

Stone Beads of Ancient Afghanistan: Stylistic and Technical Analysis

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Abstract: Afghanistan occupies a unique geographic position at the crossroads of Asia on the trade routes between east and west. Among the many objects that moved through Afghanistan, stone beads were among the most common. The study of such artifacts is important because of the social significance of beads for a wide variety of cultures. This research addresses antique stone beads from Afghanistan made of agate, carnelian, faience, turquoise, jasper, and lapis lazuli. This study focuses on stylistic and morphological features as well as manufacturing techniques, specifically the nature of drilling used to perforate the beads. Using comparative experimental and archaeological studies, I have identified the types of drills used and linked them to general chronological periods. The analysis involved detailed measurements, the employment of a bead typology, and scanning electron microscope (SEM) analysis of drill hole impressions. By following this pre-established methodology, the stylistic and technical properties of these beads were determined.

Key words: ancient drilling technology, stone beads, SEM microscopy, Afghanistan

Beads: Use and Manufacture

Beads first appeared in the archaeological record in contexts dating from the Upper Paleolithic, 35,000-10,000 years ago (Kenoyer 2003). Since then, beads have been characterized by their great diversity in different cultures and in different times. Throughout their long history, beads and other ornaments have been viewed as status markers associated with power and prestige. This social and ideological function was used to denote rank or render the owner with some special gift, such as increased fertility or protection (Kenoyer 2003). Similar to the crafting of many other non-utilitarian objects, beads contained a sort of power dynamic (Helms 1993; Kenoyer 2010). According to Helms (1993), crafted objects such as stone beads were valued because of their visible demonstration of supernatural power. Helms goes to great lengths to discuss the theory behind exotic raw materials such as gold, or, in the case at hand, turquoise and lapis lazuli. Such exotic materials were perceived as being linked to the world outside a given society, and their value comes from this connection to these exotic regions and places. The acts of acquiring and crafting beads and other objects from these exotic materials and more mundane ones, "...encapsulate power from that portion of the universe lying outside society, [and] the very acts of skilled crafting and of long-distance acquisition are important precisely because they channel and concentrate such energy" (Helms 1993:9) The production of a bead or the acquisition of a manufactured one through trade networks is one aspect of social activity that implies a certain status; one who can do so has enough time to devote to things other than simply getting a meal or values such goods enough to make time. Additionally, the control over objects of beauty to reserve them for certain individuals with adequate social value is evident in bead power dynamics (Anderson 1979). In other words, a particularly beautiful bead would lose value if everyone had one; it is through scarcity (natural or artificially imposed by elite authorities) that certain ornaments gain value. Beads, then, become a means to study social organization in the past.

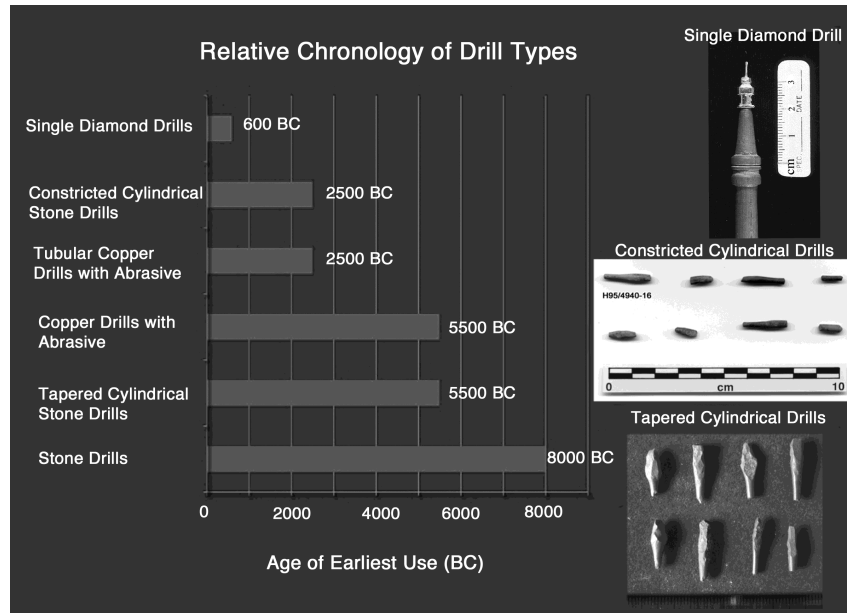


Figure 1. Drilling chronology, based on Kenoyer 2003:16.

Beads are defined as artifacts perforated through their length to facilitate stringing (after Kenoyer 2003:16; Adams 2002:214). The manufacturing techniques for beads have been relatively similar for different groups of people and at different times, continuing today in some places (see Kenoyer 1992). The first step in the manufacture of a stone bead was the acquisition of the raw material desired by the artisan or the client (Kenoyer 2005). Various exotic, semi-precious, precious, and common raw materials were available in different parts of the world wherever such deposits could be found and readily accessed (Schumann 2009, Beck 1941). After the raw material was selected, the stone needed to be gathered. That is, the desired material must either be picked up off the ground or mined using chisels, other rock cutting tools, and fire (Kenoyer 2003:15, see also Hodges 1989:106-111). Raw materials next required preparation before further modification. Certain rocks such as agate and chalcedony were left to dry out in the sun for extended periods of time to remove any moisture before being heated. When prepared, nodules were slowly heated to around 340°C to drive off intercrystalline water and make flaking easier (Kenoyer 2003:15). The next step for many beads was shaping the so-called “bead roughouts” by breaking or sawing a larger piece of stone into smaller pieces (Kenoyer 2003:15). Flaking using a hard hammer, soft hammer, inverse indirect percussion, or other forms of flint-knapping further shaped the desired roughout. Next, the roughouts were reprocessed into bead blanks, the final shape of the bead but without the perforation defining it as a bead (Kenoyer 2003). This usually involved grinding the roughout and was historically done by hand. The grinding process was extremely time consuming, more so for larger beads and those made from harder material (Kenoyer 2003:16, see also Adams 2002; Foreman 1978). The grinding of the bead blank continued until the final shape of the bead was achieved. Afterwards, production was completed when a drill was used to perforate the bead blank and make a true bead. Methods used for this perforation have changed over time with the technologies available to a culture and the dates of these changes are known archaeologically. Stone drills predominate the archaeological record from the Neolithic on, but new drills were added as technology changed, later incorporating copper and diamond drills as illustrated in Figure 1 for the region of

Afghanistan and Pakistan. On that principle, beads can be separated into chronological periods based on the type of drill used (Kenoyer 2003).

The Afghanistan Antique Beads Collection

A collection of 79 ancient beads from Afghanistan was provided by Dr. Jonathan M. Kenoyer for study. Originally acquired from a modern Afghan bead seller from Peshawar, Pakistan, this collection had been threaded into necklaces. The necklaces from which the beads were removed had been arbitrarily strung by the bead sellers of Peshawar or Herat/Kabul and therefore represented many different time periods and cultures (Kenoyer 2010 personal communication). Raw materials included in the collection were banded agate, carnelian, faience, jasper, turquoise, and lapis lazuli. This study proposes to determine the manufacture techniques, chronology, and possible cultural affiliations of these diverse stone beads.

Stylistic and Technical Analysis

To investigate the manufacturing techniques, stylistic attributes, and chronology of the 79 beads in the Afghanistan Antique Beads Collection, each bead was first sorted into one of six categories based on its raw material. These categories were banded agate (28 beads), carnelian (18), turquoise (26), lapis lazuli (5), jasper (1), and green/white faience (1). Each bead was then given an arbitrary accession number in the format of “AAB.2010.[sequential number, 1-79].” This is interpreted as “Afghanistan Antique Bead recorded in the year 2010 number [1-79].” After this, relevant metric measurements were collected for each bead, including length, width, height, end dimensions, and perforation size. Based on the results, the beads were separated into discrete stylistic types based on the Harappa Bead Code, the typology used by Dr. Jonathan M. Kenoyer for the beads of Harappa (Kenoyer 2010 personal communication). In this study, the Harappa Bead Code proved equally useful in Afghanistan; all beads fit into a category from that typology. A bead was called “long” if its length was greater than its width, and “short” if its width was greater than its length.

The next part of the nomenclature describes the overall shape of the bead’s mid-section. A bead was called “barrel” if its mid-section was convex and gave the bead the characteristic shape of a barrel. The term “bicone” was applied when a bead was composed of two relatively symmetrical cones meeting at a definite line down the center of the bead. A bead was called “cylindrical” if it had the appearance of a cylinder and “spherical” if it had the appearance of a sphere. “Lenticular” beads had distinguishable curved surfaces different from those on “barrel” and other bead types. Other shapes included diamonds (flat and other), squares, pear-shapes, and rectangles. Lastly, the term “elliptical” before the shape of the mid-section designated the section view of the bead as being elliptical in shape. See Table 1 in Appendix for a summary of stylistic analysis. The drill holes of many long barrel beads had very different recorded diameters, and it therefore seemed likely that different types of drills were used in their perforation or the long barrel shape for beads likely endured for an extended period of time, rendering this stylistic analysis unable to delineate chronological periods. However, based on the previous work of Kenoyer, it appeared that surveying the drill hole manufacture techniques utilizing a SEM could

likely do this. To that end, drill hole impressions of 53 beads were made using vinyl polysiloxane, a type of dental putty. The putty was injected through the bead and removed after it had hardened. The resulting impression of the drilled surface preserves microscopic traces of the tool used for drilling. When viewed under electron bombardment in the SEM, these microscopic features can be compared with known bead drill holes made with different types of drills. Twenty such impressions were examined with the SEM, identifying a range of drilling techniques comparable to the reference materials provided by Kenoyer from his extensive studies in this area. Based on a procedure developed by Kenoyer (Kenoyer and Vidale 1992; Kenoyer 1997), drill hole impressions were examined at 22 or 25x, 50x, 100x, and 300x magnification. Figure 2 presents the SEM images documenting the different drill types.

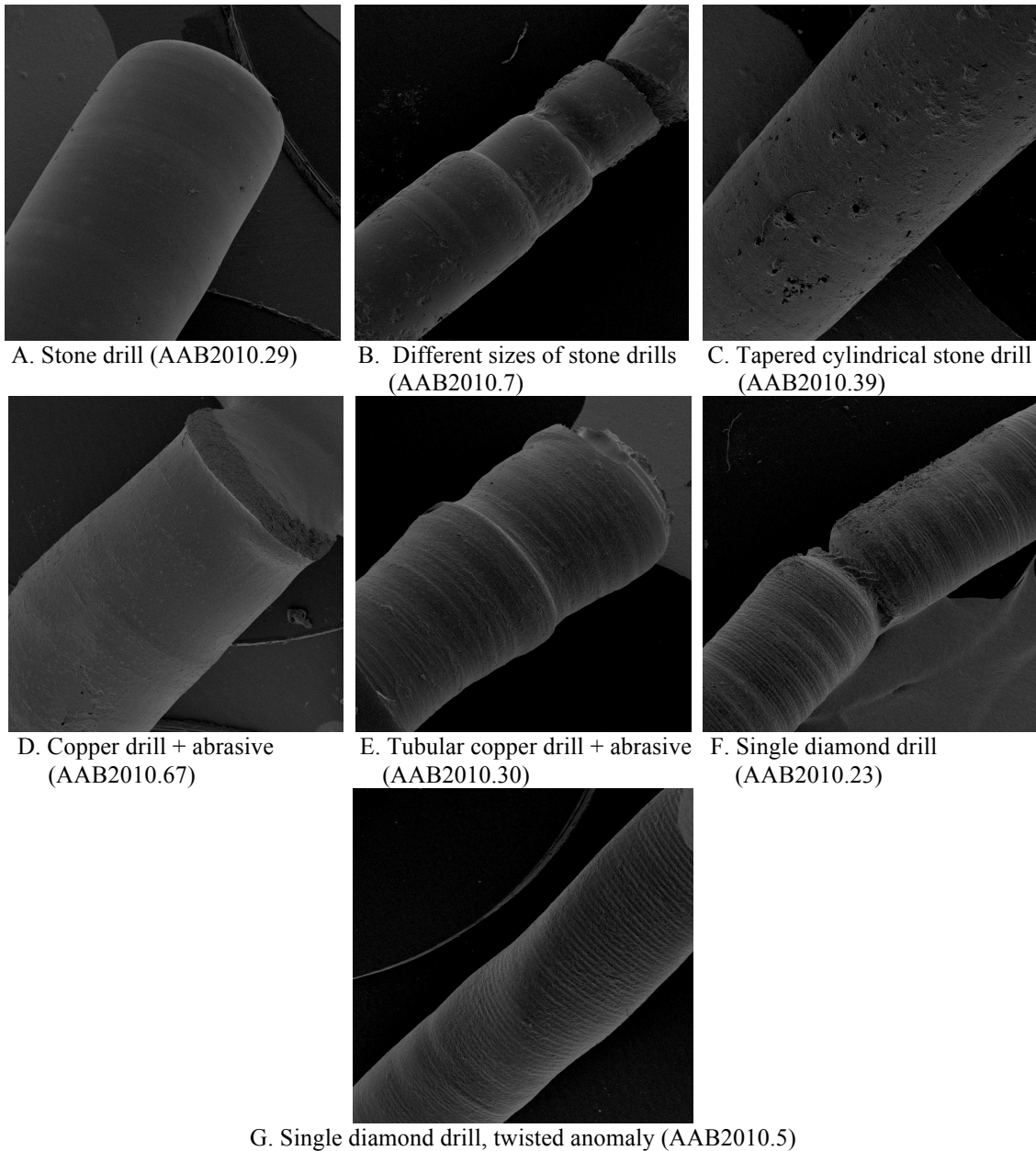


Figure 2. SEM drill hole analysis (all images at 10kv and 22-25x magnification).

Stone drills were identified by the very smooth nature of the surface and were, in general, fairly thick, as in the SEM images included as Figure 2a and 2b (Kenoyer 2010 personal communication). Tapered cylindrical stone drills featured characteristic tapered drill holes left behind, lacking the roughness and expansions of the copper drills (Kenoyer and Vidale 1992; Kenoyer 2010 personal communication). Figure 2c shows an SEM image of this type of stone drill. Copper drills with abrasives were identified by the tapered nature of the drill hole, the slightly rough surface, and the irregular lines left from places where the copper drill expanded (Kenoyer 2010 personal communication). Figure 2d shows an SEM image of an impression drilled by a copper drill with abrasives. Tubular drills of hollow copper with abrasives were distinguished by the bands of differing lengths flaring up in large, irregular ridges and by their slightly roughened surface (Kenoyer 2010 personal communication). Note these features in the SEM image of Figure 2e. A diamond drill was used on a bead if the surface of the impression was very rough and had obviously visible, parallel segments gouged in at regular intervals (Kenoyer 2010 personal communication), clearly present in Figure 2f. Additionally, this analysis was able to identify some previously unrecorded surface features that appear to be the result of a twisted form of diamond drill, represented by the impression image included as Figure 2g. The collection of beads was then chronologically sorted based on the known age of the various drilling technologies, as per the chronological sequence detailed in Figure 1.

Discussion

It was determined that, in total, fourteen samples were perforated by stone drills, two by different sizes of stone drills, ten by tapered cylindrical stone drills, nine by copper drills with abrasives, two by tubular copper drills with abrasives, and sixteen by diamond drills (with four exhibiting the twisted anomaly). The results of this technical analysis are recorded in Table 2 in the Appendix. One tapered cylindrical and four diamond drill hole impressions displayed signs of wear from abrasion while in use (Kenoyer 2010 personal communication). Stylistically, 43% of the collection of beads fell into the “Long Barrel” category, with many having very different drill hole sizes, indicating that different drills were used and that the same shape was used in different time periods. Therefore, stylistic analysis in this study was unable to sort the beads into discrete chronological periods. Cultural identity proved illusive, with the only diagnostic artifact being the green/white faience bead, which was probably traded from the Indus Valley civilization sometime between 2600-1800 BC (Kenoyer 2010 personal communication). The other beads were manufactured by drills with broad cultural applications. At this time, the cultural identities of the samples in the Afghanistan Antique Beads Collection are not directly indicated by the drilling technologies used in their perforation. Further work could assist in linking specific features of these different drilling technologies with specific cultures, both in Afghanistan and elsewhere.

The types of drills used in perforation, however, could be used to determine the relative chronology of the beads. Based on the chronological sequence of drills defined by Dr. Jonathan M. Kenoyer and shown in Figure 1, the beads of this collection could be dated. Beads drilled by stone drills were probably the oldest, since that technology emerged in the Neolithic, though they could be younger in cases where stone drills persisted in use. Beads perforated by tapered cylindrical drills or copper drills with abrasives represent the next time period, both coming into

use beginning in the Chalcolithic. Those beads drilled with tubular copper drills fit in the next youngest time period, in use after c 2500 BC. Lastly, those beads drilled with diamond represent the youngest specimens, originating in the seventh century BC in India (Kenoyer 2003). Though there may have been cases of continued use of older drill types, the beads could be separated into discrete time periods that they could not predate, providing a *terminus post quem* for each. The dramatic increase in efficiency following the development of diamond drills (see Kenoyer 1992; 2003) may limit the circumstances for the continued use of less efficient drills, though cultural choice may have outweighed efficiency in some circumstances. It is necessary that future analyses be done to determine and explain cases where certain drill types persist after newer, more efficient technologies are developed.

Additionally, this methodology has broad applications in other regions. Wherever stone beads have been perforated with different types of drills, a similar process could be undertaken by obtaining drill hole impressions and examining them under the SEM. By comparing the SEM images from those unknown samples to experimental SEM images of known drills, a similar classification can be discerned. Since the dates of the various drilling styles have been widely determined for much of the Old World, as seen in Figure 1, and parts of the New World, similar chronological separation would be possible. With that in mind, it is indeed possible to define both the manufacturing technologies and the relative history of the beads in this collection.

Conclusions

In conclusion, this research was able to show that a chronological sequence can be established for an assemblage of stone beads through analysis of their drill hole impressions. The majority of samples appear to have come from the historical period sometime after the initial invention of diamond drills in approximately 600 BC, but a good number of beads were drilled using stone drills that are dated much earlier, perhaps to the Neolithic period. Methodical measurement and stylistic analysis may provide useful information regarding the variation of styles and shapes in beads, but in this case they were unable to serve as reliable chronological indicators. Drill type, on the other hand, was able to sort the beads chronologically.

Indeed, the use of vinyl polysiloxane for drill hole impressions allowed the drilling pattern of the beads to be studied. By looking at these impressions under a scanning electron microscope, the drill type used in the perforation of a given bead could be determined with a high level of confidence. This study has shown that, although beads may appear similar morphologically, technical manufacturing choices reveal chronological associations that could be easily overlooked.

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Appendix: Tables 1 and 2

Table 1: Application of bead typology

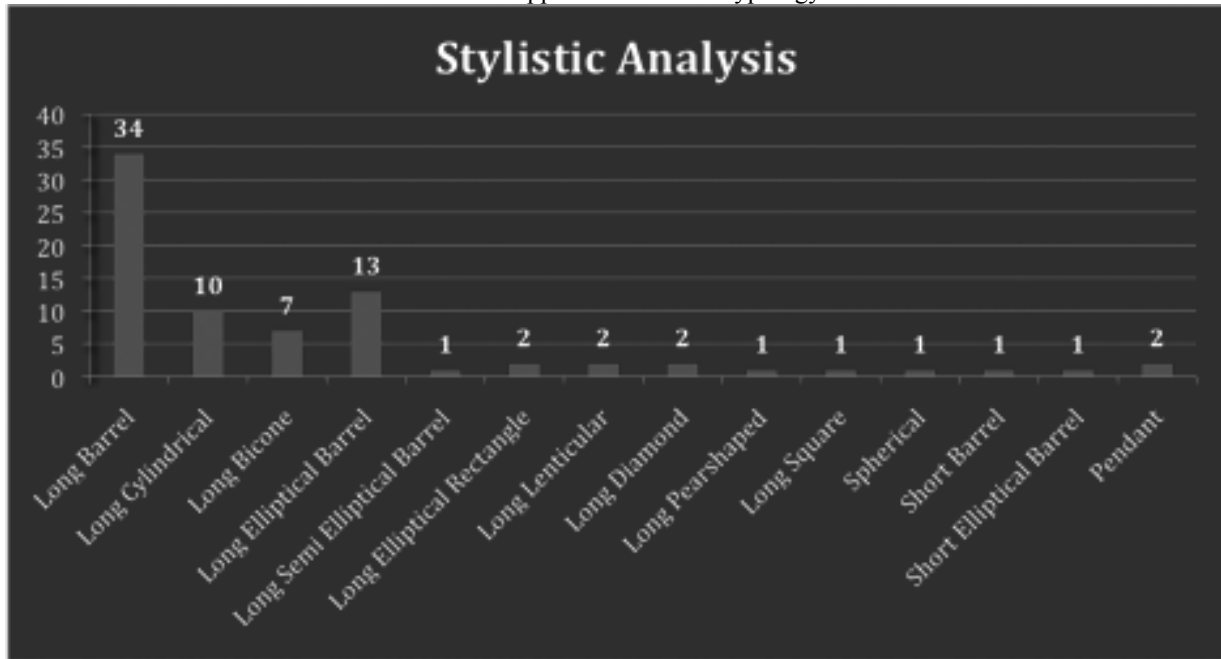


Table 2: Results

