Peer Community In Archaeology

Using Cactus Thorns to Drill Quartz: A Proof of Concept

Donatella Usai *and* ***Jonathan Hanna*** *based on peer reviews by* ***Viola Stefano****, and 1 anonymous reviewer*

Madeleine Raymond, Pierrick Fouéré, Ronan Ledevin, Yannick Lefrais and Alain Queffelec (2022) Technological analysis and experimental reproduction of the techniques of perforation of quartz beads from the Ceramic period in the Antilles. SocArXiv, ver. 4, peer-reviewed and recommended by Peer Community in Archaeology.
https://doi.org/10.31235/osf.io/a5tgp

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Quartz adornments (beads, pendants, etc.) are frequent artifacts found in the Caribbean, particularly from Early Ceramic Age contexts (~500 BC-AD 700). As a form of specialization, these are sometimes seen as indicative of greater social complexity and craftsmanship during this time. Indeed, ethnographic analogy has purported that such stone adornments require enormous inputs of time and labor, as well as some technological sophistication with tools hard-enough to create the holes (e.g., metal or diamonds). However, given these limitations, one would expect unfinished beads to be a common artifact in the archaeological record. Yet, whereas unworked/raw materials are often found, beads with partial/unfinished perforations are not. Could the perforations of stone beads be made using more accessible materials? Some ethnographic sources from Central America suggest certain plant materials could work. Thus, Raymond *et al.* (2022) endeavored to test the manufacturing process of stone beads by experimenting with several underrated (yet readily available) materials from the Caribbean: various species of wood, bone, thorns, and chert. As it turns out, thorns from an endemic cactus (Melocactus intortus) worked best and were actually harder than many of the other materials attempted. Even the chert drills were too large and fragile to be effective (neither are they found archaeologically). Using debitage powder from the rock itself, some water, and a basic bow drill mounted with a cactus thorn, the team successfully created perforations on unworked samples of quartz that were similar to those found archaeologically. This was corroborated by analyzing the results at different levels of magnification, including X-ray microtomography and SEM, and then comparing that to similar studies on ancient beads. The results of this study offer useful parameters for the feasibility of bead craftsmanship in the ancient Caribbean. For one, all of the materials used are fairly common in the region, including quartz

(although the source of amethyst in the Caribbean is believed to be Guyana (Cody 1990)). Additionally, the practice does not require much skill, as the authors (neophyte craftspeople) were able to replicate the holes. Presumably, a child could do this (an intriguing prospect). The study therefore offers practical data for the once mysterious production of precolumbian personal adornments. Indeed, the article indirectly offers arguments for the presence of bead crafting specialists in other areas of the world as well, where production of ornaments entails similar time investments and complexity. For example, similar quartz materials, like carnelian or agate, shaped into long barrels or cylindrical beads forming beautiful parures, are common to pre-metallic contexts of agro-pastoral societies of Europe and North Africa in the VI and V millennium BC. That said, the huge time commitment (over 200 hours per bead), although far less than the years (or lifetimes) some researchers had previously estimated, socially translates into a distraction from subsistence activities, which may indicate the presence of individuals devoted (at least part-time) to producing non-utilitarian adornments (see also Kenoyer *et al.* 1991 on this topic). Focusing on the specific aspect of finding the most appropriate substitute to metal piercing devices and the related aspects of the overall chaîne opératoire, the document invites further research, for example on the bead locking system during the piercing phase, in the management of the force exerted during the process, and in the number of failures (and on their potential uses).

References:

Raymond, M., Fouéré, P., Ledevin, R., Lefrais, Y., and Queffelec, A. (2022) Technological analysis and experimental reproduction of the techniques of perforation of quartz beads from the Ceramic period in the Antilles. SocArXiv, a5tgp, ver. 4 peer-reviewed and recommended by Peer Community in Archaeology. https://osf.io/preprints/socarxiv/a5tgp

Cody, A.K. (1990) Prehistoric patterns of exchange in the Lesser Antilles: materials, models, and preliminary observations. PhD thesis, San Diego State University.

Kenoyer, J.M., Vidale, M. and Bhan, K.K. (1991) Contemporary stone bead-making in Khambhat, India: Patterns of craft specialization and organization of production as reflected in the archaeological record. World Archaeology 23 (1), 44-63. https://doi.org/10.1080/00438243.1991.9980158

Reviews

Evaluation round #1

DOI or URL of the preprint: **https://osf.io/preprints/socarxiv/a5tgp**

Authors' reply, 21 October 2022

Dear Donatella Usai and Jonathan Hanna,

Thank you for handling the peer-review process of our manuscript and for this first editorial decision.

We want to thank the three reviewers and yourself for the advice given on our manuscript. It really makes our paper better to have integrated all these comments and suggestions. We thank the native English speakers for helping us improve the language.

Please find attached the version with track changes, and the file with point by point answer to the numerous comments of the reviewers.

All the best

Alain Queffelec on behalf of all co-authors

Download author's reply
Download tracked changes file

Decision by Donatella Usai and Jonathan Hanna, posted 19 October 2022, validated 19 October 2022

Using Cactus Thorns to Drill Quartz: A Proof of Concept

Dear authors

I am pleased to inform you that your manuscript has been evaluated by three reviewers and they agreed that this is a good paper that will be of interest to many. However they requested changes that mainly concerned grammar and terminology, rather than content, therefore the paper is recommended for publication with minor revision.

Please, consider their comments and suggestions and submit a new version of the manuscript.

Best regards

Donatella Usai

Jonathan Hanna

Download recommender's annotations

Reviewed by anonymous reviewer 1, 01 October 2022

The paper presents the innovative study of the drilling technique applied to perforate hard stone (amethyst and rock crystal) beads from six sites in the Lesser Antilles. The research complements general archaeological observations with detailed data obtained from rigorous experimental replication studies. For this reason, the paper is not only interesting from a regional perspective but also offers important methodological insights.

Although the study is detailed and rigorous, the manuscript has some minor issues that need to be addressed before it is accepted for publication. First, I recommend that the authors submit the text to a native English speaker for linguistic review. I reviewed most issues in the first pages but highlighted only the major mistakes and wrong technical terms in the following pages. Second, I recommend the authors include a short description of the sites and a map indicating their location. The studied artefacts, in fact, are completely deprived of any contextual information, which is important for the readers, either specialists in Caribbean archaeology or interested in bead and technological studies.

That said, the abstract is concise and presents the study's state-of-the-art, primary datasets, and results. The introduction explains the motivation for the study, describing relevant recent and past research performed in the field, the main research questions, and the hypotheses to be validated.

The description of the materials and methods at the basis of the research is comprehensive and detailed, allowing other scholars to replicate the study and/or apply the same method to their materials. I only recommend the authors elaborate more on the X-ray microtomography, an innovative component of the paper.

Results are solid and well described, with only a few minor issues I indicated in the PDF attached to this general review.

The tables and figures are clear. I only recommend a few minor improvements, also indicated in the PDF.

All references are cited in the final bibliography. I only noticed a few issues, also I indicated in the PDF. In general, they are updated and allow going back to the information sources at the basis of the paper, both historical and methodological. In some methodological parts, however, there are several repetitions of the same list of papers, which could likely be selected with more attention to the specific topic they have to represent. However, this is a very minor issue. In other cases, archaeological case studies are indicated to represent ethnographic research instead. This issue must be corrected. Also for these cases, the authors can see my comments in the annotated PDF.

All considered, the paper can be accepted for publication after these minor issues have been addressed and solved, either corrected or disputed by the authors, with recommendations for a linguistic review and sites description.

Download the review

Reviewed by ?, 23 September 2022

Dontella,

It was a great pleasure to review this preprint and I learned a lot. Thank you for allowing me to look at this important piece of work. I hope to be able to interact with the authors in the future. I would also like to send them PDFs of some publications to help their research and I hope this is possible. For more detailed comments please see my PDF review file.

Best regards,

Laura Kozuch

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.

See attached file for detailed review.

Download the review

Reviewed by Viola Stefano, 14 October 2022

General remarks

The article describes a very well structured and applied research in a geographical area that is practically devoid of techno-functional studies on ornamental elements. To my knowledge, techno-functional studies of Central and South American parures are very few and recent (the last 20 years), although they do lead to the knowledge of exceptional cultural contexts. I find this contribution extremely brilliant for several reasons:

- The research question is original.
- The methodology is well described and well applied,
- The iconographic apparatus is definitely beautiful and very evocative.
- The analytical techniques used are very effective and powerful.

The research group not only presents very beautiful and extremely well-documented material (I stress that all the figures are very beautiful, well-focused and in high definition), but also uses a set of observation and analysis techniques (optical, electron and 'replication techniques' with elastomers and digital) that is heterogeneous, complementary and well coordinated in the different levels of study (low and high power approach). This is not insignificant, as the parure is often not studied so comprehensively from a methodological point of view.

The depth of the regional scientific project should also be emphasised. This contribution follows on from previous works that deal with both the issues of raw materials (by through archaeometric analysis) and aspects of the contexts and manufacture of the objects. In clear continuation of these is the main topic of the present work: the understanding, no longer of general manufacturing sequences, but of a more specific aspect related to the perforation of hard stone beads.

For prehistoric times (better said in societies without writing), the use of organic materials in everyday life is a known fact, but these are 'visible' objects. The present work deals with something that is invisible, or almost invisible, to archaeological investigation. Convincingly demonstrating the use of such ephemeral tools is uncommon and, in my opinion, the strength of the contribution lies in the methodology followed: rigorous in its analysis as in its experimental section.

One of the shortcomings of this field of study is that it is very differentiated according to the individual researchers (different terminology and conventions, documentation and analytical techniques that are not always easy to compare, few databases for comparison of technological and functional aspects, etc.). The present contribution seems to me to be a decisive step towards the explication of a research programme that has as its focus the study of ancient ornaments in their multiple cultural aspects.

The other comments are listed below and represent some minor issues (suggestions) that may be considered at the time of publication of this document. The article is brilliant and very interesting. The sole purpose of my comments is to improve it (if some of my comments are not adequate, do not hesitate to explain it). In the end, I have to say that I would have described some aspects very differently, but I don't think it is right to get into matters of personal style even when they concern more technical and operational aspects. The different contributions must be written to represent the logicalscientific choices and styles of each particular research group.The reviews in which I have been involved have always tried to make me write the paper in the style of the reviewers and according to their technical convictions, thus deeply affecting my final message. By trying to communicate within a unified methodological framework shared by colleagues, the reader should be able to read your specific approach to the study of parure.

If requested in the future, I remain at the authors' disposal for any requests or suggestions.

See attached document for detailed review.

Download the review