3	42.5	43.25	1.336787193	87.8
CEUM9925 473	42.3	41.9	43	42.8	42.1	43.1	42.53333333	0.500666223	109.5
CEUM9925 23	35.6	35.9	33.1	36.3	35.2	34.3	35.06666667	1.180960061	46.2
CEUM9925 562	19.2	32.7	31.7	31.6	32.3	24.8	28.71666667	5.510505119	22.7
CEUM31S63	28.7	29.6	29.8	28.9	29.6	28.1	29.11666667	0.661563804	30.9
CEUM31S66	31.7	31.8	30.8	31.7	31.6	31.8	31.56666667	0.382970843	35.5

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
CEUM31567.2	42.8	48.8	42.8	46.5	50.9	49.5	46.88333333	3.468380986	141.3
CEUM31567.1	44.1	43.3	36.5	41.4	44.3	38.7	41.38333333	3.181456689	84.6
CEUM31S64	36.7	39.7	37.4	38.9	39.9	40.6	38.86666667	1.524029746	53.8
CEUM33973	43.8	45.3	39.8	45.5	45.4	40.9	43.45	2.50499501	75.7
CEUM31S60	33.2	34.6	26.5	32.3	34.6	29.2	31.73333333	3.246947284	38.4
CEUM31565	22.6	37.1	33.1	37.2	36.2	34.5	33.45	5.547882479	44
CEUM31561.2	20.4	17.9	19.3	18.2	18.4	21.9	19.35	1.544991909	10.1
CEUM31562	19.7	31.8	34.3	26.1	25.5	26.9	27.38333333	5.134361369	35
CEUM31559	25.1	25.3	17.8	24.6	25.3	21	23.18333333	3.110894834	13.1
CEUM31557	37.1	37.9	37.8	37.5	37.5	37.2	37.5	0.316227766	71.3
CEUM31556	42.1	40.4	32	42.8	41.9	36.9	39.35	4.173607552	70.5
CEUM31558	37.4	34.8	24.7	36.8	35.8	29.1	33.1	5.077794797	55.2
CEUM31587	39.9	39.7	39.3	39.9	39.2	39.4	39.56666667	0.307679487	76.2
CEUM31573	33.8	37.9	31.8	36	35.6	33.6	34.78333333	2.150736308	58.4
CEUM31571	32.4	35.5	30.3	34.6	33.7	31.1	32.93333333	2.02649122	27
CEUM31575.1	41.1	41.4	42.3	41.7	40.6	43.1	41.7	0.892188321	94.7
CEUM31575.2	34.8	35.7	32.7	35.3	35.7	34.9	34.85	1.120267825	53.1
CEUM31641	47.9	49.8	51.6	55.3	58.3	51.6	52.41666667	3.781754443	166.4
CEUM31589	11.8	12.3	12.1	12.2	12.1	11.4	11.98333333	0.331159579	3
CEUM31574	17.6	26.4	25.8	23.9	23.6	23.5	23.46666667	3.120042735	14.8
CEUM8487	23.7	23.3	23.4	23.7	22.9	24.1	23.51666667	0.411906138	14.5
CEUM13521	38.4	35.3	35.2	38	36.1	36.8	36.63333333	1.351542329	67.5
FIPR574	52.7	67.3	53.9	61.9	65.3	55.2	59.38333333	6.26495544	273.9
FIPR70	49	48.9	46.8	49.8	48.8	47.4	48.45	1.120267825	114.9
FIPR67	47	47.2	46.2	46.2	47.1	46.4	46.68333333	0.466547604	125.8
FIPR71	40.6	43.4	37.7	41.8	43	37.3	40.63333333	2.620432534	78.9
FIPR73	37.7	37.9	34.3	38.5	38	36.3	37.11666667	1.565141101	59.9
FIPR65	27.2	27.6	26.7	28.5	26.8	27.5	27.38333333	0.655489639	17.1

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
FIPR59	15	14.8	14.7	14.7	14.6	14.9	14.78333333	0.147196014	4.4
FIPR68	39.2	39.7	37.2	39.5	39.7	39.5	39.13333333	0.964710665	70
FIPR66	33.7	36.3	36.5	36.4	35.9	36.1	35.81666667	1.059087658	40.8
FIPR69	30	29.9	30.6	30.3	29.7	30.2	30.11666667	0.318852108	29.2
FIPR72	56.5	62.1	55.1	61.7	60.5	57.2	58.85	2.956856439	155.1
FIPR60	50.3	51.4	44	50.1	50.3	50.7	49.46666667	2.717842281	162.2
FIPR61	33.5	34.1	35.7	36.7	37.1	36.8	35.65	1.520197356	35.5
FIPR64	22.7	23.6	23.6	23.1	23.2	23.5	23.28333333	0.354494946	17.1
FIPR63	17.1	17.4	17.8	17.2	18.4	17.6	17.58333333	0.475043858	7.6
FIPR1536	7.7	10.1	9.4	9.3	9.1	8.3	8.983333333	0.854205284	1.2
FIPR1637	25.1	29.6	25.7	27.1	28.1	24.8	26.73333333	1.88113441	26.1
FIPR1636	35.7	36.5	34.4	36.2	37.7	34.5	35.83333333	1.258040805	47
FIPR1611 FS3681	40.5	39.9	35.7	41.1	41.5	39.5	39.7	2.093800373	57.3
FIPR1613 FS5599	33.8	35.1	37.2	34.9	34.4	37.9	35.55	1.628189178	36.8
FIPR1616 FS7263	46.6	39.5	45.7	46.7	46.1	46.9	45.25	2.850789364	99.9
FIPR1617 84.9.5356.5	42.1	42.1	38.1	42.9	40.9	42.3	41.4	1.742412121	87.9
FIPR1618 FS7417	26.7	31.3	24.8	30.5	32.2	26.4	28.65	3.057286378	32.2
FIPR1620 FS8425	48.9	55.3	54.8	52.7	54	53.9	53.26666667	2.315743221	141.3
FIPR1621 FS8511	44.5	50.1	39	47.7	47.6	41.4	45.05	4.225044378	67.4
FIPR1625 FS9554	45.8	48.5	44.8	49.9	48.1	50.1	47.86666667	2.156540439	84.7
FIPR1627 FS9557	44.6	43	37.1	45.2	46.7	39.1	42.61666667	3.747754883	65.9
FIPR1631 FS9618	35.8	35.3	35	35.2	35.3	34.9	35.25	0.314642655	53.1
FIPR1632 FS9618	43.4	36.8	32.6	41.4	42.5	36.2	38.81666667	4.261650697	68.9
FIPR1633 FS9618	41.8	41.3	40.5	41.8	41.6	41.5	41.41666667	0.487510684	81.2
FIPR1605 FS2843	46.2	44.7	48.1	45.4	46.1	48.1	46.43333333	1.399523729	87
FIPR1606 FS2920	37.4	37.2	38.1	40.9	39.3	40.7	38.93333333	1.623165631	53
FIPR1609 FS2971	45.6	46.3	45.2	44.2	45	46.6	45.48333333	0.881854107	112

Artifact Number	Diameter1	Diameter2	Diameter3	Diameter4	Diameter5	Diameter6	Average Diameter	Roundness Degree	Weight
FIPR1610 3138	31.3	28	31.3	29.4	29.7	30.5	30.03333333	1.270695348	35
FIPR1615 6711	41.8	38.9	37.4	43.4	42.8	42	41.05	2.366220615	56
FIPR1619 7802	31.5	30.6	28.3	31.8	30.5	29.2	30.31666667	1.343750969	22
FIPR1623 854	22.2	21.8	22	20.8	21.6	21.3	21.61666667	0.507608773	13
FIPR1624 8723	37.6	38.3	32.5	39.4	38.2	36.8	37.13333333	2.426245385	39
FIPR1628 6910	39.9	41.5	41.3	41.1	40.9	41.7	41.06666667	0.637704216	69
FIPR1630 9606	31.9	35	35.5	33.6	34.6	34.9	34.25	1.312630946	36
FIPR1734 3929	10.1	9.9	9.5	10.4	9.8	9.7	9.9	0.316227766	1.9
FIPR1737 4081	41.1	39.3	40.8	41.3	40.1	41.7	40.71666667	0.877306484	84
FIPR1755 4353	51.2	50.7	46.6	51.3	52.8	49.5	50.35	2.122969618	113
FIPR1756 4397	33.4	33.8	29.6	34.1	33.9	33.6	33.06666667	1.715420259	34
FIPR1769 4761	43.9	47.2	41.4	45.9	47.1	44.8	45.05	2.202498581	90
FIPR1770 4818	7.7	8.7	8.3	8.2	8.5	8.6	8.333333333	0.361478446	1.3
FIPR1771 4839	27.7	27.4	24.6	27.8	27.3	26.4	26.86666667	1.216004386	23
FIPR1772 4849	37.8	39.4	33.3	40.1	38.4	37	37.66666667	2.408042082	36
FIPR1780 5356	46.6	45.4	40.3	46.9	46.7	41.1	44.5	3.000666593	77
FIPR1781 5356	40.7	41.7	35.4	41.1	42.1	38.8	39.96666667	2.513695818	59
FIPR1782 5356	38.5	37.6	39.1	38.8	39.8	38.5	38.71666667	0.730524925	62
FIPR1783 5367	35.6	43.8	44.3	41.9	44.1	44.3	42.33333333	3.421500645	58
FIPR1785 5367	51.3	51.4	50.3	52.3	52.5	50.7	51.41666667	0.863519928	116
FIPR1786 5367	45.6	45.5	48.7	46.3	47.4	47.6	46.85	1.262933094	91
FIPR1792 5709	39.3	41.2	41.3	44.4	42.3	43.2	41.95	1.771722326	100

Artifact Number	Volume	Density	Divots	Flattening	Finger Flat	Grooving	Ochre	Burned	Munsells Color	Notes
67.047.002.1	358.0154	1.108592	1	0	0	0	0	1	7.5YR 4/4	some patina
72.042.008.001	122.6868	2.577294	1	0	0	0	0	0	10R 5/3	polished no patina
92.1.1.2	117.3917	2.346844	1	0	0	0	0	0	10YR 4/1	pecking and a little smoothing
72.42.5	110.6645	2.215705	1	0	0	0	0	0	2.5Y 4/1	pecking
67.036.017	66.23839	1.662178	0	1	0	0	0	0	2.5Y 8/1	looks like this is clay
73.478.003	28.54231	2.088128	1	1	1	0	0	0	2.5Y 6/3	pecking
2003.9.4.1	47.76597	1.930244	0	0	0	0	0	0	10YR 7/3	pecked and ground
86.12.2505	34.26997	2.138899	1	1	1	0	0	0	10R 6/6	pecked
86.12.2992	39.67647	2.144848	1	0	0	0	1	0	10YR 5/3	pecked and smoothed
88.131.005.001	13.74038	2.53268	0	0	0	0	0	0	2.5Y 4/1	natural concretion?
98.20.231	0.423429	3.070174	0	0	0	0	0	0	2.5Y 3/2	concretion
2016.4.6.1	95.69654	2.60093	0	0	0	0	0	0	2.5YR 4/2	Pecked and smoothed
2016.4.6.2	60.47634	2.519994	0	0	0	0	0	0	5YR 5/2	Pecked and smoothed
73.464.001	46.14011	2.09579	0	0	0	1	0	0	10YR 6/3	pecked and grooved, so some level of grinding
73.464.003	53.67057	2.409142	1	0	0	1	0	0	Gley1 7/10GY	pecked
86.5.343	54.47734	2.5093	1	0	0	0	1	0	10YR 8/1	pecking and grinding
86.5.509	63.31367	2.590278	1	1	1	0	0	0	10R 6/4	pecking and
86.5.826	34.48301	2.372183	1	1	1	0	1	0	7.5YR 7/2	pecking
86.005.884	31.86258	2.341305	1	1	1	0	1	0	10YR 7/4	pecked and ground
86.005.076	12.55114	2.27071	0	0	0	0	0	0	10YR 8/2	pecked and ground
86.5.1000	44.50095	2.128045	0	1	0	0	1	0	2.5Y 8/1	pecked
67.043.062	31.98424	2.172945	1	1	1	0	0	0	7.5YR 7/3	pecked
67.043.063	47.60699	2.457622	1	1	0	0	0	0	Gley1 5/N	pecked and smoothed
67.043.064	53.72793	2.188806	1	0	0	0	0	0	Gley1 4/N	pecked
67.043.065	62.35825	2.155288	1	1	1	0	0	0	Gley1 8/N	pecked and smoothed

Artifact Number	Volume	Density	Divots	Flattening	Finger Flat	Grooving	Ochre	Burned	Munsells Color	Notes
67.043.066	78.83762	2.283174	1	1	1	0	0	0	Gley2 4/10B	pecked and smoothed
67.043.068	4.241369	2.593503	1	1	1	0	0	0	10YR 6/2	pecked and smoothed
67.043.069	2.602824	6.992406	0	1	0	0	0	0	Gley1 4/N	pecked and smoothed
67.043.070	18.00183	1.827592	0	0	0	0	0	0	Gley1 5/N	pecked
42BE974 3793	0.782559	2.555717	1	0	0	0	0	0	7.5YR 6/2	concretion with some worked points
42BE974 3786	23.49127	1.575053	0	0	0	1	0	0	10YR 7/3	ground striations and pecking
42BE974 3787	19.80265	2.272423	1	0	0	0	1	0	10YR 6/1	pecked
42CB3 15000	50.35807	2.005637	1	1	1	0	0	0	10YR 4/3	pecked and smoothed
42BO57FS425.1	82.37164	2.755803	1	0	0	0	0	0	10R 4/2	pecked and smoothed with some later chipped areas
42BO57FS12.24	103.576	2.606781	0	1	0	0	0	0	10YR 6/2	uniform smoothness and not very pecked looking
42BO57FS428.2	10.0411	3.08731	0	0	0	0	0	0	10YR 8/2	river cobble, pretty sure it is just smooth
42BO57 FS99.50	5.276669	2.463675	0	1	0	0	0	0	10YR 6/4	pecked in places
42UN95 FS66.98	10.53672	2.847187	1	0	0	0	0	0	Gley1 4/N	pecked and smoothed
42UN95 FS131.223	16.41755	2.80188	1	0	0	0	0	0	2.5Y 5/1	Pecked, but hard to tell if smoothed or not
42UN95 FS289.85	4.209769	2.61297	0	0	0	0	0	0	2.5Y 4/1	pecked and smoothed
42UN95 FS410.9	74.18995	2.547515	1	1	1	0	1	0	10YR 7/4	pecked and ground
42UN95 FS138.4	29.14876	2.710235	0	1	0	0	0	0	2.5Y 5/2	pecked and smoothed
42UN95 FS172.6	31.29889	2.683802	1	1	0	0	0	0	Gley1 7/N	pecked and smoothed
42SV662FS14.9	2.232973	1.791334	0	1	0	0	0	0	5YR 6/4	pecked a little and maybe ground or smoothed
42SV662FS377.5	8.279799	1.932414	0	1	0	0	0	0	10R 6/4	formed through clay, possibly smoothed
42UT3 11452	23.7567	2.104669	0	0	0	0	1	0	10YR 5/2	pecked in parts and ground smooth,
42BO98FS153.33	8.614071	1.741337	1	0	0	0	0	0	5Y 6/1	formed through clay and smoothed
42WN261FS44.1	54.07295	2.441147	0	0	0	0	0	1	Gley1 3/N	pecked and maybe smoothed
42UN95FS223.18	28.69312	2.997234	0	1	0	0	1	0	5YR 7/2	pecked and ground

Artifact Number	Volume	Density	Divots	Flattening	Finger Flat	Grooving	Ochre	Burned	Munsells Color	Notes
42UN95FS289.237	30.46588	2.428947	1	1	0	0	1	0	2.5YR 4/6	pecked and ground
42SV662FS51.9	39.44252	2.281801	1	0	0	0	1	0	2.5Y 7/1	pecked and smoothed
42SV662FS169.5	35.17064	2.388356	0	1	0	0	1	0	7.5YR 8/1	pecked and smoothed
42SV662FS15.17	40.38383	2.005753	1	1	1	0	1	0	10YR 8/2	pecked and smoothed, grinding for flattening
42SV662FS93.12	46.29582	2.397625	1	0	0	0	1	0	10YR 8/1	pecked and smoothed
42SV662FS452.4	22.9338	2.65983	1	0	0	0	1	0	10YR 8/1	pecked and smoothed
42SV662FS452.6	47.9785	1.87584	1	1	0	0	1	0	2.5YR 5/3	pecked and barely some grinding on flat end
42SV662FS463.6	52.70167	2.257993	1	0	1	0	1	0	5YR 7/4	pecked
42SV662FS236.26	57.96618	2.104676	1	1	1	0	1	0	10YR 8/1	pecked and ground
42SV662FS379.50	35.60502	2.583905	1	1	0	0	1	0	7.5YR 8/1	pecked and smoothed
42IN40FS73.140	19.74371	2.329856	0	1	0	0	1	0	10YR 8/1	pecked and smoothed
42IN40FS26.2	23.09683	2.727647	0	0	0	0	0	1	7.5YR 8/1	pecked, smoothed, patina
42IN40FS26.1	26.41447	2.612204	0	0	0	0	0	1	Gley1 7/N	pecked and smoothed
42EM47AR1524	44.70368	2.013257	1	0	0	0	0	0	10YR 8/1	pecked, possibly smoothed
42EM47AR1525	32.76198	2.197669	0	0	0	0	0	0	10YR 8/1	pecked and smoothed/patina
42SV5FS353.15	91.2154	2.751728	0	0	0	0	1	0	2.5Y 7/2	pecked, smoothed
42IN40FS269.4	25.88194	2.550041	1	0	0	0	1	0	2.5YR 7/4	pecked and smoothed
42IN40FS32.1	44.70368	2.3488	1	1	1	0	1	0	10YR 7/8	pecked and smooth, ground flat
42IN40FS77.100	90.8077	2.598899	1	1	1	0	0	0	10YR 8/1	pecked
42IN40FS237.51	29.03441	2.204281	1	0	0	0	0	0	10YR 6/4	pecked and smoothed
42IN40FS256.26	28.01861	2.49834	1	0	0	0	1	0	10YR 5/4	pecked and smoothed
42IN40FS237.50	36.13098	2.657	1	1	0	0	0	0	Gley1 4/N	pecked and smoothed?
42IN40FS96.1	32.47399	2.247953	1	1	1	0	0	0	10YR 7/6	pecked and smoothed in parts
42SV7FS77	300.6151	2.787618	0	0	0	0	0	0	10YR 6/3	pecked and polished
42IN124FS124.86	113.6638	2.15548	1	0	0	0	0	1	5YR 7/2	pecked and smoothed
42IN124FS60.34	87.51032	2.433999	1	0	0	0	0	1	Gley1 8/N	pecked and smoothed

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42SV662FS102.166	53.90026	1.725409	1	0	0	0	1	0	10R 6/4	pecked
42SV662FS166.16	33.7202	2.402121	1	0	0	0	1	0	10YR8/2	pecked
42JB179FS17.1	7.283563	4.53075	1	1	0	0	1	0	7.5YR 3/2	smoothed and scratched, patina
42UN271FS29.22	23.3593	2.054856	1	0	0	0	1	0	7.5YR 8/1	smoothed and pecked
42DC48FS12.1	80.62932	2.455682	1	0	0	0	0	0	5Y 8/1	smoothed
42IN40FS1085.28	91.87025	2.340257	1	0	0	0	1	0	10YR 6/3	pecked
42IN40FS71.37	95.27558	1.983719	1	1	1	0	0	0	10YR 7/1	pecked and smoothed
42IN40FS182.37	19.5676	2.504139	0	1	0	0	1	0	7.5YR 7/3	pecked and smoothed
42IN40FS58.100	14.97797	2.937647	1	0	0	1	0	1	7.5YR 3/1	pecked, smoothed
42IN40FS1220.11	18.30804	2.457936	1	0	0	0	1	0	10YR 7/2	pecked smoothed
42IN40FS410.201	16.62669	2.345627	1	1	1	0	0	0	10YR 7/6	pecked and ground
42IN40FS540.66	28.57996	2.30931	0	0	0	0	1	1	Gley1 3/N	pecked and smoothed in places
42IN40FS557.23	27.72225	2.813625	1	0	0	0	1	0	2.5YR 5/3	pecked and smoothed
42IN40FS341.1	34.73981	2.504332	1	0	0	0	0	0	Gley1 5/N	pecked and smoothed
42IN40FS341.2	33.93095	2.534559	0	1	0	0	1	0	7.5YR 8/2	pecked and smoothed
42IN40FS1147.32	71.10301	2.7425	0	1	0	0	0	0	10YR 8/2	smoothed and slightly pecked (possibly water worn)
42IN40FS1326.3	25.81148	2.440774	1	1	1	0	0	0	10YR 7/3	pecked and ground
42IN40FS1266.1	20.48887	2.537964	1	0	0	1	1	0	10YR 8/3	naturally smooth? pecked
42SV455FS35.4	17.29168	1.908433	1	0	0	0	0	0	2.5Y 8/1	pecked and very little smoothing
42SV455FS43.23	34.78273	2.472491	1	0	0	0	0	0	Gley2 4/5PB	some pecked with patina
42SV455FS79.3	42.65461	2.250636	1	1	1	0	0	0	2.5Y 7/2	some smoothing and a couple of pecked places
42SV455FS82.19	42.60543	2.088936	1	0	0	0	0	0	2.5Y 7/4	pecking
26WP6 23484.2	46.45187	2.497208	1	0	0	0	0	0	10YR 8/1	pecked and smoothed
26WP6 23484.36	37.33327	2.65179	1	0	0	0	1	1	10YR 7/3	heavily pecked and some smoothing

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26WP6 23484.37	48.03173	2.831461	1	1	1	0	0	0	10YR 8/4	smoothed/little pecking. Probably a worked river cobble
26WP6 23485.2	27.31818	2.45258	1	0	0	0	0	0	10YR 8/3	pecked and some worn places, not really smoothing
26WP6 23495.5	18.90223	2.539383	1	0	0	0	0	0	Gley1 8/N	pecked, but little smoothing, hard to tell
26WP6 23495.6	24.76989	2.01858	1	0	0	0	1	0	10YR 8/2	pecked
26WP6 23495.7	28.39202	2.571145	1	1	1	0	1	0	Gley1 7/N	pecked and smoothed. A ground flat spot
26WP6 23516.33	24.83844	2.536391	1	1	1	0	0	0	10YR 8/3	smoothed and pecked in parts
26WP6 23522.2	16.97031	2.592763	1	0	0	0	1	0	10YR 8/2	smoothed and pecked
26WP6FS23529.1	38.10378	2.519435	0	0	0	0	1	0	10YR 7/3	pecked heavily and some smoothing
26WP7 23544.16	14.83153	2.696957	0	0	0	0	0	0	10YR 8/1	slight pecking, smoothing
26WP7 23578.2	26.55771	2.522808	1	1	1	0	1	0	10YR 8/3	pecked and smoothed
26WP7 23597.1	31.33893	2.616554	1	0	0	0	1	0	10YR 7/3	smoothed and some evidence of pecking
26WP7 23599.5	27.61165	1.59353	1	0	0	0	0	0	10YR 8/2	heavily pecked and smoothed
26WP7 23599.6	12.03599	2.326355	1	0	0	0	0	0	7.5YR 7/3	pecked and smoothed
26WP7_23541.1	34.56847	2.574601	1	0	0	0	1	0	10YR 8/2	possible river cobble, little pecking or smoothing
26WP7_23544.17	28.0558	2.780174	1	0	0	0	0	0	10YR 8/1	possible river cobble, little pecking or smoothing
26WP7_23555.19	16.46967	2.489425	1	1	0	0	0	0	10YR 7/1	pecked and smoothed
26WP7_23632.3	86.79735	2.477034	1	0	0	0	1	0	10YR 8/3	smoothed and pecked
42MD2 9312	54.01534	2.036458	0	0	0	0	1	0	5YR 7/4	pecked and slight smoothing
42MD2 9293	33.76228	2.102939	0	1	0	0	1	0	7.5YR 7/3	pecked and smoothed
42MD2 9235	63.12181	1.631766	0	0	0	0	1	0	7.5YR 7/3	smoothed, little pecking
42MD2 9085	44.85614	2.340817	1	0	0	0	1	0	7.5YR 7/4	smoothed and pecked
42MD2 9086	63.57009	2.516907	1	1	1	0	1	0	5YR 6/6	pecked and smoothed in places
42MD2 9048	66.63503	2.40114	0	1	0	0	1	1	5YR 7/4	pecked and smoothed with a little ground spot
42MD2 9089	31.49943	1.809556	0	0	0	0	1	1	10R 6/8	pecked with a little smoothing

Artifact Number	Volume	Density	Divots	Flattening	Finger Flat	Grooving	Ochre	Burned	Munsells Color	Notes
42MD1 9848	83.52135	2.669976	1	1	1	0	0	0	10YR 6/1	pecked, and a ground flat spot
42MD4 9877	55.46781	2.542015	0	1	0	0	0	0	10YR 7/3	pecked and ground (possibly smoothed on the sides)
42MD4 9876	30.54457	2.913775	1	0	0	0	0	0	10YR 7/2	smoothed and heavily pecked
42MD4 9878	76.34511	0.759708	1	1	1	0	0	0	10YR 6/2	pecked and smoothed in parts
42MD1 9031	23.82337	2.266681	0	0	0	0	1	0	5YR 6/4	heavily pecked and somewhat smoothed
42MD1 9311	12.70411	2.597584	0	0	0	0	0	0	7.5YR 6/4	River cobble, possibly smoothed with a little shine.
42MD1 9084	78.91174	2.23034	1	0	0	0	1	0	5YR 6/3	Slightly pecked/smoothed, Incised with lines and spiral
42MD1 9381	69.3198	2.279291	1	0	0	0	1	0	10YR 8/2	heavily pecked and smoothed
42MD1 9403	39.6296	1.766356	1	0	0	0	1	0	7.5YR 8/2	pecked and has a patina in parts
42MD1 9083.1	37.01904	2.404168	0	0	0	0	1	0	7.5YR 7/4	holes filled with dirt, likely cobble with smoothing
42MD1 9083.2	16.83759	2.553809	1	1	1	0	0	0	Gley1 2.5/N	pecked/chipped, smoothed
42TO10 11286	30.58397	1.765631	1	1	0	0	1	1	10YR 7/1	pecked and smoothed
42TO8 11230	61.16191	2.599657	1	1	0	0	1	1	10YR 7/2	Pecked in parts, smoothed? white buildup
42TO8 11664.1	95.78088	2.537041	1	1	1	0	1	1	Gley1 4/N	pecked flat on some sides, smoothed in parts
42TO8 11664.2	48.51258	1.772736	1	0	0	0	1	0	10YR 8/1	pecked and rounded
42WB34FS740.105	107.1721	2.743252	1	1	1	0	1	0	7.5YR 7/2	smoothed with some large pecked areas
42WB34FS740.95	14.85587	2.355971	1	1	1	0	1	0	2.5Y 7/2	pecked in parts, a flat spot, and possible smoothing
42WB34FS740	8.78453	1.138365	1	0	0	0	0	0	10YR 5/3	concretion, pecked? has several holes in this rock
42WB34FS559.10	5.424605	2.396488	1	1	0	0	0	0	10YR 4/2	pecked a little. Flat spot on the top by the label
42WN420FS11.2	35.47433	2.621614	0	0	0	0	1	0	7.5YR 6/4	pecked, patina of sorts, smoothed, but hard to determine
42WN420FS397.3	4.543956	1.540508	1	0	0	0	1	0	Gley1 3/N	smoothed, a little shine

Artifact Number	Volume	Density	Divots	Flattening	Finger Flat	Grooving	Ochre	Burned	Munsells Color	Notes
42WN420FS842.7	9.688926	2.270633	0	0	0	0	0	0	5YR 8/3	smoothed, concretion. Some dents that could be pecks
42UN3 11476	92.77577	2.77012	1	1	0	0	1	1	7.5YR 5/2	pecked, ground, and smoothed into a cube
42UN3 11496.1	31.78164	2.580106	1	1	1	0	1	0	10YR 5/2	pecked, smoothed, ground
42UN3 11496.2	55.40922	2.616893	1	1	1	0	1	0	7.5YR 5/3	pecked, smoothed, ground
42UN3 11499	135.1248	2.22017	0	0	0	0	1	0	10YR 6/2	pecked, smoothed, flaked
42UN3 11477	90.56367	2.683195	1	0	0	0	1	0	7.5YR 6/3	pecked and smoothed
7387	85.38306	2.529776	0	0	0	0	1	1	5YR 7/4	smoothed and pecked
7388	85.38306	2.318961	0	0	0	0	0	0	10YR 5/2	natural smoothing with smoothing, pecked
7365	120.806	1.663825	0	0	0	0	1	1	10YR 6/2	pecked, slight smoothing
42IN43 722	45.6751	2.123695	1	0	0	0	1	0	10YR 6/2	heavily pecked, slightly smoothed
42IN43 723	27.20866	2.388945	1	1	0	0	1	0	10YR 6/2	pecked and smoothed with ground areas
42IN43 739	29.99658	2.566959	1	1	1	0	1	0	5YR 7/2	pecked, ground, slight smoothing overall
42IN43 758	18.84509	2.440954	0	0	0	0	1	0	10YR 7/1	pecked and evenly smoothed all around
42IN43 796	26.62952	2.140482	1	0	0	0	1	0	2.5Y 7/2	pecked and smoothed, large peck areas
42IN43 902	25.14849	2.544885	0	0	0	0	1	0	2.5Y 7/1	peck marks like a golf ball look, smoothed in a sphere.
42IN43 913	31.29889	2.364301	1	0	0	1	1	0	7.5YR 8/1	smoothed and pecked, finely smoothed
42IN43 2089	60.72504	2.140797	1	0	0	0	1	1	10YR 7/2	pecked and smoothed a lot of smoothing, deep pecks
42IN43 2170	31.49943	2.222262	1	0	0	0	1	0	10YR 8/1	heavily pecked and smoothed
42IN43 2172	45.93305	2.307706	1	0	0	0	1	0	2.5Y 8/1	pecked, deep pits, some smoothing
42IN43 2459	32.02486	2.248253	1	0	0	0	1	0	2.5Y 8/1	pecked, smoothed, and slight patina
42IN43 3366	122.4879	2.620667	0	0	0	0	1	0	10YR 7/3	smoothed, covered in something, pecked
42IN43 3601	88.62712	2.595142	0	0	0	0	1	1	5YR 7/4	smoothed, pecked, sooting patina
42IN43 3367	120.4124	2.715666	1	1	0	0	1	0	10YR 6/2	smoothed, pecked
42IN43 3424	94.68833	2.207241	1	0	0	0	1	0	7.5YR 7/2	pecked, little smoothing

Artifact Number	Volume	Density	Divots	Flattening	Finger Flat	Grooving	Ochre	Burned	Munsells Color	Notes
42IN43 2239	73.12775	2.434096	1	0	0	0	1	0	7.5YR 6/3	pecked and smoothed
42IN43 3423	61.85265	2.360449	1	1	1	0	1	0	10YR 8/1	ground, pecked, slight smoothing
42IN43 2438	57.84554	2.247364	1	1	1	0	1	0	10YR 7/1	pecked, smoothed
42IN43 2171	50.68853	2.505498	1	1	0	0	1	1	7.5YR 4/1	heavily pecked, smoothed, patination on burn mark
42IN43 2240	41.53303	2.479954	1	0	0	0	1	1	7.5YR 8/1	smoothed, pecked in places
42IN43 2169	37.51362	2.345815	1	0	0	0	1	0	10YR 7/1	smoothed, pecked
42IN43 2088	35.25723	2.297401	0	1	0	0	1	0	7.5YR 6/2	smoothed, some pecking
42IN43 799	29.34003	2.28357	1	0	0	0	1	0	5YR 5/4	pecked
42IN43 1102	28.31707	2.048234	1	0	0	0	1	0	5YR 6/3	pecked and smoothed
42IN43 1103	27.98145	2.10854	1	0	0	0	1	0	7.5YR 8/1	pecked and somewhat smoothed
42IN43 738	22.06665	2.80967	1	1	1	0	1	0	5YR 6/1	pecked, smoothed, ground
42IN43 923	21.53204	2.229236	1	0	0	0	1	0	2.5YR 7/3	heavily pecked and smoothed
42IN43 915	19.47994	2.926086	1	1	1	0	1	0	Gley1 7/1	smoothed, pecked
42IN43 837	12.44263	2.491435	1	1	0	0	1	1	7.5YR 7/3	smoothed, slightly pecked, some deep peck marks
42EM73FS18.17	1.943533	2.572634	0	0	0	0	0	0	10YR 4/1	smoothed all over
42JB2FS593.3	125.0904	2.134456	1	1	0	0	1	0	10YR 7/2	smoothed, grooved, slightly worn on the top
42WN267FS1	111.2228	2.52646	1	1	1	0	0	0	2.5Y 7/1	pecked and smoothed/rounded in parts.
42WN286FS1	89.26954	2.576467	1	1	0	0	0	0	10YR 7/3	pecked, ground
42WN337FS1	68.50694	2.058186	0	0	0	0	1	0	10YR 8/3	pecked, smoothed, covered in mud or patination
42WN238FS1	23.69016	2.363851	1	0	0	0	1	0	10YR 8/2	pecked and smoothed
42IN124FS451.30	19.98016	2.402383	1	1	1	0	0	0	10YR 8/2	ground flat, smoothed, slight pecking
42IN124FS62.142	44.45036	2.092222	1	1	0	0	0	0	10YR 7/4	ground, pecked, smoothed, chipped
42IN124FS345.105	30.38733	2.533951	0	1	0	0	0	0	10YR 8/3	smoothed, pecked, broken
42IN124FS52.20	32.84457	2.709732	0	0	0	0	0	0	10YR 8/6	smoothed

Artifact Number	Volume	Density	Divots	Flattening	Finger Flat	Grooving	Ochre	Burned	Munsells Color	Notes
42IN124FS309.96	19.04557	2.362754	1	1	1	0	0	0	10R 6/6	ground, smoothed, pecked
42IN124FS497.90	22.41724	2.185817	1	1	1	0	0	0	10YR 7/6	pecked and ground, smoothed
42IN124FS67.64	24.6673	2.270212	1	0	0	0	0	0	10YR 7/6	pecked smoothed
42IN124FS176.99	26.77352	1.680765	1	1	0	0	1	0	5YR 5/2	pecked, possible smoothing
42IN124FS281.57	28.73091	2.4364	1	0	0	0	0	0	10YR 7/6	pecked, ground
42IN124FS209.199	29.45519	2.478341	1	1	1	0	1	0	10R 5/6	pecked, smoothed,
42IN124FS366.4	28.95833	2.728058	1	0	0	0	0	0	10YR 6/1	smoothed, pecked around the sphere
42IN124FS353.23	35.1274	2.192021	1	1	1	0	0	0	10R 5/4	pecked, ground, smoothed somewhat
42IN124FS252.151	17.21096	2.440306	1	0	0	0	1	0	10YR 7/3	natural cobble?
42IN124FS28.12	36.21914	2.595313	1	1	0	1	1	1	10 YR 7/1	smoothed and pecked chipped
42IN124FS213.55	7.544031	2.651103	1	0	0	0	0	0	5YR 5/2	natural cobble
42IN124FS522.197	153.1707	2.14793	1	1	0	0	1	0	10YR 7/3	pecked river cobble
42IN124FS62.47	74.68915	2.476933	1	1	1	0	1	0	10YR 7/4	pecked, ground, smoothed somewhat
42IN124FS171.53	72.00597	2.055385	1	0	0	0	0	0	5YR 8/3	pecked, maybe slight smoothing
42IN124FS201.45	69.11599	1.794086	1	0	0	0	1	0	7.5YR 8/3	smoothed, pecked,
42IN124FS140.158	69.93365	1.858905	1	1	1	0	1	1	7.5YR 4/1	pecked and slight smoothing
42IN124FS96.66	62.42165	1.89037	1	1	1	0	1	1	10YR 5/1	pecked, ground, smoothed
42IN124FS158.86	56.35167	1.313182	0	1	0	0	1	0	7.5YR 4/1	pecked and some smoothing
42IN124FS58.42	45.88138	1.96158	1	0	0	0	0	0	Gley1 4/N	pecked, heavily
42IN124FS302.91	38.97741	2.283374	1	1	1	0	0	1	2.5YR 6/4	smoothed, pecked, patinated
42IN124FS214.191	37.06382	2.698049	0	0	0	0	0	0	2.5Y 4/1	smoothed, patinated possibly
42IN124FS213.68	33.84654	1.979523	1	1	0	0	0	0	5YR 7/4	pecked and slight smoothing
42IN124FS187.32	30.54457	2.488167	0	0	0	0	0	0	10YR 8/1	heavily pecked and smoothed
42IN124FS433.10	31.33893	1.786915	0	0	0	0	0	0	10YR 4/1	heavily pecked and smoothed
42IN124FS166.46	34.65407	2.193105	1	0	0	0	0	0	10YR 7/6	smoothed and pecked (barely visible pecks)
42IN124FS310.27	33.76228	2.310271	1	1	0	0	0	0	7.5YR 8/1	pecked and ground

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42IN124FS363.6	35.38739	2.232434	1	0	0	0	0	0	10YR 7/4	smoothed, slightly pecked
42IN124FS233.92	37.10864	2.048041	1	1	1	0	0	0	10YR 7/4	pecked, ground or smoothed on the left side
42IN124FS294.25	16.33957	2.937653	1	0	0	0	0	0	2.5Y 8/2	pecked kind of
42SV5FS128.85	44.65294	2.709788	1	0	0	0	1	0	7.5YR 5/1	smoothed and possibly a river cobble
42SV5FS240.3	41.24371	2.618581	1	0	0	0	0	0	10YR 8/2	river cobble
42SV5FS414.1	34.91172	2.492	1	0	0	0	1	0	2.5Y 8/1	pecked and smoothed
42SV5FS416.67	35.21392	2.470614	0	0	0	0	1	0	10YR 7/3	pecked, smoothed, patinated
42SV5FS137.1	30.46588	2.593065	0	0	0	0	0	0	10YR 7/3	river cobble
42SV5FS193.124	13.80986	2.824069	0	1	0	0	0	0	10YR 7/3	River cobble, smoothed flat spot underneath label.
42SV5FS168.27	15.05156	2.723971	0	0	0	0	0	0	10YR 8/2	river cobble
42SV5FS400.27	13.97287	2.361719	0	0	0	0	1	0	2.5Y 8/1	smoothed, looks formed like from clay.
42SV5FS199.47	12.79208	2.423374	1	0	0	0	0	0	10YR 7/4	pecked and slight smoothing
42SV5FS199.46	9.506922	2.629663	0	0	0	0	0	0	10YR 7/4	Natural river cobble
42SV5FS27.21	2.870793	2.786686	0	0	0	1	0	0	2.5YR 3/1	pecked and patinated
42SV5FS221.36	3.104805	2.898733	0	0	0	0	1	0	7.5YR 5/2	river pebble, natural
42SV5FS155.60	0.962514	2.077893	0	0	0	0	0	0	7.5YR 6/4	smooth river pebble
42JB2FS451.31	45.41811	2.025624	1	0	0	0	0	0	10YR 7/3	pecked smoothed
42JB2FS759.19	15.32342	1.892528	0	0	0	0	0	0	7.5YR 6/4	smoothed, slight pecking
42JB2FS727.14	12.01484	1.914299	0	0	0	0	0	0	10YR 6/1	pecked and smoothed
42JB2FS627.5	40.7168	2.529669	1	0	0	0	0	0	7.5YR 5/1	pecked, smoothed
42JB2FS619.59	31.86258	1.788933	0	0	0	0	1	1	10YR 7/4	slight peck mark, possible smoothing
42JB2FS750.40	12.66028	1.658731	1	1	0	0	0	0	10YR 4/1	pecked slightly, maybe smoothing? Its a rough rock
42JB2FS665.184	8.597148	2.326353	0	0	0	0	0	0	7.5YR 4/1	pecked and smoothed
42JB2FS743.51	4.644187	1.937907	1	0	0	0	0	0	10YR 6/2	smoothed and pecked, chipped

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42JB2FS694.87	3.396527	2.944183	0	1	0	0	0	0	7.5YR 3/1	naturally round, slightly peck, patination, and sheen.
42JB2FS714.175	0.434893	2.299417	0	1	0	0	0	0	Gley1 2.5/N	smoothed, possibly natural. Chipped/flattened on front.
42MD180FS371.3	27.17222	2.72337	1	1	1	0	0	0	10YR 5/1	pecked, smoothed, chipped
42MD180FS333.52	26.70145	2.771385	1	0	0	0	0	0	10YR 4/2	smoothed, pecked
42MD180FS333.63	23.79002	2.269859	1	1	1	0	0	0	7.5YR 6/4	pecked, possibly ground
42MD180FS133.83	22.22555	2.654602	1	0	0	0	0	0	Gley1 6/N	pecked and smoothed
42MD180FS234.118	19.42165	2.780402	0	1	0	0	0	0	Gley1 7/N	smoothed all over (almost polished status)
42MD180FS184.58	21.50086	2.744076	1	1	1	0	0	0	2.5Y 8/1	smoothed, flat spots, pecked spots
42MD180FS209.1	22.80392	2.71883	0	0	0	0	0	0	10YR 4/1	golf ball appearance pecked and smoothed
42MD180FS73.41	15.29857	2.679989	1	1	1	0	0	0	10R 6/4	smoothed, striations visible, some pecking
42MD180FS337.17	17.34563	2.190754	0	1	1	0	0	0	7.5YR 7/6	smoothed, slight peck marks
42MD180FS248.41	16.86408	2.727691	1	1	1	0	0	0	10YR 4/3	pecked, slight ground on spot behind label
42MD180FS187.50	13.99627	2.643562	1	1	1	0	0	0	7.5YR 6/3	smoothed, ground, pecked slightly
42MD180FS255.61	7.810635	2.17652	0	0	0	0	0	0	10YR 7/4	natural, a couple pecks, not smoothed
42MD180FS333.66	33.17633	2.682635	1	0	0	0	0	0	10YR 5/2	smoothed, pecked
42MD180FS333.37	43.54631	2.411226	1	1	0	0	1	0	10R 8/2	pecked a lot, and smoothed a little
42MD180FS108.60	45.93305	2.612498	1	0	0	1	1	0	10YR 6/2	smoothed, pecked large spots
42MD180FS352.48	45.41811	2.091677	1	1	0	0	0	0	7.5YR 6/6	pecked, ground, slight smoothing overall
42MD180FS305.1	44.90704	2.471773	1	1	1	0	0	0	10YR 7/4	smoothed, pecked, ground
42MD180FS300.24	51.46521	2.351103	1	1	0	0	0	0	10YR 6/4	ground, pecked
42MD180FS333.60	61.60087	2.694767	1	0	0	0	0	0	10YR 4/2	slightly pecked
42MD180FS92.112	60.47634	2.314955	1	1	1	0	0	0	7.5YR 7/3	pecked, ground, smoothed
42MD180FS34.30	59.42693	2.406317	1	1	0	0	0	0	5YR 6/4	smoothed, pecked, slight grinding
42MD180FS160.140	79.20868	2.676474	1	0	0	0	1	0	7.5YR 8/2	smoothed, pecked

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42MD180FS347.39	50.35807	2.263788	1	1	1	0	0	0	10YR 6/4	ground, pecked, smoothed
42MD180FS278.62	110.8504	2.571032	1	1	1	0	0	1	7.5YR 3/1	ground, slight pecking
42EM3426FS6	48.94269	2.717464	1	0	0	0	0	0	2.5Y 8/1	smoothed, some pecks
42UN170FS98.183	13.01378	2.458933	0	0	0	0	0	0	10YR 5/2	pecked and smoothed
42UN170FS144.20	41.3882	2.657762	1	1	1	0	0	0	5YR 5/2	ground, and possibly chipped and smoothed
42UN170FS43.16	11.7213	2.303499	1	1	0	0	0	0	7.5YR 5/6	pecked slight smoothing below label
42UN170FS121.3	19.16077	2.557309	1	0	0	0	0	0	2.5YR 4/3	chipped, slight pecked, maybe slight smoothing
42MD76FS9.25	306.8975	2.473138	1	1	1	0	0	0	10YR 7/6	pecked, slightly ground
42SV633FS832	27.83314	2.299417	1	1	1	0	1	0	10YR 8/1	pecked, ground slightly
42WN2151FS256.2	6.178698	2.589542	0	1	0	0	1	0	7.5YR 8/4	pecked slightly
42WN2401FS165	0.659584	3.032216	0	0	0	1	0	0	7.5YR 4/2	Natural or a concretion of sandstone
42WN337FS14	91.87025	2.416452	1	0	0	0	0	0	10YR 8/3	pecked slight and smoothed
42WN231FS76.1	111.5027	2.421467	1	0	0	0	0	0	10YR 8/2	pecked and slightly smoothed
42WN337FS67.17	107.354	1.900255	1	0	0	0	0	0	10YR 7/2	pecked and smoothed
42UN1FS11469	28.01861	2.462649	1	0	0	0	1	1	5YR 6/2	smoothed and pecked
42PI2 20220	74.33235	2.475369	0	0	0	0	0	0	10YR 6/2	natural cobble
42PI2 20177	6.940806	2.88151	1	0	0	0	0	0	7.5YR 6/1	pecked
42PI2 20098	20.54928	1.265251	1	1	1	0	1	1	10YR 6/2	smoothed, ground (flat spot), slight pecking
20081	91.2154	1.776016	1	0	0	0	0	0	10YR 8/2	pecked with possible slight smoothing
42EM63AR1618	30.0355	2.596927	1	1	1	0	0	0	10YR 7/3	pecked and slightly ground (flat spot)
42EM63AR1619	32.14694	2.115287	0	0	0	0	0	0	10YR 4/1	pecked and slight smoothing (Could be natural)
42EM63AR1625	52.81505	2.480354	1	0	0	1	0	0	10YR 7/3	pecked on sides, natural on other parts of rock
42EM63AR1626	62.10511	2.31865	1	1	1	0	1	0	Gley1 5/N	smoothed, pecked
42EM63AR1627	48.51258	2.370519	1	1	1	1	0	0	10YR 6/4	smoothed, pecked in parts
42IN40FS820.42	15.32342	2.806163	0	0	0	0	0	0	2.5Y 5/1	heavily pecked and heavily smoothed

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42IN40FS659.8	17.72644	2.989884	0	1	0	0	0	1	10YR 5/3	polished, smoothed out peck marks
42IN40FS842.6	31.01955	2.643494	1	1	1	0	0	0	2.5YR 5/1	pecked, smoothed, a little sheen to it
42IN40FS821.28	43.99679	2.431996	1	0	0	0	0	0	10YR 7/4	smoothed, and pecked
42IN40FS947.12	42.40909	2.452305	1	0	0	0	0	0	10YR 5/1	pecked, smoothed
42IN40FS808.13	51.07588	2.290709	1	0	0	0	1	0	7.5YR 7/3	smoothed, pecked (likely naturally round originally)
42SV21AR5574	61.47524	2.407473	0	0	0	0	0	0	2.5YR 4/4	smoothed, heavily pecked
42SV21FS3.1	42.31115	2.316175	1	0	0	0	0	0	10YR 6/4	pecked and smoothed slightly
42SV21FS3.2	31.29889	2.364301	1	0	0	0	1	0	10YR 8/1	pecked and smoothed
42SV21FS41.2	6.552367	2.289249	1	0	0	0	0	0	10R 4/3	pecked and smoothed
42SV21FS22	26.27176	2.245758	1	1	0	0	1	0	10YR 7/3	smoothed, chipped
42BE974AR2339	109.0929	1.98913	1	1	1	0	1	0	10R 6/8	pecked and smoothed, ground
42BE974AR2341	50.30314	1.90843	1	1	0	0	0	0	7.5YR 7/2	pecked and somewhat smoothed
42BE974AR135	46.71274	2.376226	0	1	0	0	1	0	10YR 7/3	smoothed, ground, pecked
42BE974AR2344	32.80326	2.560721	1	1	1	0	1	0	Gley2 4/5PB	smoothed, sheen
42BE974AR2343	38.14943	2.385357	1	0	0	0	1	0	7.5YR 6/2	pecked and smoothed heavily
42BE974AR2342	29.30171	2.388939	1	1	0	0	1	0	10YR 6/2	pecked and smoothed
42BE974AR2345	21.87696	1.782697	1	0	1	0	1	0	7.5YR 8/1	highly smoothed, but deep pecks
42BE974AR2338	22.38522	2.010255	1	1	1	0	1	0	10YR 8/3	pecked and slightly smoothed
42BE974AR2340	21.4386	2.7054	1	0	0	0	1	0	10YR 8/2	smoothed, pecked,
42SV805FS246.1	52.8718	2.553346	1	1	0	0	0	0	10YR 8/1	pecked heavily and slightly smoothed
42SV805FS150.1	118.0694	2.650984	1	1	0	0	0	0	2.5Y 8/1	smoothed, pecked
42SV5 AR2179	106.175	2.55239	1	1	0	0	0	0	10YR 4/1	pecked and smoothed
42SV5 AR2180	39.25604	1.859587	0	0	0	0	0	1	10YR 8/2	heavily pecked and smoothed
42SV5 AR2181	33.76228	2.310271	1	1	0	0	0	0	2.5Y 8/1	pecked and slight smoothing
42SV5 AR2178	52.13722	2.47424	1	0	0	0	0	1	10YR 7/2	pecked and smoothed

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42SV23AR1474	36.44017	2.305149	1	1	1	0	0	0	10YR 7/6	pecked, ground slightly, and smoothed
42SV28F2	26.20059	1.908354	1	1	0	0	0	0	7.5YR 7/3	smoothed, slight peck
42SV7FS81.9	35.08419	2.023704	1	1	1	0	0	0	10YR 7/2	pecked, slightly smooth
42SV7FS57.1	27.39135	1.934917	1	0	0	0	0	0	10YR 8/2	pecked, chipped, smoothed
42SV7FS57	32.51503	2.02983	1	1	0	0	0	0	2.5Y 7/3	smoothed, slight pecking
42GA43F4	53.21315	2.668513	0	0	0	0	0	0	10YR 7/4	river cobble
42GA51FS34	58.75441	2.39982	1	1	1	0	0	0	10YR 7/2	pecked, ground, smoothed
42WB318FS25	44.80528	2.499705	0	1	1	0	0	0	10YR 4/2	ground, possibly a cobble that has been worked
42PI508FS31.1	137.2583	2.309515	1	1	1	0	1	0	Gley2 7/5PB	smoothed, slight pecking (a couple peck marks)
42WB34FS584.20	2.267574	1.764	0	0	0	0	0	0	10YR 6/2	Concretion, sheen
42EM2095 1782	0.693747	2.882895	1	0	0	0	0	0	10YR 7/2	concretion
42EM2095 1867.1	0.758847	2.635578	0	0	0	0	0	0	7.5YR 3/1	concretion with sheen
42EM2095 1361.1	0.748833	1.335411	0	0	0	0	0	0	Gley1 4/N	concretion with sheen
42EM2095 1877.000	10.36336	2.122864	1	0	0	0	0	0	5YR 3/1	smoothed, drilled with slight peck maybe
42EM2095 933.1	13.41925	2.310114	1	0	0	0	0	0	10YR 7/3	slight peck, possibly naturally round. smoothed?
42EM2095 1878.1	10.32509	2.905543	1	0	0	0	0	0	2.5YR 3/1	concretion slight sheen
42EM2095 2442.1	22.80392	2.148753	1	1	0	0	0	1	7.5YR 5/2	pecked on the top right
42EM2095 2407.1	109.3692	2.358983	0	0	0	0	0	1	7.5YR 6/2	pecked, possibly smoothed, but difficult to say
42EM2095 2411.1	119.5302	1.748512	1	0	0	0	0	0	10YR 8/4	pecked, chipped, smoothed
42EM2095 297.1	51.13138	2.601142	0	1	0	0	0	1	2.5YR 6/4	smoothed or ground, slight peck
42EM2095 674.1	44.90704	2.00414	0	0	0	0	0	1	5YR 7/4	natural with a couple peck marks
42EM2095 2352.1	27.87017	1.829914	1	1	0	0	0	0	7.5YR 5/2	pecked, heavily smoothed,
42EM2095 942.1	21.84546	2.197253	0	0	0	0	0	1	5YR 6/4	natural, one peck

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42EM2095 993.1	27.50135	2.181711	0	0	0	0	0	0	10YR 8/1	natural river cobble, possibly smoothed
CEUM1805 SS CB12 D8	47.29008	1.953898	1	0	0	0	0	0	10YR 6/2	pecked in part, slight smoothing, natural concretion
CEUM1806 SS CB12 D8	29.84123	2.077663	1	1	1	0	0	0	10YR 7/4	heavily pecked, possibly smoothed, flattish spot
CEUM302 SS CB12 D8	111.1297	2.779636	0	0	0	0	1	1	10YR 6/3	smoothed, striations visible
CEUM 39369	7.778949	2.249661	1	1	0	0	0	0	10YR 6/3	pecked, dented,
CEUM 39370	9.928984	2.276164	1	1	0	0	0	0	10YR 5/2	pecked ground,
CEUM 39367	1.755391	2.221727	0	0	0	0	0	0	10YR 7/6	natural concretion with a possible peck
CEUM08366	2.295511	1.263335	1	0	0	0	0	0	10YR 7/6	bone with slight chip spot, possibly patinated
CEUM9925 892	46.71274	2.070099	1	1	1	0	0	0	10YR 8/1	pecked, smoothed, ground
CEUM9925 608	43.14848	1.995435	1	0	0	0	0	0	10YR 7/3	pecked and smoothed a lot
CEUM9925 620	72.9869	2.356587	1	0	0	0	0	0	5YR 4/1	pecked, smoothed, chipped to flat spotish
CEUM9925 522	27.87017	2.081078	1	0	0	0	0	0	2.5YR 5/3	pecked smoothed
CEUM9925 451	28.95833	2.458705	1	0	0	0	1	0	2.5Y 8/2	smoothed, pecked,
CEUM9925 828	55.7026	2.222518	0	0	0	0	0	0	10YR 8/2	smoothed and pecked
CEUM9925 13571	35.86736	1.826173	0	1	0	0	0	0	2.5Y 7/3	ground, smooth, pecked heavily
CEUM9925 602	1.743688	2.924834	0	0	0	0	0	0	2.5Y 3//1	smooth concretion
CEUM9925 651	42.3601	2.072705	1	1	1	0	0	1	10YR 8/1	pecked, chipped flat or ground, smoothed
CEUM9925 473	40.28904	2.717861	1	0	0	0	0	0	10YR 8/1	smoothed, pecked heavily
CEUM9925 23	22.57782	2.046256	1	1	1	1	0	0	10YR 7/2	pecked, grooved, chipped flat
CEUM9925 562	12.3994	1.830734	1	0	0	0	0	1	2.5Y 6/3	smoothed, pecked
CEUM31S63	12.92479	2.390754	1	0	0	0	1	0	10YR 7/1	heavily pecked, smoothed
CEUM31S66	16.46967	2.155478	1	1	0	0	1	0	5YR 6/4	pecked, smoothed
CEUM31567.2	53.95778	2.618714	1	0	0	0	1	0	5YR 7/3	pecked, smoothed, slight grind
CEUM31567.1	37.10864	2.279793	1	1	1	0	0	0	Gley1 7/N	pecked, slight smoothing

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CEUM31S64	30.74189	1.750055	1	1	1	0	0	0	7.5YR 7/4	pecked, possibly smoothed, ground flat
CEUM33973	42.95047	1.762495	1	1	0	1	0	0	5YR 4/1	pecked, smoothed, grooved
CEUM31S60	16.73192	2.295015	1	1	1	0	0	0	10YR 7/3	pecked, possibly smoothed, ground flat
CEUM31565	19.59688	2.245255	1	0	0	0	1	0	10YR 8/1	heavily pecked, smoothed
CEUM31561.2	3.793513	2.66244	1	0	0	0	0	0	7.5YR 5/3	smoothed, slight peck
CEUM31562	10.75122	3.255446	1	0	0	0	1	0	10YR 7/1	pecked, smoothed,
CEUM31559	6.524185	2.007914	0	1	0	0	1	0	7.5YR6/4	pecked, smoothed, chipped to flat spotish
CEUM31557	27.61165	2.582243	1	0	0	0	1	0	5YR 6/4	smoothed, pecked
CEUM31556	31.9031	2.209817	0	1	0	0	0	0	5YR 8/3	pecked, smoothed
CEUM31558	18.98815	2.907077	1	0	0	0	0	0	Gley1 5/N	smoothed, slight pecking
CEUM31587	32.43299	2.349459	1	0	0	0	1	0	2.5Y 8/1	pecked and smoothed a lot
CEUM31573	22.03496	2.650334	1	1	1	0	1	0	7.5YR 8/2	slight grinding, pecked,
CEUM31571	18.70276	1.443637	1	1	1	0	0	0	Gley2 4/10B	pecked, slight smoothed
CEUM31575.1	37.96704	2.494268	1	0	0	0	0	0	2.5Y 8/1	pecked heavily and smoothed
CEUM31575.2	22.1619	2.396004	1	1	0	0	1	0	2.5Y 8/1	heavily pecked, smoothed
CEUM31641	75.40616	2.206716	1	0	0	0	0	0	5YR 6/4	pecked, smoothed
CEUM31589	0.901014	3.329582	0	0	0	0	0	0	5YR 6/3	concretion
CEUM31574	6.766325	2.187303	1	0	0	0	0	0	7.5YR 8/1	pecked, smoothed
CEUM8487	6.809668	2.129326	1	0	0	0	0	0	2.5Y 7/2	formed and smoothed
CEUM13521	25.74115	2.622261	1	0	0	0	0	0	7.5YR 6/3	smoothed and slight pecking
FIPR574	109.6459	2.498042	1	0	0	0	1	1	7.5YR 7/2	smoothed, slight pecked in areas
FIPR70	59.54975	1.929479	1	1	1	0	0	0	7.5YR 7/1	smoothed, pecked
FIPR67	53.27018	2.361546	1	0	0	0	1	1	10YR 6/2	pecked and smoothed
FIPR71	35.1274	2.24611	1	1	1	0	0	1	5YR 6/4	pecked and some smoothing?
FIPR73	26.77352	2.237285	1	0	0	0	0	1	10YR 4//1	pecked, smoothed, patinated

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FIPR65	10.75122	1.590518	1	0	0	0	0	0	10YR 8/1	pecked and smoothed
FIPR59	1.69167	2.60098	0	0	0	0	0	0	7.5YR 4/1	patinated, smoothed possibly a concretion
FIPR68	31.379	2.230791	1	0	0	0	0	0	10R 7/4	pecked, patination/discoloration, some smoothing
FIPR66	24.0577	1.695923	1	0	0	0	1	0	7.5YR 8/1	smoothed, pecked
FIPR69	14.30274	2.041566	1	0	0	0	1	0	7.5YR 7/2	smoothed and pecked
FIPR72	106.7181	1.453362	1	0	0	0	0	1	10YR 7/2	pecked, ground, smoothed?
FIPR60	63.37771	2.559259	1	0	0	0	0	0	2.5YR 5/1	pecked, smoothed, chipped
FIPR61	23.72342	1.496412	1	0	0	0	1	0	2.5Y 8/1	pecked and smoothed
FIPR64	6.608975	2.587391	0	0	0	0	0	0	10YR 4/1	concretion? Smoothed/polished, patinated, pecking?
FIPR63	2.846441	2.67	1	0	0	0	0	0	10YR 7/1	smoothed (possibly a concretion)
FIPR1536	0.379587	3.161332	1	0	0	1	0	0	10YR 2/1	grooved, pecked or drilled hole
FIPR1637	10.00364	2.609051	0	0	0	1	0	0	10R 3/1	grooved, smooth (another possible concretion)
FIPR1636	24.0913	1.950912	1	1	1	0	0	0	10YR 7/2	pecked and somewhat smoothed, ground
FIPR1611 FS3681	32.76198	1.748979	1	0	0	0	0	0	10YR 8/1	heavily pecked, and slightly smoothed
FIPR1613 FS5599	23.52434	1.564337	1	1	1	0	1	0	10R 4/4	pecked, ground, somewhat smoothed
FIPR1616 FS7263	48.51258	2.05926	1	1	1	0	0	0	7.5YR 6/2	smoothed, pecked,
FIPR1617 84.9.5356.5	37.15349	2.365861	1	1	1	0	0	0	2.5Y 7/1	smoothed, ground, pecked
FIPR1618 FS7417	12.31324	2.61507	1	0	0	0	0	0	Gley2 7/5PB	pecked, smoothed
FIPR1620 FS8425	79.13438	1.78557	1	0	0	0	0	1	10YR 5/3	pecked, kind of smoothed
FIPR1621 FS8511	47.87216	1.407916	1	0	0	0	1	0	7.5YR 8/1	pecked, slight smoothing
FIPR1625 FS9554	57.42463	1.474977	1	1	0	0	0	1	10YR 7/1	smoothed, pecked
FIPR1627 FS9557	40.52631	1.626104	1	1	1	0	0	0	10YR 6/1	smoothed, pecked
FIPR1631 FS9618	22.9338	2.31536	0	1	0	0	1	0	10YR 7/2	heavily pecked and smoothed (golf ball appearance)

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FIPR1632 FS9618	30.6234	2.249914	0	0	0	0	1	0	10YR 6/3	river cobble
FIPR1633 FS9618	37.19838	2.182891	0	0	0	1	1	0	10YR 6/3	grooved, smoothed, pecked
FIPR1605 FS2843	52.41894	1.659706	1	1	0	0	0	0	2.5Y 8/1	pecked and smoothed
FIPR1606 FS2920	30.90035	1.715191	1	1	0	1	0	0	5YR 6/3	grooved, pecked and smoothed
FIPR1609 FS2971	49.26693	2.27333	1	1	1	0	0	0	10YR 7/1	pecked, smoothed
FIPR1610 3138	14.18434	2.467509	1	0	0	0	0	0	10YR 7/2	pecked, natural rock?, possibly smoothed
FIPR1615 6711	36.21914	1.546144	1	0	0	0	0	1	10YR 8/1	smoothed adn slightly pecked
FIPR1619 7802	14.58959	1.507925	1	0	0	0	1	1	7.5YR 8/1	pecked and slightly smoothed
FIPR1623 854	5.288893	2.457981	1	0	0	0	0	0	Gley1 5/1	chipped, smoothed/polished
FIPR1624 8723	26.80961	1.454702	1	0	0	0	0	0	7.5YR 8/1	pecked and smoothed
FIPR1628 6910	36.26327	1.902752	1	1	0	0	0	1	10YR 5/1	heavily pecked, dirt covered. Smoothed? flattened spot
FIPR1630 9606	21.03683	1.711284	1	0	0	0	0	0	10YR 6/1	pecked,
FIPR1734 3929	0.508047	3.739809	0	0	0	0	0	0	Gley2 5/5PB	concretion, patinated
FIPR1737 4081	35.34397	2.376643	1	0	0	0	0	0	5YR 7/1	heavily pecked, chipped/dented spot, slight smoothing
FIPR1755 4353	66.83394	1.690758	1	1	1	0	1	0	7.5YR 8/1	smoothed, pecked,
FIPR1756 4397	18.93084	1.796011	1	1	1	0	0	0	2.5Y 8/1	pecked, smoohted, slightly flattened on back
FIPR1769 4761	47.87216	1.880007	1	0	0	0	0	1	10YR 6/2	pecked, smoothed in parts
FIPR1770 4818	0.303009	4.290308	1	0	0	1	0	0	7.5YR 4/2	Concretion with grooving, slightly drilling, patination
FIPR1771 4839	10.15407	2.265102	1	1	0	0	0	0	10YR 8/2	pecked, smoothed, might be natural sphere
FIPR1772 4849	27.98145	1.286567	1	0	0	0	1	0	7.5YR 8/1	Natural? Smooth, natural holes, scraped spot
FIPR1780 5356	46.14011	1.66883	1	1	1	0	0	0	2.5Y 7/2	pecked, smoothed,
FIPR1781 5356	33.42662	1.765061	1	1	0	0	0	0	10YR 8/1	smoothed and slighlty pecked
FIPR1782 5356	30.38733	2.040324	1	1	1	0	0	0	10YR 6/1	pecked, smoothed, slighlty flat
FIPR1783 5367	39.72336	1.460098	1	0	0	0	0	0	10YR 7/1	smoothed and ground a little bit

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FIPR1785 5367	71.1722	1.62985	1	1	1	0	0	0	10YR 6/1	pecked heavily and smoothed in parts,
FIPR1786 5367	53.84277	1.690106	1	1	1	0	0	0	10YR 7/2	pecked, smoothed in parts
FIPR1792 5709	38.65401	2.587054	1	0	0	0	1	0	10YR 6/1	natural