

# EAC12 Q&A Session 12

2021 March: 12th Experimental Archaeology Conference #EAC12, World Tour

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Good evening. This is the question and answer portion of Session 12. My name is Eric Marks and I am the emcee for this live session.

The first question is for Matt.

**What about the archaeological objects studied? How did the marks compare to your experiments, for example, regarding the chisel marks you left?**

That's a great question, thank you very much. I mean, in some cases there are chisel marks left on some of the archaeological artefacts. And in other cases you see absolutely nothing and that was also replicated in my experiments. And I wonder if the degree of marks that are left on the broken artefacts has some bearing on skill. Someone who is skilled with these tools and very sure of themselves will very easily just break these objects with the first hit. And when that was achieved, no chisel marks were left of the tool. There was no indication of the tools that I'd used other than that the objects were broken. So where you see chisel marks on the broken artefacts, I think that's where someone has mis-struck, and has got it wrong with the first strike. And then the second strike, they've actually managed to break it in that way. And the same with hammer blows. If you do it correctly, the first time, with enough force, you generally just break it in one. If you have to hammer it a couple of times, you're going to start leaving hammer marks on the surface and you'll see that on the archaeological artefacts as well. So I think that one of the really interesting outcomes of the experiments is that you can start to assess the degree of skill in fragmentation, whereas it's previously just been thought of as this ecstatic event, people just smashing up bits for no good reason.

Okay, John,

**Are you planning to use use-wear on your experimental daggers to compare them to archaeological objects?**

Well, first off that's a good question, but I'm not planning on it right now. I do have other dagger experiments planned for the future, of course, because you know, like any experiment they need to be run over and over and over again. And these daggers would have to be used over and over and over again. So right now, I mean, I did take casts of the edges before I used them in the experiment in the UK. But I took them more or less for somebody else if they wanted to look at that after a certain amount of time. So no use-wear at this point, because what I was really looking at was, you know, the efficacy of that flint dagger as used as a weapon, because there's been decades of literature put out there that they're too frail, too fragile to be used as a weapon. And like I said in my presentation several times, I don't think they were ever created to be a weapon. But the thing is we need to look at every object: could it be used for that purpose if it was actually employed. So, you know, use-wear would be great, surface-wear for [sheaths], things like that would be good to look at, but in the immediate future, I don't have any plans on doing that, but I would be open to somebody else doing it on these replicated artefacts if they wanted it to.

Okay, good. And there's a follow-up: **You wore a cut proof glove as you carried out your experiments. Would hafting the daggers have modified the impact of the thrust instead?**

I don't think so, actually I think if anything, they probably would have allowed a better purchase on it. I think that the gloves, the cut proof gloves I was wearing were Kevlar based with a rubberized palm. So they gave me a lot of grip, but I've also made some, I just didn't have time. And I think we all understand that when you're under constraints of doing an experiment, especially for a thesis, dissertation work. So I just wore the glove and I mean, it gave good purchase. I have used them with cordage that I've made and put on them and they also provide really good purchase. But, yeah, I don't really think there would have been that much difference in the penetrability. Maybe it would've made a little bit more, but, you know, from what I've seen already, even without, and knows that the tangs on daggers, whether they be from Scandinavia or the ones from the UK are usually dulled on the margins. So laterally on the margins so that it is kind of dull there anyway, if they didn't, if they weren't wrapped, but I'm pretty sure every one of them had some type of handle covering, which is yet another thing that needs to be explored further.

The next question is for RJ (Richard Joseph Palmer).

You estimated that a team of three women could spin and weave a chlamys in about three weeks. **What is the division of labor between spinning and weaving? Especially as the two processes... Can the two processes overlap? I mean the weavers, can they begin before the spinners are finished?**

I believe that the weavers can begin before spinning is finished. In this team of three people, normally there is some form of family unit. Obviously I'm mostly dealing with archaic and early classical Greek time periods, so slaves could be part of that. But normally you'd have one person preparing wool all the time, and then the other two would prepare it early on and then start weaving while the spinner spins. But I think you would need to plan out some of the spinning beforehand. Otherwise you'd just be waiting a long time.

Yeah. **A lot of times when people are just viewed as weavers, there's three of them, like the three fates, or pottery work and stuff.**

It's as much of a trope as an actual family unit, because it would be the mother-in-law, wife and the daughter, or the mother-in-law, wife and slave, or some combination.

Okay. Thank you so much. Tim:

**How can you reach more experimental archaeology interested colleagues in North America, old and young and include them in your REARC network?**

That's a great question, Eric. And it's a challenge, not to start with the negative, but conferences are expensive and it's becoming exceedingly more and more difficult for people to attend conferences, and more than one conference a year. So that's a challenging question to address. Perhaps reaching out to the larger organizations and making a more concerted attempt at advertising at those events, like the Society for American Archaeology, or the Historical Society, or the Historical Archaeological Society meetings, to make our presence known a lot more I think certainly wouldn't hurt.

Having said that: **When will the next REARC conference take place? I can't wait.**

This is double trouble. Another excellent question. So ideally we would be on course to have our next meeting in the fall of 2021. But as the rest of the world is experiencing, that all depends on a lot of things, namely the global pandemic we're all living through. So if we can find a university or institution to host the meetings, and if colleges feel comfortable traveling with students, then we will be having a meeting. So hopefully we'll be able to make that progress and we'll be gathering this fall.

The next question is for Avalon,

**Have you tried using your sample of the kapa kaha?**

Okay. So I should explain this type of kapa made is supposed to be a kilohana, which is a top sheet for a bedspread. But what I made is only a small section of that. So I was basing my research off of written records by the Hawaiian historian, Samuel Kamakau. And the piece that I made is very small. It's only a couple of feet by, I think it's like two feet by maybe a foot. I would have to make several of these and then felt them together at the edges to make a larger sheet. And then I would have to sew those onto undyed kapa underneath to make it into an actual bed sheet. So, no, I'm not actually planning on using this piece unless I reproduce this experiment with several other pieces of kapa and then turn them into one huge kapa moe or bedspread. And that could take a very long time because a kapa moe would probably be about six by six feet, maybe even eight by eight feet. So that would be quite a process. And I do know some kapa makers that have made a kapa moe, but it takes a long time, but it would be really cool to use it. For now it's just sitting in my studio.

And the follow-up:

**How supple or brittle is it and how would use affect the rigidity of the material? So the more times that you use it, would it get softer, more flexible?**

That's a good question. So as far as how soft or brittle it is, so kapa in general is not brittle. That's definitely not a word I would use for kapa, but this particular piece is pretty soft because I did soften it by taking a pohaku, stone, and rubbing it so that it softened the material and also cowrie shell to further soften it. And I would not say that this particular kapa that I made is soft. It is still pretty rough to the touch and use would almost definitely soften these things over time. I think that's a really good question. And that's the thing is that I generally make my kapa as art pieces more than as functional materials. So I think it would be really neat to try to make a kapa moe and see how that does change over time with use. And I could imagine that it would definitely soften with time.

Okay, good. Thank you so much. Jack, I got a question for you. **On what other material than quartzite could this mining technique have been used?**

Good question. When I first started doing research on quartzite, way back in the early seventies, I looked at quartzite principally and in the last five years, the materials that we have now come to find out that were mined with fire are growing exponentially. And some of that work is coming from Scandinavia and some of it's coming from us in North America. I think you could use fires to mine any material in a prehistoric context. And we have great plans to test fire mining on metasediments like argillites and also metavolcanics like diabase. In Norway, a fellow named Per Storemyr has demonstrated the use of fire and reported on the use of fire in mining on chert, rhyolite, diabase and one other material that I can't remember now. Last fall, we demonstrated the use of fire on metavolcanic material in Pennsylvania, and it worked fabulously and we have also documented the use of fire on quartz in a quarry up in Massachusetts. So I think there's no limit. All you need to do is have people be cognizant that fire played a role. And this all began for me, based on archaeological work years ago and putting the pieces together. And after I saw the film, the ethnographical film by [...] in the early nineties on the [...] folks in New Guinea, mining glaucophane schist and andesite, it just, it just blew me away. So, like I said, I don't think there's any limit to what we'll be able to find in prehistoric contexts, if you look for it.

Okay. There's a follow up.

**How would you predict a more homogeneous material to react to the same stimulus?**

You mean like chert? It would react the same way. It depends on the context of the chert. If it's a limestone or dolomitic chert in layers it works one way, but if it's a huge mass like Storemyr reported on trying to heat spall chert by putting fires on top of it, it will crack it to get through [entry] and it'll work, but there's an up and downside, the downside on any material is how much is destroyed in the course of getting the initial cracks to occur to get [entry]. And that's what we were doing in our tests on the Cheshire quartzite in 2018 and 2019, we're looking at various packages, both as I reported both in situ and in [border] icelets and each one worked wonderfully and we tested the ones that had obvious fire damage, tested them by flaking afterwards to see how well they would hold up and based on several experimental runs, mine and two other colleagues that were in the team, we have a failure to a success rate of 30% to 70% in the Cheshire quartzite. So the trade-off is pretty good. And if you're careful, when you select your raw materials, you can have almost a hundred percent success with that. You know, if you just winnow out all the stuff that looks fire spalled or blackened, or maybe some sort of color shift in the material itself, you just pick the materials that are further in, you know, further away from where the fire was.

Thank you so much.

**Brianna, you said the scored basin was not able to transform into a finished piece. Could you clarify or expand on that? Did it not reach any level of ceramic or so it could still dissolve in water, or did it not reach a suitable level of vitrification to test?**

Thank you for the question. When I fired that piece, I had three pieces in there with it, and two of those pieces were made of kind of like a stoneware. And then the third piece was made more into an earthenware that I locally dug up and that one reached full fire, but it unfortunately exploded in the kiln itself. And the bigger piece made out of the stoneware, it didn't reach the temperature that it needed to be to fully be a ceramic vessel. It didn't necessarily dissolve in water afterwards, because I had left it out over time. And we had, you know, North Carolina weather... has terrible weather, and so it rained continuously and it didn't completely destroy it. It did make it weaker. So it didn't, it wasn't to the form that I wanted it to be to test out exactly.

Okay, let's see, Kelly

**Where did you get the original selection for glosses lard, beeswax or terra sigillata? And what were the results for lard that eliminated it?**

The terra sigillata, I made myself, produced from the clay I was using, which was just terra cotta. And as for lard, it looked like it had been store bought. It was in the ceramic studio that I had been working in and the beeswax was provided by professor Linda Hurcombe. She had some, in the form of a stick, to use. Sorry, I don't know what the rest of the question was.

**What were the results for lard that eliminated it..**

Oh, okay. So, when applying all three of those, two of them were post-fired polish. So it was applied while the vessels were still very hot. With the lard, it had a sheen, but it was kind of a muted sheen. It was not glossy. Like you could tell that there was a difference between the lard and the beeswax. So putting that on the test tiles kind of eliminated it and it left using the terra sigillata or the beeswax in the following firing on the actual vessels.

Okay. Thank you. Next question is for Giovanna,

**Did they practice annealing to soften work hardened metal, or did the native copper not work harden?**

The problem is copper will work harden, but it's got its limits. When I first did the experiments back in 2007 as part of my undergraduate work, I did anneal the copper, and you can anneal it in a campfire. When I did the recent ones for the video I didn't anneal it, I just worked all the way through and didn't experience any problems. I had some cracking because there were crystals of quartz that were developing inside of the copper that I couldn't see when I started. But, yeah, it works really well without annealing, so it can be done. I don't think the science museum is willing to let me cut out pieces to do some micrographic analysis to see if it was annealed and work hardened, but it could go either way. The copper from the UP is just incredibly pure and ductile.

Okay. Thank you so much.

Grzegorz, there's an experimental archaeology conference session in Warsaw the other day with a good number of people from Poland, Russia, et cetera. **What is the status quo of experimental archaeology in Poland compared to the countries around you? Is Poland indeed the bridge between different experimental archaeology communities in Europe?**

That is a difficult question to answer. I was participating in this conference. I had a speech and it's true that it was plenty of people from the Central and Eastern Europe there. And I think that the experimental archaeology now in Poland is focused inside the universities mostly, all of us working on our own fields. And we try to meet from time to time and cooperate in some wider projects. For example, kind of such a project is our International Camp of Experimental Archaeology that we organize this year here in Torun and I think that Poland has a chance to become a kind of a bridge between the Western European experimental archaeology in Western Europe and Eastern Europe. Not only because of its location, but also because of the possibility to communicate in both languages and to take the people from around because you know, it's always close to Poland and it doesn't matter where you live in Europe, simply it's central Europe and that's all I think. And of course we have to remember about a place like Biskupin because you have our experimental archaeology centre and such a very old and well-known centre. In Biskupin, every year gather a lot of people from many countries of the Western, Eastern Europe, I think that from the entire world and to what will happen later, I don't know. As I said for now, it looks a little bit strange because a lot of change, old professors are retired and now we have very young scientists with new ideas. What will be in the nearest future? I don't know. I think that we can be quite optimistic and that Poland can take a very important part to the experimental archaeology development. So it's just my opinion, but as I said: what'll happen? We'll see.

Thank you so much. John, the next question is for you:

**Using the blades with bare hands would be quite different, unless the user was so desperate to be prepared to sustain various serious injuries to their hands, especially with sharp points and stuff. Have you carried out any experiments to see how barehanded use would have influenced the nature of using the dagger and impact?**

Another, another good question. I've pretty much, I mean, as far as thrusting, no, into an object, but you need to understand I've been doing and working with stone tools for quite a while and yeah, you're right. They're absolutely right. It would cause probably some discomfort, but again, if they're hafted probably not quite as much. And again, I do believe that most of them were hafted. Two, three years ago, a type two dagger was found in Denmark that had a birchbark wrapped around it and a birch tar holding it on. So I'm pretty sure that we have some kind of handle there, but again, if we're using it in a manner, that's either defensive - because that's what I think they would have been used if they were put into play - I don't think that people probably cared that much because basically

if you're using that as a weapon, you're using it for personal defense. And you're kind of at one of those places where you have two choices, like I spoke about in the video, it's either fight or flight. And in that time, if you were running away, you probably just end up with a big crush in the back... or crushing blow to the back of the skull. So I don't think that an injury sustained at that point in time would be that big a deal. You know, if it saved you or prolonged your life. But yeah, it would, and then it would also be interesting to see different types of material, whether it be cordage or some kind of types of horn where it's set into, a handle. I mean, there's a lot of different things to look at. So, good question. And I think, like everybody's saying kind of a difficult one to answer, you know, just off the cuff without looking at it. But the other thing, I guess I want to kind of throw out there is, again, these are just starting points. You know, we need to carry it all of these forward. I mean, because most of the time we create something, we test it once and make our inferences on it, and then that's where it stops. But what we really need to look at is that whole life cycle of that object and use it in... everywhere, from just a normal everyday use to its extreme possible uses.

Okay. Thank you, [Gregorz](#).

**I hear there's a conference coming up. Can you explain a little bit about it?**

I wanted it only to add one word that I would like to invite all of you, because the next experimental archaeology conference will be probably in Poland, exactly in Torun, my city, that it is going to be organized by EXARC. So please feel invited all of you if you are interested and I am sure that you are. So that's all that I wanted to say. Thank you.

Thank you. I actually do look forward to that. **In 2023, you said, right?**

Yes.

Good. Okay.

[RJ](#) (Richard Joseph Palmer), your next question.

**Your loom weights were 180 grams, but how many yarns had you per weight? Did you try any other ways to get the fabric rolled up than the time-consuming untying and re-tying the weights? For example, lifting the weights higher with a plank or basket to untension the fabric for rolling?**

Thank you for that question. The first answer is roughly four to six. I mentioned that these were an average of 180 grams. So I used Stella Spantidaki's research in the functionality of loom weights to calculate the tension. And it came out to roughly 40 grams of tension per thread that I used or per yarn that I used. So there were a few loom weights around 200 grams and there were some that were around 180, that'd be four, the 200s would be five. So a little bit of a spread, but pretty consistent.

Second part of that question: I did not use another way to do that. I untied, I didn't untie them from the loom weights themselves. I made a big knot with all the excess material and tied the arm to itself. And then just let it loose. All the depictions of looms from that era, show them free of any type of a basket or table or anything, they're just floating there. So, I felt like using a different method would be not taking the evidence into consideration. I have heard some Northern Italian sites dug pits, and that is how they were able to deal with this tension. But I couldn't find any of that in the research that I was doing. And that seemed to be a little bit more Etruscan or Celtic Italian, which was not the main cultures I was focusing on.

**Did you ever try using a plank or basket to untension the fabric for rolling it?**

No. I couldn't find any evidence of that in the weaving practices or visual depictions.

Okay, thank you, Tim.

**Got a question for you about our sister EXARC. Should REARC and EXARC have a joint session at the SAAs or another large gathering of archaeologists?**

That's a great idea, Eric.

**Should we do an online event aiming on North America, or would you consider having the REARC conference be a formal conference, added to that workshops in a museum as well as the digital component?**

Holy moly, there's a lot of parts to that question. I think it would be a great idea to do a joint session at SAA with you know, sponsored by REARC and EXARC. Absolutely.

**Should we do an online event aiming at North America?**

An online event, aiming at North America? Yeah. You know, and perhaps if we can't meet in person this fall, that would be a really great idea just to keep the momentum alive. I like that idea a lot. Whoever asked that question, I would encourage them to reach out to me and perhaps we can put our heads together.

**Or would you consider your having the REARC conference to be a formal conference added to that? The workshops in a museum or as well as a digital component?**

Okay. I'll do my best with that one. It is a formal conference, at least as far as I understand what a formal conference is. And we are currently working with different museums, meaning the first day is formal conference, academic style presentations. And then the second day is public facing, whereby members of REARC put on hands-on workshops, activities, displays intended for other REARC participants, but also to engage the public. Yeah, that's kind of what we're all about.

Okay, Justyna

**How did you go about fastening the bone blades and what would have been the types of shoes used to fashion them?**

In our institute we have two groups which are recreating the medieval times, early medieval times. And for the purpose of our experiments, we just borrow from them the proper shoes made from hide, plus the skates from Ostrów Lednicki, they're from early medieval, and we just wanted to have, you know, most accurate experiments for this, because also on the, let's say, upper sides of the skates we have use-wear traces, visible polish, and other types of changes. So we just also wanted to compare the traces connected with hafting and connected with using the skates on feet, you know, chronologically accurate shoes.

Okay, Susan, the next question is yours.

**Is gruit something only known from the North Netherlands or did other countries have similar mixture or way of brewing in those times?**

That's a good question because it comes up quite often that gruit is a general beer brewed throughout Western Europe and it actually wasn't, it was confined to the low countries only. But in that time, the low countries was a region larger than a single country and it encompassed both an eedi beedi bit of Northern France, Flanders or Belgium, the Netherlands and a sliver of Western Germany. So yes, there's four different countries. Oh. And Luxembourg, but everybody always forgets Luxembourg. So it's about five countries, although France and Germany is only a very tiny bit.

**Okay. And if not gruit and not hops, what did other countries use back then?**

Scandinavia is well known for using juniper, meadowsweet, though that might be more from England. It's better known for being used in mead. Interestingly, when I was looking for real evidence for use of different herbs in brewing, I found a lot of assumptions and herbalist and dictionary. Like if the word has some sort of connection to brewing, therefore it must have been used in brewing, but factual recipes and instructions I didn't find very much. So I can say for sure that the gruit herbs were used, which are bog myrtle, marsh rosemary, laserwort, and laurel berries. That bog myrtle was definitely used in Scandinavian context as well as meadowsweet and some other herbs, especially Juniper. Though that had a practical function too, because it was used as a filter. But for instance, yarrow, which is well-known modernly as a historic brewing herb, I can't find any evidence for it having been used in historic brewing, not until 1911 when it showed up in a brewing book without referencing. So I don't know. I'd love to learn more and I'll keep looking. I'm fascinated by the use of herbs in brews.

**Avalon, the next question is for you. Going back to the kapa kaha: how was the clothing assembled?**

So just to clarify, this particular type of kapa is a part of a bedspread, but yes, kapa is used or was traditionally used for clothing as well, amongst other things. For clothing, there are several different types of kapa that were used for clothing. Pa'u, skirts, were a main component for women's wear. Men would have worn malo and malo are, for lack of a better term, essentially a loincloth. It's a wrap that girdles a man's nether region. Those were the two main kapa clothing pieces that were worn by men and women in historic Hawai'i and these would have been made with many, many wauke trees, which is the best that kapa is made from is generally made from wauke, which is paper mulberry. There were a few other tree species as well, but for simplicity sake, I can just discuss wauke. But it would've taken many trees to make... maybe not many, but it would have taken several trees to make a single piece of clothing because you'd want it to be long enough that you're wrapping it around yourself. So pa'u for example, the skirts, are several feet long. I'm not sure off the top of my head, how long they're usually recorded as having been, but 12 feet plus. And generally when I make a piece of kapa, for example, I'm only making a piece that's maybe a couple of feet wide by whatever the height of the tree would have been long. So let's say about seven feet for the height of a tree, maybe getting that out to be about two to four feet wide, depending. But yeah, for kapa moe for bedspreads, those are usually recorded as having been between six by six feet, eight by eight feet. And so that's where the section that I made is very small being only about two feet by about a foot, or a foot and a half or so. Very, very small, just a sample piece, essentially.

**And can one make several kapa kaha pieces and fuse them together at different times? Like let one dry out a little bit and then have a newer piece or do they need to be roughly the same manufacturing point to fuse?**

Oh, that's actually a really good question. And that's where doing this experimental project was really interesting for me because I would say it actually opened up way more questions than it answered questions, which I think is fun. Because again, I was going off of a written record for this particular experiment. Samuel Kamakau doesn't explain whether these pieces would have had to be made contemporaneously with each other. But I can say almost definitely that would not be necessary. The beautiful thing about kapa is that it is a material that can be re-wetted at basically any point in time and then re-worked. The only situation where you wouldn't want to do that is if you are putting design work on a kapa that you wouldn't want to get wet later. In the case of kapa kaha,



because it's simply a dyed material, but there's no additional design work that was put on the dyed material, it would be no problem for me to take... for example, I could take the piece that I made, just re-wet it, soak it for a couple of minutes in water, and it would be good to go and I should be able to take it. And another piece of kapa kaha that I could make, you know, further down the road, years down the road, even, and wet these two pieces and work them into each other.

Thank you. Brianna, it says: **Are you familiar with the wheel coil approach for ceramic production?**  
Yes.

**Did you use it?**

For the coil technique, no, I did not use that. I am familiar with it. It is during that time period that they did have that for larger vessels, like [...]. However, I did not have close access to a wheel. I did have access to a wheel at some point through the [...] pottery, where I got some of my materials from. However, it was not at my home. So, I was not able to use that technique. Instead I just built it by hand with the coils.

**And now do you think adding a rotational forming would have made your production of the scored basin easier?**

I do believe it would have made it easier and it also would have made it faster. And I felt like I could have made a lot more than just the one, seeing as how it took me longer than expected to make the larger one by hand. But I do feel like that technique would have made it go by faster.

Jack,

**Are there any other stone quarries in Quebec, not quartzite, that could have been exploited in the same manner?**

I confess, I do not know. I do know that there's one in Labrador, the famous [...], which is really not a quartzite that I suspect could have been. But, It would be my dream to get up there, to test that. And that's what we did when we did the research at Colline Blanche in Central Quebec was to look at that quarry and you know, dumb luck then found that indeed there was a fire being used to crack open and get into quarry faces as well as other parts of it. But I don't know. Like I mentioned in my previous comment to the question about the efficacy of using fire on other materials. I think if there's a prehistoric quarry anywhere, it needs to be looked at from the standpoint of fire as an agency to mine.

**Next question was: Were traces of [pre-knapping] thermal modification present on the archaeological material? And how would you go about attributing these traces to the quarrying rather than heating of the piece before [knapping] process?**

In the prehistoric quarries that we've observed or in the experiments?

**The ones that you observed.**

Yes, there absolutely was. And how would you go about taking samples that were fire spalled and then re-treating them to make them more amenable to flint knapping tasks?

**I think it's more of, how would you tell them apart from...**

I usually... because the initial stages of, you know, fire spalling show evidences of that, you know, thermal colors shifting from a natural color to a more reddened one. And once those colors are flaked off, it's difficult to tell. The only way you could tell if it's a certain kind of material would be in the lustrousness of it, or the shininess of it. Sometimes there's shifts in that, but it would be almost

impossible to tell, unless you had remnants of unflaked core, thermally altered surfaces. It's difficult to tell. Now I'm sure there's geochemical ways to sort that out, but just based on, you know, standard, archaeological and/or observations of stone tools are debitage that you find, it's really difficult to tell, unless you have previous knowledge of the material that you're finding and know that prehistoric cultures had a pattern of not only quarrying material with fire, but also of heat treating it. For an example, many of the... in this part of the world in North America in the broad sphere phase of prehistory certain lithic materials like Jasper or various kinds of chalcedony were almost always heat treated. And you can tell that not only in the debitage we would find these things, but you can see it sometimes in the finished pieces because of their very very... light reflecting surfaces. I know there's a way that can be sorted out through geochemical techniques, but I can't do it.

Okay, thank you. Kelly, the next question is for you.

It says: **you use terra sigillata in your experiment while other presentation by Igor Bahor & Milko Novič was also explaining the use of terra sigillata among Roman potters. While there is likely a difference between the iron age Britain and Roman practice, can you talk about the application and characteristics of terra sigillata a bit more? You did say you produced your own and if so, what was your approach?**

Yeah, that's a really good question. I'm not very familiar with their work. I know they presented on it, but I think what they were testing had to do with not using a deflocculant in their terra sigillata. For me, I used a deflocculant and all it does is it helps to levigate the particles into the finest and the least fine will settle to the bottom. So in making my own, I was able to kind of control that part of the experiment. And I used sodium silicate, which I don't believe Romans would have had access to, but they certainly would have had access to ash, which I also used. And in some readings that I found they came across using multiple types of deflocculants helps to levigate those particles best. And if you levigate them enough you have a very fine material that you put on the surface and that can produce a really nice shine. So, I would apply mine and I would do several layers after, like it would dry and be absorbed into the clay body at greenware stage. And I would also burnish them. And for some of the vessels that ended up getting a second dose of the sigillata for the post-firing process, they were fired first to a poor state, like a low fire bisque. And then I applied the final layer, if you will, of the sigillata on and polished that. And that gave it a really nice shine, almost as nice as just doing beeswax onto the vessels. And by not adding deflocculant, in my mind, that just makes it a really fine slip if it's just water and clay, because sigillata is really just that, but you're adding the deflocculant so it can be done, you can have a very shiny pot if you burnish it with water on the surface of your clay body. But for me, I wanted to test the sigillata and really produce a high gloss sheen rather than just a smooth surface. I hope that answers the question.

It does, the next part of it is: **How about maintaining the gloss, which is the best and remains on the longest without too much maintenance, also taphonomically.**

I've not really had to maintain pottery vessels that were just fired to a lower temperature and not glazed before. And what I've come across is that sometimes using beeswax, like a small amount on like a rag, can sometimes help with that and you just kind of polish it up. I'm not quite sure how to answer that because I haven't really tried it on my own pieces. But when I use the beeswax right immediately after the firing, the heat from the vessel helped to melt the beeswax so that it would produce a smoother coating on it. And, I would imagine you could warm some beeswax, so it's less like a solid and more of a liquid and kind of trying it out. Probably try it on a spot that no one sees. Like the bottom of the vessel to see how that goes. Thank you for the question.

Thank you.

Okay. (Giovanna Fregni), you mentioned that there were multiple experiments on the hammering and forming of tools and weapons from the copper.

**Do you know of any current or past experiments that have looked at the tool-wear with the reconstructions to give a better depth to what their surviving artefacts were used for and to what degree they had been used? And if not, do you think this could have been a useful study to be undertaken?**

I don't know of any experimental work on use-wear on the copper. The knives that I've made, they stay fairly sharp, but they do wear out. You can get a nice edge, but you're constantly having to resharpen them, much more so than a bronze knife. And almost all of the spear points I've seen, especially the longer ones, have bent points. As soon as it hits something with any amount of resistance the point gets bent and dented to the side. The Historical Society of Minnesota here, they've made huge ones. I mean, there's ones that I saw that were over a meter long. Must've been a massive piece of float copper they've got hammered into a swaging mold. And so it's impressive, but I think they may have been used for hunting or as weapons, but stone tools would be far more efficient, I think, you know, of the technology they had available then. I do think it would be useful to do some use-wear analysis and just some experiments with replicas and see exactly how hard you have to hit the thing before it gets the duller or bent.

Part two is: **with swaging as the copper is getting folded in as it is hammered, do the layers laminate or are the spearheads full of cracks from the process?**

So what you get, and it was what originally got me started on the project when I was working at the science museum was that all of these spears were triangular in cross section and two sides were perfectly smooth. And one side was all kind of folded and corrosion was forming in the layers. So, I haven't seen any that have been broken in half. They didn't destroy things like in Europe, which is kind of unfortunate for research, but they seem to be very solid and the evidence of working is on the one side that would have been upward in the swage where you're hammering the sides and the bits of pieces over and over again into it. So I would suppose if we were able to cut something in a cross section, you would have a very solid homogeneous copper that forms most of the spearhead, and then you'd have much more fragmented and laminated layers where you've been pushing it down from the top.

Next question is: **Can you compare the techniques from elsewhere? How much can the metal working techniques of the Middle Archaic and the Early, Late Archaic be compared to other groups elsewhere in the world, known through archaeology.**

As far as flattened spearheads, not the Wittry type that are triangular, but the ones where you take a piece of a knife or arrowhead or spearhead, where you just take a lump of copper and hammer it out on both sides. So you have something leaf shaped, it's slightly wider in the center and sharp on the edges. I have seen those in Inverness, in Scotland, where I was looking at bronze axes. And there are some early bronze age objects that are made the same way. But unfortunately in Europe people started recycling and casting and there's very few examples of the earliest bronze and copper objects made, because it was recyclable. And once you have an old knife, rather than continuing on with it, you could just melt it down and make a new one. So there's not much that we have in evidence of, you know, at least in Britain. There might be some Alpine copper that'll be discovered where we can see something similar where they also had a fairly pure copper there that could have been hammered out in the same way.

Okay. Good. Thank you so much, Susan, this is your next question.

**There's likely been more time since your brewing, did you keep any back to sample as it aged and how well did the various samples age in terms of keeping and in terms of flavour?**

Yeah, I was a little surprised of that. That is the perfect question because that was exactly what I was trying to figure out. How well does the gruit actually preserve? Like why was it deemed so necessary to make a good beer? And I found that the two beers that I made, because I made four samples, a test, one with just herbs, and two with the complete gruit, yeah, compilation that's to the best of my research and those two, they were good for very long, about two months, before they... and all, mostly they didn't actually sour. We used them. And it is very much, cause one of the ingredients that I found is completely overlooked in the literature is the use of resin in the brewing. I had a suspicion that the resin plays a much larger role in the preservation than the herbs themselves or that actually that experiment is a good kickstart for a new experiment to figure out how big of a role the resin actually played because earlier [when researching the topic], I wasn't aware that would be such a major contributor.

Thank you so much, Matt, back to you.

**Did the unheated bending eventually result in fragmentation or was it just frustrating?**

Certainly frustrating. But you were able to eventually get the pieces, get the swords and spears and everything else to fragment through that sort of unheated bending. And it's certainly a case of extensive hammering and bending backwards and forwards bending backwards and forwards to eventually achieve the fragmentation. And it was by comparison with heating the objects and just hitting them, it was just such an inefficient method. I struggled to think of a reason why you would go through that process. Yeah, it was certainly frustrating to try it out but interesting that, that was the result as well.

Okay. A follow up to that:

**Are high temperatures needed for fragmentation or could you also break swords at lower temperatures with smaller fires?**

That's a really, really good question and something that I haven't yet explored, but I'm aware that... I'm aware of a student at Cardiff University who actually tested that exact question with different bars of bronze. And he heated them up to increments of, I think 100, 150, 200, 250 degrees Celsius, heating them to different temperatures each time. And what he found was that the fragmentation was associated with greater degrees of bends at lower temperatures. So at every temperature it was sufficient to make the bronze brittle enough to break it. But the defacement that came with it, the bending of the bronze was more extreme at the lower temperatures. And by the time you get to the higher temperatures, you've created such a brittle microstructure that it does just snap without the bending, which was essentially what my experiment showed up, about 600 degrees. But, there's an interesting correlation there between how much defacement and the temperature that is applied.

Okay. And lastly: **Are there any links in distribution between these fragments and cremation burials?**

Not in Britain. I haven't actually explored this for other parts of Europe, but in Britain, the fragmentation of certainly Late Bronze Age metal work is almost completely unassociated with cremation burials. And this is partly because in the Late Bronze Age, we have very limited evidence for burial practices, though that evidence is growing. For the Early Bronze Age what you do find is a

correlation between daggers that show signs of burning and cremation burials. And this is something that I'm in the process of exploring a little bit further, but where cremation experiments have been undertaken in the past, what you see is that, the really slight bits of metal, things like pins or awls or tiny, bits of bronze will either melt or completely disintegrate alongside cremation burials, but what you see with larger bronze objects such as daggers is you'll see that they're either very slightly deformed or they might fragment. But this seems to be a byproduct of just being in a fire for a long period of time alongside the cremation. And then these fragments are also deposited with the body. But it's a really interesting question and there doesn't appear to be a correlation in the archaeological record, at least not for Britain. On mainland Europe it may be slightly different. I know there's a much greater relationship between the treatment of objects and the treatment of people. Certainly for instance in the Urnfield culture.

Okay, John: **Could the flint daggers have been used as a form of personal protection? If so, do we have any idea of how they would have been carried around?**

Well, again another good question that does need exploration. I mean, I would say that yeah, sure. I think daggers, flint daggers, no matter where they are, you're talking about a piece of material culture that have very, very complex biographies. They're not just status. They're not just, I mean, you take a place like Scandinavia, even into the UK where you don't see daggers, daggers show up on the scene. And they're there basically for a very brief period, 800 years maybe or something like that in Scandinavia, shorter in the UK or the British Isles. But you see these things where you have beautiful, pristine daggers, and then you have ones that have been resharpened down to a [knob]. I was fortunate enough to examine five undocumented as of yet, they are now, they weren't really documented into the registry of all the flint daggers. I did that in Bristol, and they ranged from being heavily resharpened to a couple of them with hardly any resharpening at all. So it seems like they were treated differently by different people in society. So I think that you have, I mean, right there, you've already showing some complexity in their nature. Some of them were definitely probably markers of status. And then some of them were exactly what they were, they were flint knives. So yes, I'm sure they were carried. I mean, look at Ötzi, Ötzi was even carrying a flint-bladed knife. Some people may call it a dagger, but as a flint-bladed knife, could it still be used? Sure. The same way a kitchen knife could be used to defend yourself. As far as carrying I believe in... it was... there's a book out, a publication out called Flint daggers of Europe, something along those lines, but it's edited by Catherine Frieman. There was an actual experiment where they were carrying daggers in different types of material. And there has been some look at wear on the surfaces of daggers and they have seen where they can associate some of that with both vegetable or plant based..., some type of carrier and also a leather based. So they were probably carried in a wide variety of things. In fact, Ötzi's again - because it is one of the preserved ones that we have - his was actually in a small, like a, I don't know the exact species, but it looked like a reed or some kind of twine type of cordage there as well. So yeah personal protection, personal use, absolutely. Status, absolutely. Markable [warrior class], absolutely. And yes, they had to be carried somehow. I'm sure in big ceremonial - and I know we all hate the word ceremonial and ritual - but we know that there were ceremony and ritual where those were actually being used as some kind of a part of that. They were probably unsheathed and that was probably part of the process. I mean, I can see that, you can kind of see that in that whole process. So I hope that answers your question.

It does. Okay. **And I see on the EXARC website that you're sponsoring an award for experiments and people can still apply.**

I'm glad you mentioned that because I probably would have got chastised by Roeland if I didn't bring that up shortly. Yes, I am sponsoring two 500 Euro scholarships that people can apply for. I think the application process is open until June and we have a board of people from various backgrounds that will be looking at this and determining the two recipients of this. But I also retain the right to fund another one or two if I want. And I think I also saw on there, they ask why? Well, why? I spent 24 years in the military and this whole thing with archaeology started with me when I was eight years old. I grew up on a ranch in Eastern Colorado, Western Nebraska. So on the High Plains I found an arrowhead when I was about eight years old and that opened the door for all of this for me. And I've, it's never stopped. I'll be 56 this year, which is 44 by my mathematics. But anyway, I don't have any children and this is my legacy. This is where I want my legacy to be. It's our collective understanding of our shared prehistory, no matter where you are. And I know that sometimes, especially in archaeology, we all know that archaeology is not the best-paying job. And especially when you're a student or when you're not a student, sometimes maybe the difference between testing out an idea is maybe a couple of hundred euros. Well, I've tried in other avenues to do the same thing and didn't get any takers. So I work with Roeland on this with EXARC because I've been a member of EXARC for almost five years now, when I first ran into them in Denmark, when I was doing some work over there. And it seemed like the right platform. So I'm hoping that somebody wants my money and I was hoping to make this an annual thing. So apply, apply, apply. Yes, there are some things that go with it. But, pretty much, it's there for the taking. So that would be the short reason why. And I hope you guys take my money.

I think that is a great initiative and I'm sure many people will look into it. Thank you.

Avalon, I got a couple of questions for you. **How does it respond to movement, temperature and moisture, which come from sleeping as in the kapa kaha?**

That is a great question. And again, I don't necessarily have an exact answer for that, considering the fact that I have not used this kapa as it's intended, as a bedspread. So, kapa in general, though, when it comes to movement, kapa is very supple. It can take on shape if you let's say fold a piece up for a long amount of time, you can kind of imagine, and I don't really like using this metaphor just because a lot of people tend to acquaint a kapa with paper, but, it's really very, very different, but it is similar to paper in the sense that if you take a piece of paper and you fold it in half, kapa is going to have a crease in it. You can work that crease out with rubbing with a stone or with a cowrie shell or something similar over time. So when it came to kapa moes, bedspreads, I imagine that, I mean, these were big pieces, so they would have really covered a sleeping person. They're not, you know, they're very different from, say, what we imagine to be like a typical blanket, nowadays, or like an animal hide or something like that. So they would have been soft and they would have been made to be nice and soft and comfortable, though they would have been a firmer substance, I think, than a lot of other blanket materials that are out there. That being said, I have actually touched kapa before that was really, really soft and, and it felt very soft, very, very comfortable to the touch and probably less likely to crease with movement of a body or an object than most of the kapa that I make, for example, because I don't soften my pieces to really, really soft. And I have not softened this kapa kaha piece to be very, very soft yet. As for moisture, and this is where I wonder if maybe some information might be missing from Samuel Kamakau's recounting of how a kapa kaha was made. Certain types of kapa would have been oiled and that oil usually with kukui nut oil which is the candle nut, and that oil would have helped make things more water resistant and kapa in general is very susceptible to wetting. As I mentioned in an earlier question, you can take a piece of kapa and

rewet it very easily and within a couple of minutes, it can be soft enough that you can start working it again. Resizing it, felting it to other pieces, for example. So, in general, I would imagine a kapa moe you wouldn't want that to be getting wet and most accounts, most historic written accounts of kapa mentioned that clothing was not washed usually. Probably not ever actually. You wouldn't really be able to wash a piece of kapa very easily. You could, but once you are done washing it, then that wetting process can have detrimental effects on the size of the kapa once it dries again. So, I imagine kapa moes probably were not washed, but they were probably cleaned, you know, brushed off or maybe even gently, you know, wiped down with something that might've been wetted, but probably not washed per se. So you wouldn't want to have that get wet. Does that answer everything?

**Yes. When making the kapa kaha, what is the mechanism for the sections of bark fiber to join? I know with felt it's the scale pattern on the wool fibers, but is there something similar to the bast fiber or is it a gum or anything else?**

That is an excellent question. I'm really glad somebody asked that, I saw that question on the Discord. So when it comes to kapa in general, I will actually make this more specific to the kapa kaha. So as Samuael Kamakau explains with a kapa kaha, these pieces were cut. So the process would be you're taking the bast, the inner bark, if you will, off of the wauke tree, that material is being soaked, dyed, and then is being beaten into kapa. And so once these pieces were made into sections, so for kapa kaha, according to Samuel Kamakau, these pieces were made into smaller sections, and then they were felted together at the edges. Now that's really interesting to me because generally when I make kapa, what you're doing is you're taking the beaten material, the beaten bast from maybe two or three trees, or from one tree that has been cut into sections. And what you're doing is you're layering them one on top of the other, so that they are perfectly one on top of one another. And what you do with that is you're felting them together using an i'e kuku. And this is a wooden mallet that has been carved so that there are groove marks on it. And there are a whole bunch of different varieties of these groove patterns. But in general, these patterns usually are designed so that they are helping work the fibers from the upper portion of bast into the lower portion. So you were effectively felting them together by beating them together and usually making a piece of kapa, involves taking some of these pieces, putting them one on top of another, beating them together. And as you're beating them, what's happening is these fibers are felting together from top to bottom as you are beating, but then they're also spreading out from left to right as you're beating. So you would be beating it out. And that will result in a piece that is larger than what you're starting with, of course. Now, with the kapa kaha, according to Samuel Kamakau, he says that these pieces were made in small sections, so kind of like the one section that I made for my experiment. But if you can imagine making, let's say, you know, two of these smaller sections and the way that Samuel Kamakau describes, it sounds like how they were felted together was not laid one on top of another and then beaten out to make a larger piece, but rather these pieces would have been wetted and then taken so that they were overlapping I imagine just a couple inches, maybe along the edges of each piece so that one piece is overlapping the other just by a couple of inches. And then beaten and felted together at those edges instead. So a little bit different than how other types of kapa were made.

Thank you so much.

Yeah. And actually just to throw out there, so I saw there was a mention of gum. No gum was used in Hawai'i. Bark cloth in other parts of the Pacific there are..., there have been and there are gums from trees or other exudates from tree materials that can be used to help secure pieces, you know, one on

top of another, for example. In Hawai'i, there traditionally are mentions of some plant exudates that were used to help stick things together. Palaholo, for example, which is prepared using the young fronds of the ama'u fern, but generally speaking, just the act of beating alone [...] have any extra sticky exudates or other material added, all you need is water and time basically, and just beating things together.

Thank you. Okay, Kelly, this is my last question for the session, so I will open it up to your questions for each other, but first Kelly. **Is the technique you use to create these Roman British reproductions similar to the methods to create Northern Etruscan Bucchero?**

I believe there are definitely similarities to the production process. I believe the Bucchero vessels were wheel thrown. My vessels were also wheel thrown and then they were burnished both of them. And, with mine, they did not quite turn out pure black, because it was kind of an uneven firing. It was in a bonfire, it wasn't done really in a kiln. And what you need to get that really black color that's uniform it needs to be a reduced atmosphere. So it's kind of a dirty atmosphere. It's not pure oxygen. So you get the blackening and the carbonized black fabric. So in making vessels either throwing them and then burnishing them and then firing them, I believe it's very similar. And the Etruscans came before the Romans and we know that the Romans took on the techniques that they liked from their predecessors. And so I definitely believe that the Etruscans could certainly have been an influence on their work as well.

That was my last question that I saw from our YouTube and our Discord. I'm opening the floor up to any of your questions for each other.

Giovanna: Matt and I were kind of chatting on the side here, but I was mentioning that factors that couldn't... that are... influence shattering and breaking metals depends on the amount of tin. There's a condition called 'hot shot', and that, when you heat up bronze, it's the condition that describes in a word basically what you need to, how it needs to be to, in order to fragment bronze and percentage of tin, the temperature. And like he said, also lead and other metals that are included in the alloy can influence how this breaks and I'd love to get together with you sometime and just chat about metal and breaking it and fun things like that.

Matt: Yeah. I mean, that sounds great. And, yeah, I should thank Giovanna for prompting my memory about copper tin phase diagrams and hot shot metalwork. It's about half past 11 at night here in the UK and my brain isn't ready for equilibrium diagrams, but that's kind of the science behind why bronze fragments. And then, you know, as one of the things that was kind of crucial to understanding the fragmentation of metalwork, and this is what Giovanna was kind of highlighting, there's the kind of objective science that goes behind it, where you could find exactly the point at which this stuff should and does break. And one of the very fun things about doing the experiments also was the kind of experiential side of things, how that actually manifests itself so we can understand exactly how the metal could and should behave. But there's any number of things that will also impact that. And for the late bronze age metal work, there's often a very small amount of lead that's included in this world. This seems to be done mostly because it improves the casting fluidity of bronze. So you'd have an alloy of copper and tin, and then a very small amount, 1 or 2% of lead. But what that also does is create faults in the micro structure because lead doesn't dissolve in the mixture and then that facilitates breaking as well. But yes, I mean, Giovanna, it would be fantastic to sit down and kind of chat this over, certainly when I'm a little bit more awake. There's so much to be explored here. And,



as I pointed out in my talk, there's so much left to be done. You know, my experiments were essentially me heating bits of metalwork and smashing out and then recording it, that going from there, I think there's loads of different things to be explored.

Giovanna: Yeah. One of the things that we regularly do is when we cast something, rather than cutting off all the sprues and the casting jets, we just take off a bit of the mold right around the edge of the casting. Give it a whack, [...] right off...

Matt: I've seen it done. It's something that explains all the casting jets that show up in the Bronze Age...

Giovanna: Yeah. You say they didn't have any saws, so it would have been horrible work to try and cut them off somehow.

Yeah, yeah.

All right. I think that's it. I want to thank everyone again for their wonderful presentations and the excellent questions from our audience.