

Review of Raymond et al. 2022 Analysis and reproduction of the techniques of perforation of quartz and amethyst beads from the Ceramic period in the Antilles, *SocArXiv Papers*
By Laura Kozuch

This is a very important work, and it applies innovative, comprehensive, and good methods towards an understanding of the topic. The authors present a good review of current bead drilling research from Europe and the Caribbean. Most importantly, this focuses on bead crafting without using metal tools. Much research shows how stone beads are made with metal tools but methods for making beads without metal has rarely been discussed and is not well understood.

The authors demonstrate that a cactus drill tip was probably used. This coincides with the Chumash tribe on the California coast using sea lion whiskers (Arnold and Rachal 2002). I wonder whether *pitahaya* cactus spines (*Acanthocereus tetragonus*) may have been used.

This corroborates my own research on the types of materials needed to drill through very hard materials (Kozuch 2021, 2022). Some beads are sometimes up to 6 or 7 centimeters long and could not have been drilled with chert or other stone drill tips. The numbers shell beads found at Cahokia in the heart of North America are astounding and the shells used have high Mohs (5.5) values also. I can send the authors copies of my publications if authors have trouble locating them.

Line 24: “First Ceramic communities” should be “Early.”

Line 28: Delete the negative symbol in front of 400; should be “400 cal. BC...”

Line 37: New paragraph should begin with sentence, “Raw materials...”

Line 43: Use “Quartz” as the first word in the sentence rather than “It...”

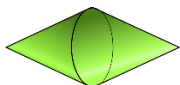
Line 64: change word “resumed” to “summarized.” Resume means to begin again.

Line 66: Wow! Amazing amount of time to drill a bead.

Line 75: Please don’t use the word “stigmata” as this word has religious meaning. Use “microwear” instead throughout. 😊

They correctly note (lines 90 and 91) that there is a “scarcity of elements from the chaîne opératoire, represented by only 6 small amethyst flakes and 5 rock crystal flakes and crystals.” This supports the hypothesis that beads were drilled with biological materials, not stone. Note that some editors prefer that whole numbers below 10 be written out: “five” instead of “5.”

Table 1: I don’t know the term “Bitronconical.” Maybe they intend “biconical,” meaning “two cones?” Two truncated cones joined at the wide ends. Two truncated cones joined at the narrow ends are also biconical.



The shapes of archaeological bead drill holes are *prima facie* evidence that the drilling method they propose (with cactus spines) is the correct one for longer beads. It is possible that disk beads and beads with drill holes less than one centimeter long may have been drilled by stones drill bits. Disk and smaller beads exhibit widely conical drill holes (higher than 7 degrees).

Line 97: Heading should be titled “Methods” not “Method”

There should be a sub-heading before line 98 titled, “Imaging Archaeological Beads”

Line 109: wording is awkward. “It also allows to overcome the...” should be changed to “This technique overcomes the constraints of 2D while eliminating the need for elastomer impressions.” I hope that does not change the intent.

Line 111: “In this study four amethyst beads...” They need to state they are archaeological beads and not reproductions. “In this study four *archaeological* amethyst beads...”

Paragraph beginning on line 114 should have its own sub-heading, “Bead replication experiments.” I also think the first sentence in this paragraph more properly belongs in the literature review or in the introduction section.

Line 117: The archer drill is known as a bow drill. The authors may want to state that or change their terms. Line 120 “archer” needs to change to “bow” throughout.

Figure 5 is great! Note that a vise can be made with wood and string:



Line 130: “perforation performance” should be “perforation effectiveness.”

Line 134: I disagree that hardness of the drill tip needs to be equal to the material being drilled. The other drilling aids (grit, oil and/or water) help to overcome the lower hardness of the drill tip. My opinion only.

Line 138: A new paragraph is needed for the sentence beginning, “For the organic drills...”

Line 180: I don’t understand the four types of perforations (or drill holes as I call them). I think(?) rectilinear might better be described as narrow angle, such as 1 or 2 degrees (1 to 2°).

Maybe you mean cylindrical? You might want to define these four terms, as I am also unclear what you mean by chamfered.

Line 198: It is better to be more precise in the language used to describe the drill holes. I have quantified the drill hole shapes of longer barrel-shaped beads using a mathematical frustum equation (Kozuch 2021). This allows for more precision when describing the shape of the drill hole. Sometimes the holes have almost parallel sides, other times they are more like two cones joined at the narrow ends.

<https://mathworld.wolfram.com/ConicalFrustum.html>

Line 199: Sentence beginning, “Long acquisitions...” I don’t understand the intent of this sentence. Do you mean, “Long scan times?” Long amounts of time being scanned in the X-ray microtomography machine? Please clarify.

Line 210: These are casts of the drill holes, right? You should say “elastomer casts” instead of “impressions.” I’m sure this is a simple translation problem. *Cast* is defined as - to give a shape to (a substance) by pouring in liquid or plastic form into a mold and letting harden without pressure. It can also be used as a noun, e.g., a cast of the drill holes. Please change all instances of “impressions” to “cast.”

Figure 13: I would add (lines 228 to 232) that this may illustrate the flexibility of the drill shaft; that it’s probably made from biological materials (cactus spine).

Line 244: Replace sentence beginning with “Other...” with this, “Bead drill holes made with experimental chert drills create wide, conical and short perforations.”

Line 248: I would add that the shape of drill holes made with chert or stone have greater degree angles ($>7^\circ$?) than those made from biological drill tips which result in more parallel sided drill holes (cylindrical?).

Lines 255-256: I would suggest that for beads drilled with bone or wood, that the drill holes were started with chert drills, then mostly accomplished with bone or wood drill tips.

Line 259: “Inverted cone shapes...” You mean partial or truncated cones. These are frustums and you may want to point that out.

<https://mathworld.wolfram.com/ConicalFrustum.html>

Line 260: Change “(i.e., at the bottom of the hole)” to (i.e., point at which the cactus drill tip was drilling into the amethyst).”

Line 270: 215 hours for one drill hole. Fantastic!

Line 298: Again, please ensure you are clear regarding definitions of rectilinear and chamfered. I think you mean drill holes with small angles such as one degree (cylindrical?). Please define conical. How many degrees would make a drill hole conical? Ten degrees or 20? Maybe use a protractor. I’ve used a goniometer which is more commonly used by medical doctors.

Line 311: The word “stigmata” should be “microwear.” Please see Richard Yerkes important publications involving microwear.

Line 359: Use of river cane, which is widely available, serves well as a shaft to hold a drill bit in North America. See Kozuch 2022. Species name is *Arundinaria gigantea*. This species may not have existed in the Caribbean, so I suggest *Guadua amplexifolia* which is native to the neotropics.

https://en.wikipedia.org/wiki/Guadua#Distribution_and_habitats

Also, people may have obtained bamboo or river cane by barter or travel, but I really like the cactus spine option.

Line 363: Again, a simple vise made of two pieces of wood held together at the ends with string would be sufficient. See above.

References Cited

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