

# EAC12 Q&A Session 3

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

<https://exarc.net/meetings/eac12> | <https://www.youtube.com/c/ExarcNetofficial>

So, hello and welcome to Session 3 of the EAC 12 EXARC Conference. Thank you all for such amazing talks, they've all been so inspiring. Listening to them, I've really, really enjoyed them. And we have quite a few questions already, so, shall I start with one for Silje?

**Will you be testing also if there is a variant of colour when ostrich shell is heated as a container for boiling water or for cooking the whole egg?**

Actually I did. I just didn't have time to include it here. So I tested various, both whole shells and that I've just emptied the shell and put it on fire, but also shell fragments. So they all change colours but in various ways and I didn't really have time to go into all of the colour changes, but it's very interesting to see how that happens and how it changes colours. And I wanted to try to say something about what had happened to the egg, by what colour it had, but it also, my experience actually also proves it is quite difficult to do that.

Thank you. That sounds really interesting. A question for Sarah: **Does ochre solidify over time or is it more a stain in the overall soil? Would rain and time break it down and then it could harden thinking more about how clay acts? Could burials have been partially desiccated beforehand and then have ochre spread over them before getting around the issue of skin slippage?**

So the first part of that question, ochre in burials appears to be mainly used, in a sort of a mixture. So, it's ground into a powder and then mixed with something like animal fat or water or something to make it into a paste or a liquid. That's something I'd like to look at more to see, whether the staining changes based on those mixtures, based on those binders. I think that there is definitely going to be going to be some findings. And I know Beth Velliky, also presented in this session, has done things in this area before. The ochre pigments themselves don't really break down. They have an amazing staying power and stain everything they touch. So anyone who experiments with ochre knows that anything you use is going to be absolutely covered. So I hope that answers that part of the question.

In the archaeological collections that I've worked with, it's very unlikely that sort of secondary burial, you do see that in ethnographic exam articles. Where you have secondary burial practices, you often lose skeletal elements. So, the smaller bones, the phalanges; the ends of the hands and feet often get lost as movement of the burial causes disruption. And most archaeological assemblages with ochre, you generally see fully articulated skeletons. So it's definitely a possibility and there are, and I said, ethnographic examples where we see these secondary burial practices, but not the archaeological collections that I've worked with.

Okay. Thank you. A question for Ole: **I was wondering what causes the buried items to move and thought it might be the moisture within the sand evaporating. Therefore, I was wondering if you've recorded the change in moisture content of the sand before and after the fire?**

Hello. Thank you for the question. The short answer is no, we didn't do a moisture temperature recording of the sand prior and post experiment. I will say that there was a lot of change of the moisture content because we experienced rain and we also used water to try and stabilize the sediments prior to re-excavation. But I believe that a lot of the movement that we saw could be caused by the sediments compacting over time because the sand was introduced very carefully, layer

by layer. And then, as the fires were carried and the rain came and, and so on, I believe it's quite possible that there is some compacting that occurred that made most of the material move downwards. Of course, there was also some movement occurring when sediments were re-excavated as you touch something unintentionally with the trowel or so.

Thank you. This is kind of a follow-up question, but it's for Magnus: **You mentioned Murphy's law providing you with rain and have you also done further experiments or are you planning to do more in different, more suboptimal weather conditions?**

Thank you for the question. Do we plan to do similar things in the future? Yeah, I do think so. I think that one of the reasons why we had such a standardized approach here, not just my fire but all the other participants, was to basically first test if this is a way forward, but obviously now that I think that we learnt a lot, and I think it was quite a good success. We can now start a season two with the knowledge we have now and look into other variables. And of course, for me, since I'm working in caves and shelters, I'd like to probably have less weather and less environmental variables. But of course I can also recognize that people would go the opposite way if they are working primarily in outdoor environments. So I think that with the set that we have now, we can go in both ways.

Thank you. And another question for Sarah: **Have you done, or do you know of any similar experiments just on bone? So for bone carvings etc.**

This is the only experiment of this type that I've carried out. I guess in terms of the methodology for the block lifting, if you were to look to see changes on whether you would see/be able to capture that in a block lifted sample for carvings, I'm not sure. I think the thin slicing would be, you would have to be very careful where you cut your thin slices because when it's in a solid block, you are, it's an educated guess as to where the best plane in which to cut the block. I think if the CT scan scanning worked, if you didn't have such dense soil blocks, you might get better results with that. But I mean bone carving is not an area I know a lot about. It sounds interesting though.

Thank you. **I've had a bit added to the question saying about the taphonomic analysis of how ochre fades over time. So, similar experiments, not including skin.** I did apply ochre to bone directly. So I haven't fully analyzed and compared the different variables, but the ochre directly applied to the bone didn't adhere as well as when ochre had been applied to the fur or the hair. And I think part of that is that the bulk of the ochre seemed to wash away. I would need to look more closely at the bones to see whether, if the ochre under a microscope had stuck in carvings, if that's what the question means, with the effective carving on the bone would make the ochre stick better.

Okay, thank you. A question for Elizabeth: **Did you also do any assignments of ochre being used against other materials, for example, to transfer colours, to see if there were any similarities in the traces left from the other perspective?**

I did do some previous experiments where we were looking at the longevity of ochre residues on other types of archaeological materials. I haven't published it, but we looked at, I think it was flint, different other types of stone tools. [... materials]: ivory, shell, treated bone and non-treated bone, mixed with different organic residues. And I think the most interesting thing that we found in that study was that it actually didn't really..., the organic binder didn't make that much of a difference in the preservation of the ochre residues on these materials. It was actually the porosity of the material itself or the [...] itself. So ochre was more likely to preserve on, for example, shell in ivory than it was to preserve on other types of stones like limestone or flint. So I think that's something to consider archaeologically as well. And I think Veerle got into this a bit with her presentation that, are these residues that we're finding as certain types of archaeological materials, incidental, or are they intentionally put there by human agents? So I think that there's quite a lot to unpack when it comes

and there's a lot more experiments to be conducted in that respect. But I do think that oftentimes when we find ochre residues, on bones or other types of material, we assume that they're there because they've been mixed with an organic binder and that's what has preserved them. But my past experiment actually found that that wasn't necessarily the case. So I hope that that answers your question a bit.

Thank you. A follow up one to that is: **Have you done any experiments using ochre as the tool? So using ochre to colour leather or stone or bone, et cetera. Do you see a difference on the ochre?** ([Elizabeth](#))

So, if you're asking whether the colour transforms based on the type of material, I haven't actively studied that through an experimental perspective. I do think it would, and I think it would also depend on the type of ochre that you're using and the, I guess the saturation of the pigment. So if you're using a lot of ochre, if you're using a little bit. Some types of ochre, the colour is much more saturated. These tend to be the more hematite rich ochres than the more clay based ochres. So there are a lot of factors that can determine that and not all materials are created equal, right? So the way that ochre would appear on a bone or a piece of leather would, I think, appear differently than it would on a rock wall or something like that. I think another PhD student I met had done studies on that, but I personally haven't conducted any experiments and can't speak to that in more detail, but it's an interesting thing and it would be worthwhile to explore a bit more in detail.

Thank you. A question for [Veerle](#). I think this is a group of three. **Wouldn't the distribution of incidental pitch on a tool potentially indicate its accidental nature? For example, being present on only one side or away from the presumed hafting area?**

Hello. Yeah, the location could be informative, but for that you would have to perform a functional study to identify which part would be the used edge and the incidental pitch would indeed normally be just on one surface only, but that can also be the case when it's functional. So it can go either way. I think it just shows that you need to do a comprehensive study to really know where it comes from.

Okay. So the followup to that is, I guess: **What criteria needs to be met to feel confident in its purposeful anthropogenic origin?** ([Veerle](#))

Well, in the ideal scenario, you would have to associate it with the functional study in which you can confirm that there is hafting of those stone tools, and then you can confirm its nature, or when you see that it's associated with specific damage on the edges, that would also help confirming it. But I think one element is where the stone tool was found. If it's found in a location close to a hearth, I think the chances of incidental pitch are bigger. If it's found far away from a hearth, if you're certain about that, the chances for incidental pitch formation would be smaller. So it kind of depends on the context and it just means that you would have to look at it in the perspective of all the other evidence on those stone tools.

Thank you. Going back to [Silje](#): **How did people first come to the realization do you think, that eggs might have changed colour through fire rather than just being dyed, for example, and do you know if any other eggs change colour in this way?**

I'll take the last thing first. I think that all eggs will change in one way or another, but it depends on how thick the shell is, et cetera. So for those who are interested in eggshells, there's a lot of work done on medieval material, for example, because they often have eggshells preserved. But when it comes to colouring, just a few years ago, that was actually the question: is this colouring due to ochre staining or is it due to something else? So when the Diepkloof team, for example, their reference in my talk started there and in their experiment, that was one of the main questions. Could they replicate the colour changes they saw in the eggshells with using ochre and they couldn't. And then

they started trying with fire or other factors simply because you can see that the eggshell fragments are also cracked and et cetera. So fire was a very likely source. But, that being said, so many of the colours that we have been able to replicate are caused by heat, but there is, among other things, a specific shade like red or brownish-red, which no one has actually been able to replicate, neither with ochre or with fire. So, there is a big potential for many more experiments when it comes to eggshells and not just with ochre eggshell.

Thanks. This is another question aimed at [Silje](#), but it's also open for anybody that was involved in your fire experiments. **Why did you use dune sand in particular? Was this similar to the ground type in the archaeological context or did you try to experiment with any of the ground types?**

The shorter answer is yes, it's similar to the archaeological sites. SapienCE works at the Blombos cave, for example, where there's dune sand in the cave. So that was one of the factors we wanted to replicate in this experiment. I have previously tried with other types of underground [substrates], other types of fire experiments before and it's really interesting to see how different sediments react to fire and you get different shades of colour, you can get different temperatures due to insulation and sometimes moisture. And of course all the other things that play into it. So it's a very good question, actually. It's based on the archaeology and then we worked from that. I don't know if anyone else wants to comment on it, because we did do a lot of discussions about substrates and undergrounds before.

Yeah, maybe [Magnus](#) here. I could also just chip in from a geoarchaeological point of view. So a lot of the sites, just as Silje says, that we are working on archaeologically, they do contain a lot of Aeolian beach sand. So it would be natural for us to get a substrate that was quite similar. The other thing is that a lot of other fire experiments conducted elsewhere have very often been conducted on soils or on different types of sand. So when it comes to understanding how heat transfers through our specific substrate, we couldn't really use the published reference samples. So this was also an excellent opportunity for us to establish some new standards. At least from the beach sand that is in our local area. So I think that in my mind, at least, that was the most natural thing to do here. To replicate an archaeological setting and to get some temperature recordings in this particular type of sand.

Thank you. A question for.., back to [Sarah](#): There are two parts in this question, another two part one, and it comes from somebody doing similar experiments with ochre at their AFTER taphonomic facility in Australia, but with fully decomposing bodies. So the two questions are, I'll read one at a time, if you like. **How do you account for the full decomposition, including putrefaction and the many liquids that are present when a full body decomposes? So this is absent in trotters.**

How do you account for it? You can't. Obviously there were limits to, or there are limits to any experiment. The options were to either use a whole pig and to choose just one element to look at. The problem with that is you have no control. I didn't have space to bury two pigs side-by-side in separate grade cuts to compare different elements. It's one of those really difficult things about experimental archaeology. It's finding that balance between what you can do, what you'd like to do and what you can do practically. It sounds very interesting what you guys are doing, and I'd love to be able to get in contact with you guys, if that's possible.

I'm sure it's possible. The second part was: **Why did you choose animal fat as a first binder?**

In the literature, there are so many different options when it comes to binders. As Beth said earlier, the material to which the ochre is applied, seems to be quite a crucial factor into how well the ochre adheres. Based on the literature, it seemed the most appropriate. Again, it would have been really

nice, and it's something that I'd like to do in the future to repeat those experiments, using different binders, to see if you get different results. It was just picking the best one from the literature.

Fair enough. Thank you. This is a question for Elizabeth: **Did you differentiate between the pressure generated by the tool cutting into the ochre versus pressure created by the hand holding down onto the tool?**

No, and I'm not exactly sure how one would possibly do that. So I'm definitely open to suggestions if somebody has a better idea. I think that was perhaps the biggest experimental variable we were trying to tackle and how exactly to quantify that. The only idea that we could come up with was to apply the pressure directly on top of a scale and videotape it while we did it. So that way we could at least know what exactly, the average temperature that we tried to apply and the standard deviations within each session. I'm not exactly sure. I suppose you could probably create some sort of mechanical instrument where the type of pressure could be completely controlled, and entirely controlled. So that would be a good experimental control, I think, in the future. But right now we're focusing more exclusively on the human experiments and human-based experiments. So we're a bit limited in that scope, but perhaps that could be a step to think about for the future. And I do think it would be worthwhile. I will say though, I think I might've touched upon this in the presentation, but it does seem like two kilograms is more or less the sweet spot because at about three kilos, I actually broke one of the stone tools, one of the silcrete stone tools that I was using. And it was extremely difficult to maintain that level of pressure consistently for an incision. So maybe you could start at, like when you write with a pencil or when you write with a pen, often you'll start at a much higher pressure than when you follow through. So I think those types of variables are things that we're looking for; if there's a deeper mark in the beginning and it tapers off. But the first part of the experiment, we just tried to have that consistency in the amount of pressure that we applied. So I think using a machine element might be something to consider in the future, but I wouldn't know what to do outside of that.

And we've had a follow-up comment from the questioner for that part of the question and they said: **Could you potentially tare the scale whilst holding down the tool and then cut?** (Elizabeth)

We do tare it to a certain extent, like if there's a bag or something on it, we tare it in that respect. So I think that they're suggesting that we tare it with the weight of the tool in addition to the ochre piece and that that's a good point. And actually that might be something, a variable to consider for the future, because I do wonder if we would have differences. But I think the measurements would still in the end be the same, but I think they might be suggesting that there could be more fluctuation within the pressure applied or there might be some more subtle nuances within the pressure measurements there. So now, that is a good point because it is making me wonder, are we getting the true pressure there because we're not accounting for the weight of the stone tool? So thanks for that suggestion. That's something that we can consider for the future portion of the experiments going forward.

Thank you. Sorry. There's one more part to the question. This is a follow-up: **Did you test scraping as well and would these marks potentially be intermediate between scoring and grinding?** (Elizabeth)

Yeah, I think for the talk I focused exclusively on the scoring incisions, and I just think that we did that primarily because there seemed to be so many variables with that in that, in the paper that was published in 2020 by Magnus Holland and myself as well as other co-authors, that's where the Eureka moment came from was where we saw that the similarities between grinding, striations and scoring. So we decided to focus more on scoring first, just because you have those associated behaviors of engraving. You know, making these patterns, especially from the Blombos ochre pieces, you have those herringbone patterns and those cross hatch patterns. So that was our primary archaeological question to tackle first. But obviously we would like to tackle all forms of ochre modification,

including scraping, as well as grinding and other things like that. So that's more of down the road, because there's so many variables to account for in each of these modification types. And what started off as a very simple experiment, as I thought, it just exponentially grew. So for the sake of the presentation and the sake of the time that we had, we focused primarily on the scoring marks, but we do hope to include other types of modifications as well. And we encourage other people to do that too once we have this study uploaded and a bit larger discussion can ensue from the observations.

That sounds great. Thank you. A question for Silje again: **Have you determined if the colours are just on the surface of the shells or is the entire fragment colour changed?**

When you see it in the plain eye, it looks at the whole fragment's colour changed. And then, if you look at it in a microscope, I haven't done the detailed analysis yet, but much of the shell is actually coloured through, depending on the heat, but I haven't done all the detailed analysis yet. So I would have to actually go back and do more analysis if I can see properly. But there is some I have to add though, that there is some literature on the colours of ostrich eggshell, and experiments with that. And I'm also looking at using different types of methods to analyze them. So not just colour, but a microscope for example, or other ways of identifying not just the fire damage or heat damage itself, but other types of changes.

Thanks. This is a question for Sarah: **Would the type of bone and the level of surface area make a difference in the chance of bone stain staining? i.e. a skull versus of patella or a scapula versus a femur?**

In theory, yes. So in archaeological assemblages where there's only a small amount of ochre in the burial, you're more likely to see staining on larger bones. But in practice, smaller amounts of ochre on bone, are much more likely to be transfer, from something else, maybe post excavation. Where ochre, in my experience and in the archaeological collections I've worked with, where there is ochre, it usually gets everywhere. It really surprised me how many of the joint surfaces of the bones had ochre staining; so the acetabulum or the socket part of the hip joint. In a human burial that is normally if it's articulated. The head of the femur is pretty neatly inserted in that. So you'd be hard pressed to get too much soil or sediment between them, but I've seen lots of acetabuli that have quite a lot of staining. So, it certainly, in the collections that I've worked with, it really seems the ochre is really moving about during that decomposition process.

Okay. Thank you. This is a question for Silje again: **When answering another question, you mentioned that there was a red-brown colour not replicated via ochre or fire application. Has anyone tried staining the shell in ochre and then firing the fragments similar to glazing for ceramics?**

I have to admit that I'm not a hundred percent sure. I know that the Diepkloof team did a range of experiments and that that was one of the things that I think they looked at, but actually, I'm not sure. It's a very good suggestion though.

Thank you very much. Thank you. And this is an open question for the whole SapienCE team: **Doing your different experiments at the same time obviously saved time and effort in running and recording new experiments. Could you explain a little more about how much time do you think this saved and also how agreed/planned the experiment designs were overall?**

(Silje) So what happened was that I wanted to do... I needed to do some fire experiments with ostrich eggshells and other people in SapienCE also had similar things that they wanted to look at. So we chatted and we realized that it would be to everyone's advantage if we could combine our efforts [instead of] build up a big season. And then we applied for money, we got money from SapienCE to do this season. And we spent quite a lot of time in SapienCE or in Bergen, [...] of Norway, planning

what we were going to look at, how we were going to do it. [Then ...], for example Ole, he spent a lot of time preparing boxes, designing the boxes and worked also with a carpenter to find a proper solution so that we didn't have to transport the heavy boxes. But if we could take the boxes apart, for example, that was really good; we had good factor in our success. It saves a lot of time because we got, for me personally, I got much data at a relatively short time. It was a lot of work while it was on and we knew that when we left. So, we had to all, or I made everyone write these [...] project proposals, and then we tried to make a puzzle where everyone could answer the questions and [could start] to answer it. But you know as you saw, some of the fires went for 10, 12 days and we had to work 24 hour shifts. So it was a lot of work, but we also got very much data out of it and much more than I know that I would have gotten in the past had I done it alone. And then in the past, I've done some longer experiments, but for example, I think Chrissie Sievers is on [a ... on just now]. And she and I sometimes had to collaborate so that one of us could write temperatures and monitor experiments while the other person slept. But in this case, we already had a roster for when people could sleep and when they would work. At the time, it said me personally, apart from the fact that I accumulated a lot of data and instead of doing a series of smaller experiments, I got a lot of data within the three weeks that we were there, but also because we wanted to do it in South Africa and the South African conditions. So that means that for me personally, I would have had to add travel to the time the experiment took. So you'd set it up an experiments and it takes quite a long time and takes longer than you think. And in this case we were six people that could help each other, setting up the experiment. And then you run the experiment. And in this case, again, we were six people who could record data and take photos and help each other with that. And then you take down the experiments and that also takes quite a lot of time, both documenting the excavation, documenting the, in my case, the ostrich eggshell and packing up, throwing away or disposing of the sand in this case, taking samples. All of these things take time and then if I had done this alone, I would then have had to maybe [reset up] and maybe I couldn't have done all of this in one setting. Maybe I would have had to leave South Africa, go back to Norway, look at my data and then come back again to South Africa. So in that perspective, for me it saved maybe actually a year, if you look at it like that, but I'm really interested to hear what the other SapienCE people say; so maybe Turid or Magnus, or Ole, Beth?

I can just say that for what I wanted to try, which was to employ this method of 3D recording, it was very, very useful to be able to be part of a team where we had so many different experiments being carried out so that I had a wide variety of different case studies to employ it on and also to give actualistic challenges of finding a method or a strategy to actually, fit different questions.

(Magnus) I could also just add that from, you know, my perspective was to study the taphonomy of different types of fires and hearths. And even though in my presentation, I only focused on the 11 day hearth, obviously I did take samples from all the hearths, so that gives a very nice reference sample for different durations, everything from one hour to three hours, one day, four days and 11 days. Most of these fires were of course not maintained, but they still would provide a baseline of how the fires would look like at various stages. So I think that the benefit then to have these shared experiments is that you actually get a lot of reference samples for free. And I also agree with Silje that being together when you make an experiment like that, a fire experiment, there are a certain amount of tasks you have to do no matter what. Whether you are one person or six, and if you were six persons, you can divide the workload on six. I would say that though, in hindsight, the 11 day fire was kind of the odd outlier fire, like the experiment here, and it did test our morale in the end. I think that we all started to cough and kind of develop some kind of lung disease cause it was quite wet wood. And mind you, this was just a few days before the Corona outbreak so that, you know, we were kind of worried that it could kind of have some long term impact on our ability to withstand lung viruses.

So I would say that in hindsight, maybe I would have that as a separate experiment just because of the effect it had on the rest of the team. And another thing that we have discussed as well is that we could probably have practiced more on the documentation techniques so that everyone was at the same level, once we went into the field. But I mean, these are things that you think about afterwards. But it was definitely one of the most intense seasons I've ever been through I think.

Silje? I just wanted to add one thing because there's a really big advantage that might not be immediately scientifically recognizable, but in that you learn from other people. So not only are you working together as a team and you learn how other people work and how they think, but also what exactly they're working on and what they're interested in. And through that you can build not just future collaboration, but you understand them better. And that, to me, has been a great experience [outside of just the science results we got].

That's such a good point. We have another question for Magnus: **You use a dustpan and a hand broom to carefully remove the ashes. How do you think the end result might have differed had you only used materials or tools available to paleolithic peoples to sweep or scoop out the ash? Presumably less careful removal could result in more ash spreading i.e. a larger hearth size, and a more pronounced incidental basin or "cuvette" cut into the ground surface?**

Yeah, probably. I didn't use a broom though. I used a kind of wooden stick that was naturally shaped. Yeah, I mean, definitely I think that the way that you remove the ash would have a certain impact on the end product. However when we did remove the ash twice, I think it was around two liters of ash each time. So in the end, it also depends on how much you remove. Are you lazy that day and you just remove as much as you care or do you go all the way down where you don't see any more ash? So I think that when it comes to those aspects, there was not really any right or wrong. I think you just need to document what you did and how you did it. And that becomes a reference. And maybe next time we will either do the same thing and see if it's consistent or do something different and see if it differs. But I think that you can't really get around those types of questions here. You just have to be transparent and then everyone can see what you did.

Thank you. That's a great answer. So this is a question for Veerle: **You mentioned that residues applied to stone tools were often lost in the sediment after heating. Do you have any advice for how this could possibly be captured archaeologically, perhaps through micro morphology?**

I think the only way to capture that is to be very careful during the excavation because, as soon as the link with the stone tool is lost, then you cannot really do much with the residues anymore. So I think you really need to try and look underneath the stone to see whether something has detached. You can, of course, through other ways like sediment samples, try to get a view, but generally that's used for having a view on the taphonomic residues. If you really want to have the association, you really need to collect the sediment just underneath the stone tool and not do it to take, but just collect a thin layer of sediment underneath the stone tool to then analyze that later on in the lab.

Thank you. This is a question for Turid: **Could you comment on the difference between heating effects in microfauna and larger fauna, if any?**

Thank you for the question. And that is actually, I have to be honest, one of the things I'd like to investigate further. I don't, at the moment, really know. I just know that there's been some studies where they're kind of in reference to archaeological material, it's been argued that you could, like I also say in my presentation, that you could link the changes of colour on burnt micro mammals, and then possibly with a higher temperature, you could then identify if it was a anthropogenic fire. And then they used a reference to, I think it was pig phalanges, and that actually made me spark this whole investigation with the micro mammals, because I thought, we need a reference that's from

micro mammals. And to then look further into all the burnt material that we find in the archaeological material and try and investigate if we can kind of replicate this theory. So we'll see, is the answer. I can't really say anything yet, but hopefully once I've done some more analysis, I'll be able to answer better.

Thank you. That sounds great. I hope you get to do more analysis. It sounds really interesting. So this is for Sarah: There's a few questions. The first one is: **so ochre is a bit like glitter? Do you think that the iron oxide content in ochre powder could explain the amount of staining that occurs?**

Firstly Ochre is very like glitter. It gets everywhere and you can get sparkly ochre. And then second, I think that the iron content in the ochre powder can definitely affect the amount of staining, and I think also the inclusions. So the other kinds of minerals that you get combined with the ochre, likely have an effect. So in my main site that I'm working on for my PhD, the main archaeological site, I've noticed two or three different colours of ochre. So an orange, a red and a purple and the purple has noticeably bigger crystal structure, visibly different. And it is the difference between red ochre and purple ochre, I'm not a chemist, but as I understand it, is largely to do with the crystal structure. And some of the bones, the human bones, and in my experiments that I've seen, the ochre is permeating and penetrating down into the middle part of the bone, the trabecular bone. And I think that can only be possible if the particles and the type of ochre being used have small enough particles. So it'd be very interesting to look at.

That sounds super interesting. I think you've kind of answered this, but this is a follow-up to that question: **Will you be looking at ochre mineralogy at all?** (Sarah)

I would really like to, unfortunately COVID has really played a blinder on this part of my research and because of various time pressures, I won't be able to include these experiments in my PhD research. Where this part of my part of my project goes from here, I'm not really sure. It's certainly something that I would like to look into. So it depends on the opportunities as to where it goes next, but I definitely think it's a really interesting avenue to look at, both from an experimental and an archaeological perspective.

I really agree with you. Thank you. So this is another question for Veerle: **I'm wondering, based on the results of your experiments, what your thoughts are on the recently published papers on the use of birch bark tar by Neanderthals?**

There are several things to say about that, of course. But if the question is, there are some papers where the amounts of birch bark tar that are discovered are very large; they're bigger chunks. So I think that in those cases, the chances that they are related to hafting are bigger, but even on those pieces, it's necessary to examine whether it makes sense in terms of the stone tool - where the location of the use-wear would be and where the location of the bark is. That's often not very clear in those studies. If the question more relates to the whole complexity of the manufacturing process, because that's another aspect that's been linked to those studies. It's clear that birch bark tar can be produced incidentally, and that may have played a role in how it was gradually developed. So I think people have demonstrated that the process can be rather simple. It doesn't necessarily need to be so complex, but of course the amount of birch bark tar that you will produce incidentally will always be rather small. It will not be major chunks of birchbark there. So I don't know if this responds to your question.

Oh, thank you. No, that was a great answer. Thank you. And, and then this is our final one for this session, although I think this is a two-part question and I think this links back to maybe the first question I asked. And so this is for Silje and it's about the differences between using eggs as cooking containers versus boiling the whole eggs. So the questioner has asked: **Does the water keep the**

**entirety of the eggshell cool enough, i.e. under a hundred degrees, to avoid noticeable colour changes, minus scorching of the exterior, of course, or is there perhaps a thermal gradient between the exterior and the cooler interior that could be visible perhaps in cross section under a microscope?**

Yeah, that's the big question isn't it? And if I had had time, I would have looked at it by now, but unfortunately I haven't had time to look at it. It must be said that no one has really looked at it though. As I said in my talk, actually, ostrich eggshells were sometimes used as water containers; we know that ethnographically. But no one has really looked at whether they could have been used to boil things. And there's not really many indicators of that either. So, someone will have to look at, for example, residues of the eggshells to see something other than water was in it. But it's part of what we're trying to find out. So did people take the eggs and then cook the egg, for example, is that, could that be how it broke and how could they have cooked it? Could they have used it as just a water container? Is it random that we find fragments of eggshells on sites? And to my own last question, I would say, no, it's not necessarily random. We see that they have engraved patterns on the eggshell. So they have some kind of meaning to them either as a water bottle or as a food resource. There's a very much to be done within the field of ostrich eggshells and different ways of looking at them. So there's more than enough work, not just for me, but for anyone who would want to.

Yeah, I think you've kind of, you kind of answered this, but they've also asked: **Is there any archaeological evidence for food residues on the inner surface of an ostrich eggshell?** ([Silje](#))

Not that I'm aware of, but I do know that there are people who have started to look at it. So maybe in a couple of years, maybe if we're lucky, sooner, we will see some publications of that.

I look forward to it. I hope there are. So just to wrap up now, I just wanted to say thank you so much. This has been really enjoyable and I've really loved listening to all of your answers.