Paul: This is The Paul Kirtley podcast, episode 10.

Voice Over: The Paul Kirtley podcast. Wilderness bushcraft, survival skills, and outdoor life.

Paul: Welcome, welcome to episode 10 of The Paul Kirtley podcast. Yes, episode 10. I feel like it's something of a milestone I've reached in creating 10 podcasts. If you remember back, I was a little bit nervous about starting a podcast when I started, but I've got to 10 and I thoroughly appreciate you listening to this podcast and previous podcasts and helping make this podcast success. So thank you very, very much.

In this episode, episode 10, I have a great guest, Alyssa Crittenden who is a Lincy Assistant Professor of Anthropology at the University of Nevada. Professor Crittenden has done some groundbreaking research with the Hadza in East Africa in Tanzania, and I would like to welcome her to my podcast to talk about this and other aspects of her work. Hi, Alyssa. How are you doing today?

Alyssa: Hi, Paul. Good. Thanks for having me.

Paul: You're very welcome. I'm honored to have you on. Alyssa, maybe we should just say that I became aware of your work several years ago through your work with the Hadza and the film about the Hadza and we can link to that in the show notes, but your job, if you like, your work. is as a human behavioral ecologist and nutritional anthropologist. And I think maybe for the listeners who aren't familiar with what that entails, may be you could just explain a little bit about what that role entails and what you find exciting about it.

Alyssa: Sure, I'm happy to. I am first and foremost an anthropologist but of course there's many different types of anthropologists. So I identify as a behavioral ecologist and nutritional anthropologist. So this means that my primary interest include using principles of evolutionary theory to study aspects of human behavior and culture, and most importantly then situating these principles within an ecological framework.

So I'm really interested in looking at the evolution of human behaviors and how they're adaptive solutions to life history demands, things like reproduction, growth, development. So what this means is that a lot of my work focuses on the evolution of the human diet and also certain aspects of life history. So certain aspects that are really unique to human reproduction and human biology and how those link to ecology and nutrition.

So I work with a group of hunter-gatherers, the Hadza of Tanzania, who we'll talk about today. And one of the reasons that they're so interesting and relevant is because although they're not a model by any stretch of the imagination, they're certainly not a model of Paleolithic populations, but they do live a lifestyle that has characterized 95%, some even say 99% of human history, human evolution. We evolved as nomadic foragers collecting wild foods. And so working with a group of foragers who still maintain that lifestyle really helps give me a window into some aspects of human evolution.

Paul: That's absolutely fascinating. I think, just to pick on something you said there, because it's a common misunderstanding certainly for lay people and maybe even some others to pick up on what contemporary hunter-gatherers are doing and use that as an analogue, if you like, for our history. And that's not the case at all, is it? That's a mistake to make, isn't it?

Alyssa: I'm so glad you pointed that out, it's as if I planted you somewhere in the audience to ask me that question. It's a great segue because I do think that that's important to remember, especially because so much of my work and so much that I'm asked to do in terms of my public persona as a scientist is in regard to the Paleo diet. And so there are a very few nutritional anthropologists who actually work with hunter-gatherers on diet-related issues.

So there is a very handful of us that get asked to really speak on the Paleo diet and it's something that I routinely have to emphasize is that there is no way that we can ever know with 100% certainty what life was like in the Paleolithic, we just have our informed, I wouldn't say that they're guesses because they're very well-informed by many different lines of evidence with really robust data to show what life was like during the Paleolithic, but there is no way for us to tell certain aspects of behavior because we're limited by what would actually fossilize.

So while working with extant human foragers, living hunters and gatherers is a wonderful and very informative piece of the puzzle. We do need to remember that they are modern populations just like you and me, and they've been interacting with other populations for a very long time.

Currently, right now in the 21st century, there are less than 10 populations on the planet who are still foraging for the bulk of their diet. And of those populations who are practicing a mixed subsistence regimes, so they're mixing foraging with small-scale horticulture or maybe sometimes there's some animal husbandry involved, so this mixed subsistence is what really is characterizing these last groups, and of those, maybe dozen if we're lucky, groups of small-scale foraging societies, there are a handful and I mean two, three, tops, who are still foraging for the majority of their diet. So we're talking 75% or greater.

And the Hadza of Tanzania, the group I work with in East Africa, are the last group of foragers on the African Continent who are collecting this much of their diet from wild foods, which means that there's been a lot of attention on the Hadza recently simply because they're one of, if not the last population who is living their life this way.

Paul: Just as an aside to that or a segue from that, why do you think that is? Is it the Hadza have been particularly successful? Is it that they haven't interacted as much with the others? Is it because their locality is particularly well suited to a sustainable hunter-gatherer lifestyle? Why do you think that is, that they still exist when many others don't in that lifestyle?

Alyssa: That's a fantastic question and one that I have not answered or I guess has not been posed to me very often. So it's something I certainly think about all the time. My answer is an evolving answer. We didn't even really know about the Hadza. The Hadza didn't even show up in Tanzanian registries or in history books until the turn of the last century. And part of that is because they were living in the interior of Northern Tanzania in a very remote area of the bush near Lake Eyasi directly . . . I'm not sure, probably many of your listeners will be familiar with the Serengeti National Park.

So my field site where the Hadza live is south of the Serengeti and they used to live in a much, much larger area. And it's hard to tell how big that area was in terms of their ancestral territory, but they are low population density and they were living in an area at a low population density that was quite large and very remote and very difficult to get to. So I think that that certainly was the case until around the 1950s.

And it wasn't until . . . Let's see. The early 1920s, a German anthropologist named Dorothea Bleek, she was a linguistic anthropologist. She was the first anthropologist who went out there and she took some really fantastic photographs and really did some first pass documenting.

There were several other German anthropologists who followed, but the first time that the Hadza really made it onto the academic and scholarly scene in terms of being on anthropologists' radar was in the '60s when a British anthropologist named James Woodburn spent extended periods of time living with the Hadza, learning about hunting in particular.

And increasingly, they were interacting and have been interacting with other tribes in the area. And now in the 21st century, they are not only interacting with all sorts of other tribes in the area due to population impaction, the area they lived is much, much smaller, but they're now engaging with government officials, missionaries, NGO workers and increasingly with ethno tourists, not to mention the anthropologists like myself who still go knocking on their huts. So I think that the world is becoming increasingly smaller and so we have the ability to access groups like the Hadza in a way that we didn't, even 10 years ago. Their exposure has just really blossomed.

And there are positive aspects of this and negative consequences. Unfortunately one of the negative consequences is that is that with the population boom and land and resources at a premium, the Hadza lifestyle is slowly diminishing. It's no longer sustainable in the way that it has been simply because there are too many people who need access to very small amounts of viable land.

So what this means is that while there are still about 200, possibly 250 Hadza who are still foraging, 15% of that group is moving to the village or to the market economy every year. So what that means is that the foraging lifestyle, as we know it, for the Hadza will no longer be sustainable. And it's hard to tell when that will end, but I guess only time will tell, and we'll see.

Paul: Yeah. On one level, it's a shame, isn't it? Because they're being pressured by pastoralists on one side, and part of that is a result of changes in national parks up the hill from where they are.

Alyssa: You know this issue, yes. You know more than most Tanzanians actually.

Paul: Yeah. And then you've got the Arab hunting concession on the other side. So they're squeezed in the middle.

Alyssa: That's right. And really this is history repeating itself. We've pushed indigenous populations and foragers in particular to the most marginalized areas of their land for time immemorial. But the difference here is that we're in 2015 so we can document what's happening and we are watching it, the world is watching what's happening to the last foragers. We're running out of space to

push the Hadza so I think that's part of it. They're sandwiched in a vey small area so if you keep pushing them to these more remote areas of their territory, soon you're going to just push them into another village complex or another city.

So that's what we're looking at right now. There are a lot of work being to help Hadza in terms of maintaining land rights, but what's wonderful, I think, about the NGO community that is working with the Hadza is that there are many who do want to live in the village and who do want access to healthcare and who do want to send their children to schools.

So for me as an anthropologist, I think it's really a human rights issue. I do what I can to help the Hadza who would like to integrate with the market economy and participate in wage labor and send their children to school. And I do my very best to assist with the human rights, the land rights struggle aspect of it as well in terms of trying to do everything within my power to support the Hadza who want to maintain a bush lifestyle and stay in the bush and continue to be foragers.

Paul: Yes. Because I think again there is a tendency to almost see them as living museum exhibits, isn't it? And that's also not a very healthy approach to their plight.

Alyssa: Absolutely. There are a small group of foragers who desperately want to maintain their foraging lifestyle, and I truly hope that that's possible. I'm not sure how that's possible, but we're making some really good inroads and there are some groups who work with the Hadza, particularly Dorobo, which is a Hadza-based NGO that involves the Hadza in all of the decision-making processes, and I think that's really key to what's happening. And they've done some really interesting work in terms of carbon trading, which is fascinating to think about some of the last foragers in Africa doing carbon trading. But it's wonderful. It's been very interesting to be a part of this experience.

Paul: Yeah, absolutely. Now, you've been documenting various aspects of Hadza life as an anthropologist, and one of the first pieces of your work that I was made aware of was your work and thoughts on the role of honey, both in terms of documenting the Hadza, making use of honey and how they find it, but also your thoughts on the importance of honey in our evolution more widely. And perhaps you could share some of your thoughts and findings and conclusions there, Alyssa.

Alyssa: Sure, I'd love to. I love talking about honey. I love everything about honey. So it's a bonus that I was able to bring my love of apiculture in general

and honey to my research, it was kind of an unexpected turn. So as a nutritional anthropologist, I'm always really interested in what the world is eating and I'm really interested in the way that food, the history, our ancestral appetite, so to speak, and just what the world is doing with food.

So when I first went out for my very first pilot study, it was then summer of 2004, and I didn't know . . . Now, you can Google the Hadza and get a ton of really relevant, interesting, validated information on them. But at this time, there wasn't a lot out there other than academic articles.

Paul: Yeah. You see, even Woodburn didn't really publish anything, did he? He spent a long time with them, but didn't . . . Did he just publish just one paper or two papers?

Alyssa: He published a few and he published a great little book on Hadza material culture in the '60s, which was great and I have a copy on my bookshelf right now. But I wasn't prepared, I really had no idea what I was going to encounter when I first saw honey being collected, and it's really a sight to behold.

The Hadza collect several different types of honey from several different species of bees, from stingless bees which are in the meliponine family, to stinging bees, African killer bees. We'll all heard about African killer bees, not the friendliest social insects. All of it's interesting all of it's delicious, but I think for me the most striking thing was when they would collect honey from the African killer bees, the first time that I saw them interact with a honeyguide bird.

The greater honeyguide bird, its Latin name, aptly named, is indicator indicator, which couldn't be more perfect. And the Hadza honey hunter and the honeyguide bird will communicate back and forth with a series of chatters and whistles. And the honey hunter will whistle to the bird and the bird will chatter back and forth, and the bird flies from tree to tree essentially leading the honey hunter to a hive. Once you get there, particularly for African killer bees hives, the Apis mellifera species, they tend to be housed very high in baobab trees, so sometimes 30-40 feet in the air, really quite an impressive feat simply to get up to the hive.

So what a man typically does is he . . . It's a very laborious process because he has to cut pegs and then hammer them into the trunk of the tree in order to essentially make a ladder in which to access the hive. Once he's up there, he has to smoke the hive which incapacitates the bees, so to speak. It's a long and involved process, but the short of it is that by smoking the hive, you essentially

pacify the bees, and they end up packing these little saddle bags they have full of liquid honey and they vacate the hive.

So once you have smoked the hive, the man will chop into it with his axe and he'll chop into the hive to access the honeycomb, which is, from a nutritional perspective, really an amazing kind of super food because it's not just the liquid honey, it also contains all sorts of bee pollen and larva, so liquid larva in some of the cells as well, which is not only a good source of protein and fat, but then you have all of the of the glucose with the honey.

So they access the contents of the hive and the honeyguide bird, although there is some new research suggesting that possibly the Hadza want to starve the bird a bit and keep them a little bit hungry so they continue to guide them to trees, there is some new research by a colleague of mine that suggests that, but you do in fact oftentimes see the birds gorging on the bees and some of the leftover remnants of the wax.

Some argue that it's a mutualistic relationship and others argue that's it's more of a kind of human exploitation of the birds' assistance. So I think only time will tell as more data comes out on this. So the first time I saw that I thought, okay, this is just a striking thing to witness, And certainly from an anthropological perspective, I just couldn't get over it. So I thought, all right, well, I wonder if other foragers around d the world are doing the same thing.

And it turns out that honey is a very highly ranked food. For the Hadza, it's number one, it actually beats meat. So men, women and children rank honey as their number one food. And it turns out that this tends to be the rule and not the exception for every population for which we have data around the world. Historically and into contemporary times, honey is a really important food for foragers.

My background is in evolutionary biology so I thought, well, I wonder if other apes like honey as well. It turns out, they do. It turns out, all the great apes also target honey. Baboons have also been known to destroy beehives to get at the honey. So here we have all of the great apes, all of the foragers group for whom we have data are now consuming honey, so I thought, okay, this is a pretty interesting tale.

So I went further and started looking for other lines of evidence and found out that some have . . . I went into all sorts of archives to look for some of the oldest rock art that we have, and it turns out that many ancient pieces of rock art are depictions of either figures smoking beehives, or climbing ladders to access bees' wild nests. So from all around the world, there's multiple examples of

Epipaleolithic rock art that are linked somehow to honey and bees in Spain, India, Australia, South Africa. So I thought, okay, this is really telling a story, the history of human honey hunting and honey exploitation.

And so I hypothesized in a paper a few years ago that honey may have been a key food in the evolving human diet and one that we just haven't really spent a lot of time focusing on. And I think that it just makes sense from a nutritional perspective, and it makes sense when you think about our enlarging brain. So the fact that we evolved this very large brain, and the human brain is what's called an obligate glucose consumer, which means we need a lot of glucose in order to meet these high metabolic requirements of our evolving neural development and function. So the enlarging hominid brain would have really benefited from energy.

Even from a modest amount of liquid honey could have had some really great benefit to the evolving brain. And remember, in addition to energy, honey can provide small amounts of protein in those larval cells. So in a very seasonal environment such as Lake Eyasi in East Africa, the same area in which the Hadza live now, honey and larva may have supplemented scarce resources during certain seasons.

So the ability to find and exploit these beehives with early stone tools would have been a fantastic innovation that could have allowed early members of our genus to nutritionally out-compete other species. So there has been a lot of increasing attention on the role of honey simply because, I think, we, too long have been focused on meat. And then there was a short time where we were looking at tubers, underground storage organs, so it's been a meat and potatoes debate. Then finally, the long history to the human sweet tooth, finally honey is coming to the table, and I'm so happy to see that.

Paul: On one level, we clearly do have a sweet tooth and of the things that we can taste, simple sugars are one of the things that are right up there in terms of what we enjoy, having to taste and having in our mouth. And we taste salty things and we taste . . . To me, on a very superficial level, hat my understanding of the anthropological side of things is it makes sense to me, it's logical to me that that's been an important food source to us in the past. The fact that we really like the taste of simple sugars suggests to me that that's really, really important at some point.

Alyssa: People always ask me, is there a history of a human sweet tooth? And of course, from a nutritional and anthropological perspective, I have to say yes. And I know this is also self-serving because I myself love honey. So I might

add it to my tea, I just say, "Well, we have a long history," the human interaction with honey and the honey bees. So I think that that's very true.

There are a lot of honey enthusiasts who have reached out to me in recent years and it's been really interesting to talk about the evolutionary side of things with beekeepers and also with people who are just really interested in honey. And I became a member of the Biological Beekeepers Society simply because I needed more information on beekeeping essentially. Yeah, it's fascinating. It's on my bucket list. It's one of my life's desires to have, to keep bees so we'll see. I'm not quite sure how you do that in a very urban setting like where I reside, but I'm thinking about it. I'm skimming on ways where I can have hives.

Paul: I think there are people now who keep bees on roof tops in New York and all sorts of places.

Alyssa: Yes, there are. And I have a friend who actually keeps them on the roof of his house in urban San Diego. So it's going to happen, I don't when, but definitely I'm going to do it.

Paul: Cool. I look forward to hearing more about that when you get around to it. Clearly honey is one of your passions, and the relationship to our past is there as well, as a clear passion. And you mentioned the meat and potatoes debate as well. But you have looked at nutritional content of tuberous roots, haven't you? And particularly in the case of the Hadza, I think Frank Marlowe documented them as one of the key fallback foods, some of the tubers that they collect. But you did some work on comparing the nutritional value of them, cooked versus raw. Could you tell us a little bit about that, please, Alyssa?

Alyssa: Yes, I can. It's a very interesting debate. So tubers are one of these smoking gun foods in human evolution. A very influential seminal hypothesis in anthropology is called the cooking hypothesis and it was largely based on tubers, which is this idea that cooking is actually what made us human and that cooking food, we know this, we know very well, there's a lot of data to suggest and to support the idea that cooking does things like denatures toxins and makes otherwise indigestible things digestible, and it certainly makes it easier to do things like consume meat. It's much, much harder to consume raw meat than it is to consume cooked meat.

So the idea was that by roasting tubers, early members of our genus had gained nutritional access to resources, micro and macro nutrients that they wouldn't have been able to access before the controlled use of fire. It's fairly controversial actually among anthropologists because it depends on what type

of fire you're looking for in the fossil record. You have to find some type of evidence for controlled use of fire.

So there are some dates that go back fairly far, but some of those are contested. The hypothesis suggests that we probably had controlled use of fire hovering somewhere around 2, 2.5 million years ago. So who knows? The jury's still out. But what I can say based on my work with the Hadza, I can say two things. One is that I think there is very little attention placed on what I refer to as ephemeral fires. So a lot of Hadza fires are brush fires that happened above ground, and some of the fires that they will use to briefly roast tubers before consumption wouldn't really leave an archaeological trace.

And so I always think about, "What's going to fossilize?" Because certainly even a lot of the bows that men used to target avian species, to target birds, they are not metal-tipped. And so I always think to myself everything on this arrow is organic. Everything. It's made out of wood, it's fletched with arrows and with giraffe tendon, none of that is going to fossilize.

Paul: Yeah. It's same with the fire making set. If you look at the fire making sets that the Hadza carry, and they carry along a hand drill with arrows and they cut the half that they need normally straight from the bush when they need it, that's going to leave no trace at all in the fossil record.

Alyssa: Absolutely. So I think that all the time. I think about what's actually going to survive. So when I think about the use of fire, that's always in the back of my mind. I have looked at the macronutrient content basically - your fat, your protein, basically looking at all the basic macronutrients. And we don't see a difference between cooked versus raw in that regard.

I was surprised, at least for Hadza tubers, you do see differences for other tubers, but for Hadza tubers, the differences were negligible. But that's not to say it's not important and here's why. It turns out, I worked with a graduate student named Stephanie Schnorr, she's finishing up her PhD in Leipzig, Germany at the Max-Planck Institute for Evolutionary Anthropology. And Steph and I, we worked in collaboration with the lab director who she works with there, Amanda Henry, who runs the plant foods and hominin evolution laboratory.

So we knew we were going to be focusing on plants once we all started this collaboration. And what we found, coming out of that very recent collaboration was a paper that's actually in press, it's coming out very, very soon, is that glucose absorption is in fact affected when you roast tubers. And I won't get down to the biochemical details here, but the take home message is that the

tubers that the Hadza are most likely to roast before they consume them, it turns out that it releases glucose.

So there are, in fact, differences, but they're the much more fine-grained level. And what this tells us, it was a proof of concept project, because what it tells us is that we need to start using much more nuanced methods in order to figure out what is happening with cooking. And cooking really is a very critical part of the story, a very critical part of the story.

And if you ask the Hadza why they roast tubers, they'll tell you two things. They'll say, one, they taste better which, of course, there's no way for us to quantify that scientifically. But the other reason they say, which is it makes them easier to peel. That one we can do and it turns out, I have a colleague who's at Dartmouth, Nate Dominy, who looked at fracture properties, basically looking at the different levels of fibrousness in all sorts of wild tubers, and it turns out that if you roast a wild tuber, it does in fact make it easier to peel.

So I think about, you know, they always start it when they hand it to a young toddler, to a four-year-old, if you're going to hand a four-year-old a tuber to start chewing, they need some help. It's like starting the banana peel for a little one. And that does effectively increase digestibility and it does effectively increase the amount of tubers that you can consume in a period of time. So it does increase digestibly even at the very basic level simply by making it easier to handle manually. And it turns out that there are some other really interesting stuff happening with glucose absorption as well.

So stay tuned because we're still working on all of that stuff and it's been a really interesting project because we had . . . Anyway . . . I won't get into the details, but I can talk about tubers and glucose and digestion machines all day long.

Paul: No, that's fascinating to me. Probably it's not everybody's ideal topic of discussion, but it's fascinating to me. That new research, this is the first time I've heard about that stuff you've been doing with Stephanie, and that's absolutely fascinating. It really is intriguing that there were those more subtle changes which are potentially significant and certainly, I guess, from an evolutionary point of view where things, marginal, those small differences could make a big difference, couldn't they historically?

Alyssa: That's right, that's absolutely right. And I am happy to basically see a trend towards a more inclusive picture of not only contemporary forager diet, but also using that to extend back into how we perceive of the Paleolithic diet

because I think far too often, there's been such a focus on meat and animal protein exclusively.

And we know based on various lines of evidence that we evolved on a broad-based diet that wasn't just meat and marrow, there were a lot of other components And I think that's one thing that this research really highlights, really underscores is that there is a lot of variety, not only in contemporary foraging diets, but also in our historic Paleolithic diet, our ancestral diet.

Paulo: And that's before we even get into a discussion about the meat that's available now versus the meat that would have been available to people . . .

Alyssa: Right. Don't even start me on that. That's a whole another talk. That's a whole talk.

Paul: I'll get you back for a future episode, we can talk about that.

Alyssa: Absolutely.

Paul: One of the other things I noticed you worked on more laterally was to do with dental microwear as well. Because clearly cooking things makes them easier to chew as well. Is there anything there? Is that too simplistic a reason why people might cook things?

Alyssa: That's a great question. No, I don't think that that's too a simplistic. I think that the mechanical breakdown, making things easier to consume, would have certainly offered a huge advantage in our evolutionary history. Even at the masticatory level, being able to chew them more easily, absolutely.

The type of work that I'm doing right now is certainly getting at these finer questions. It's taken me down some different routes than I originally started because our methods are so much more refined. So I'm so privileged to be a scientist in the 21st century because we get to ask these age-old questions about evolution of the human diet, but we get to answer them with all of these new refined methods.

And I've been incredibly lucky to have partnered up with many different collaborators. I'm the person who's looking at Hadza diet, but I don't have all of these scientific and academic tools in my tool kit. So I've been really lucky to partner up with people to do some really great projects.

I'm actually leaving in just a few days to finish up this project on dental microwear and oral health among the Hadza in collaboration with a friend and a

colleague of mine, Peter Ungar, who is a dental anthropologist at the University of Arkansas. And we skimmed at a conference, they made the great mistake of sitting us side by side at a conference and all we did was whisper and write notes to each other the whole time about what great projects we could do with the Hadza.

So it turns out that all the food that we eat essentially leaves a food print on our teeth. So certain types of food are going to leave - like hard foods, brittle foods - they leave different types of markings on our dentition, so this dental microwear. And Dr. Ungar is really kind of a pioneer in the field in terms of looking at fossil dentition and trying to figure out what our ancestors were eating based on the marks on their teeth, what we don't have is the contemporary foraging counterpart. We know what the Hadza are eating, we know what the Hadza have been eating, we know what these foods are.

So looking at what these wild foods, the marks they would be making on the teeth, that, it's a critical data and we couldn't figure out why no one had the brilliant idea to do this before until we got out there for our first trip in January of this year. And after day one, we looked at each other and said, "Oh, this is why nobody's tried this. We're insane. We're totally insane."

Paul: Is this just looking in people's mouths all day?

Alyssa: That's what I thought. Here, I was so naive. I thought that we were just going to look in their mouths and see some stuff, and oh wow, it is such a complex process. And we have a graduate student who we took out with us as part of her dissertation work, Sarah Livengood, and she was such a trooper because we had to figure a lot of these out on the fly because, of course, nobody's done this.

So it involves making molds of their teeth which, as you might imagine . . . The Hadza are used to the crazy antics, they're used to, "What is Alyssa doing now? What kind of crazy thing is she bringing out now?" But this one, they were a little leery, as you might imagine. They've never been to a dentist. It's invasive to have somebody in your mouth.

So they did to me first. And of course, everything went wrong when Peter and Sarah were trying to make the mold of my mouth to show the Hadza. So all I hear is cackling and howling on the sidelines because the peanut gallery is watching it go terribly wrong with me.

But they were fantastic and they were really patient and when I explained to them what we were doing in terms of why were taking these molds of their

teeth, and we showed them pictures on my computer of what microwear patterns looked like, they were fascinated. They were really interested. And any question related to diet, they were really keen on learning about what we're doing and participating.

So it ended up we solved all of our problems but it essentially meant having a dental anthropology lab out in the bush on a card table using a generator. So I think most of it, for us, was the logistics were the craziest for us to figure out. Once we figured it out, everything went pretty well. And now peter and I are going back as a follow-up. Next week, we'll be there. So this time next week, I'll be looking in Hadza mouth to see it again.

But this time, we got savvy. So what we're doing is we're using something called the DIAGNOdent laser pen which is used in pediatric dentistry, which essentially means that we need to, before we can start making any comparisons about what a bush diet versus a village diet looks like, we also need to be able to quantify things like periodontal disease and cavities.

There's a ton of literature on there that basically talks about how the origins of agriculture, that the advent of agriculture led to a lot of cavities, led to the decline of oral health in our species, but I didn't know this, as a person who is not a dental anthropologist. And I have learned more about caries, more about cavities than I ever thought I would know in my life after starting this project.

And it turns out that a lot of the bush-dwelling Hadza also have quite a few cavities and so this was something that went against bio-archeological canon and all this perceived wisdom. And so what we're doing, this has only been done a couple of other times and never at this scale, is we're looking at essentially oral health and then coupling that with the microwear data. So that's going to tell us a lot, not only about what's happening with the transition diet as the Hadza are transitioning from a bush diet to a diet dominated by cultigens, an agricultural diet, which we don't really know anything about that transition in terms of the story that the teeth tell.

But we're also going to be able to answer some of these questions about, "Was agriculture really the downfall of dentition in a way," because it will just be very interesting and it's going answer a lot of questions about early human diet and dental health that have been evading scientists for sometime. So the Hadza told me they're ready to do this project, they are really interested in it. They also already put in their orders of what gifts they want to see me come back with. So they're ready.

Paul: What do they typically ask for?

Alyssa: It's changed over the years, it's really evolved. But the women always ask for beads. Beads is a staple. They always, always ask for beads, although the color and the size of the bead has come in and out of fashion over the last decade. When I left they said, "When are you coming back?" And I said, "I will be back in about six months."

Now, I don't know if I'll hit that same bush camp, you don't really know where they are going to be, and I don't know who will be living in that camp, but I did make a note because they said that the fashion right now are really large glass Maasai beads, and they're quite beautiful, quite lovely. So we're going to make sure I have those ready to go. The standards - knives are always something that the men can use, pots.

Paul: They asked me for sharpening stones once when I was there.

Alyssa: Oh, yeah, I've been asked for sharpening stones. And then some chisels, that was a fun one. The year I brought chisels out and my suitcase, oh my god, I think my suitcase weighed 100 pounds. But it's always different things. Most of my work has been with the women and kids, I have a soft spot for all of the things that they ask for.

But the men ask for knives, they ask for chisels, all sorts of things. Because they also need nails so I always go out with very long nails that end up being used as the blanks for the tips of their arrows. So I always stop with my research assistant in a hardware store on the way out and we get as many nails as we can possibly fit. It's really desired out there, they really need those.

Paul: I remember sitting by a camp fire with some Hadza guys making arrows and the dexterity and the skill is quite incredible.

Alyssa: Oh, my god, it's remarkable, it's remarkable to me. And how they can make those arrows so straight. And they end back to the teeth. They end up using their teeth as a third hand, particularly in things like making arrows. So that's another interesting aspect, would be the microwear, what do the teeth look like when they're using them in this utilitarian way as a tool.

Paul: Yeah. And one of the things that I've read about in the past in terms of fossil records is people looking at marks on teeth and coming to the conclusion that the specimens in question were holding meat with their teeth and one of their hands and then cutting it with flint tools. And I've seen the Hadza do that with knives in a very similar way that I've seen described in books in terms of

fossil records. So I guess that also has an effect on their teeth as well, doesn't it? So you've got to factor in all these different wear patterns and factors.

Alyssa: Absolutely. And then you add my background in terms of looking at life history and the evolution of childhood, which is a whole different talk for another day, but it's all related. And you have to start thinking about certain foods, like weaning foods becomes a really important part of diet because you have immature dentition. So you have little ones that don't have the teeth that are strong enough or that can process these types of foods.

So then how does food get modified for different degrees, different types of teeth? It's a really complicated and interesting question and project. I feel like we are going to down the rabbit hole though because the more that we do, the more we want to know. The more work that we do, the more interesting questions emerge. So it's been a ride, it's been a fun ride. And I'm still on it, I'm leaving in just a few days.

Paul: That's fascinating. So how long are you out there for, Alyssa?

Alyssa: This time, it's going to be a really, really short trip. This time, it's just a few weeks. I have a graduate student out there right now, so this time, it's a short, short little jaunt for just a couple of weeks. But typically my trips range anywhere from six weeks, to three months, to however long. But this will be just a short, short trip. It will be interesting, I've never gone for such a short period of time. So no jet lag allowed. I'll just get right into the bush.

Paul: Hit the ground running. Yeah, it will be good to out there again, I'm sure.

Alyssa: I can't wait. I just can't wait.

Paul: And then in terms of coming to any conclusions and writing things up, what sort of timeframe are you looking at there? When might we hear of any conclusions to this work? Or is it simply ongoing at the moment?

Alyssa: Well, a lot of the tuber cooking stuff and all of the plant digestibility stuff is in press and should be coming our fairly quickly in the next few months. A lot of work, which we didn't even get the chance to talk about are projects looking at the Hadza gut microbiome because, of course, as a nutritional anthropologist, that's a huge part of the story, is looking at the gut bacteria and how that affects digestibility in all sorts of aspects of diet. A lot of that work has come out already and is coming out.

And for me, that's really an important part of the story because we're more microbial than we are human in terms of cell numbers. So I've always been very, very interested in looking at the role of the human gut microbiome in terms of that interplay. So a lot of that work has come out and it's continuing to come out.

And that work has had a lot of traction in the medical fields as well, not surprisingly. So that's just come out. And all of the stuff on the dental microwear and the oral health, that stuff, we're still colleting the data so I'm hoping by this time next year, we'll have all of our results written up, and we'll be hitting this nutritional anthropology circuit on that stuff hopefully in the next year.

Paul: Okay. Super. And a lot of your published work is listed in your CV which is online. Is there a better way of finding a list? Is there anywhere else or is that the best place?

Alyssa: That's a good place to go. Also, there are several different academic websites that not only list them but also where you can download the papers. And so that would be Academia.edu and ResearchGate, so you can also go in there. And Google Scholar is another one where you can find them, but you can't necessarily download them.

So if you're interested in reading more about Hadza gut microbiome, or food sharing, or diet composition, or any of the work I've done with my colleagues on tubers, there's a lot of interesting anthropological takes. Also, just a Google search of a lot of these topics will give you some . . . So you can spiral out of control though when looking at these things though. But you can find me, I'm out there. You can find me.

Paul: Excellent. And you have your own website. Where can people find that, Alyssa?

Alyssa: Where can people find that? You can Google me and you can find it. It's linked through the University of Nevada, Las Vegas anthropology site. So I am an assistant professor of anthropology at UNLV, University of Nevada Las Vegas. And I can also send you the link if you want to post it to the podcast.

Paul: Yes, we'll put that in the show notes so that people can find these all quickly and link through. Are you active on social media at all? Are there any other places people can follow you? I know you do interviews from time to time, is there . . . ?

Alyssa: I do interviews and I'm a semi-frequent fixture on National Public Radio. So I have some of those up under the media coverage section of my website. I've been getting increasing pressure to start a Twitter account, so I think I'm going to buckle soon. I think especially people would really like tweets from the field as I'm out there which, as you might imagine, is tricky because I don't have electricity, let alone WIFI. But I keep getting pressure from all sorts of groups to do a Twitter feed. So if that happens, if I ever get around, I will certainly let you know and you can get tweets from Hadza land.

Paul: Yeah, that would be good. I'm sure that will be interesting to some people. I'm happy to share that for you as and when it happens. Happy to help amplify what you're doing because it's fascinating work, Alyssa. And I appreciate you're busy and you're getting to go off for your next trip so I would let you get on with your day. But I really, really appreciate you taking the time out tonight. I appreciate you taking the time to explain some of these things in very much layman terms for the listeners.

It's all absolutely really, really interesting to me and I'm sure it will be interesting to the listeners. If people are listening, please leave comments, please get in touch with Alyssa and let her know her much you found it interesting. And thank you very much. It's really, really appreciated, Alyssa. Thank you.

Alyssa: Thank you, Paul. It's been my pleasure.

Paul: Brilliant. Thank you. And speak soon. We'll get you back on the podcast at some point in the future and we can talk about Paleo diets and various other aspects of that as well as some of your new findings. So thank you very much, Alyssa. Take care.
Alyssa: Thanks so much.

Paul: Well, thank you again to Alyssa for such a wide-ranging and interesting discussion there. I do genuinely find her work absolutely fascinating. I used the word "fascinating" probably way too many times in that interview, in that discussion, but it's very interesting work, it dovetails with my interests massively and I hope you found that interesting, too.

If you did, please let us know that you enjoyed and found this podcast interesting and useful. Tweet me @PKirt, that's @P-K-I-R-T. If you would share this podcast with other people who you think would find it interesting, that would be fantastic. Leave me a comment under the show notes on my blog.

And also, if you listen to this on iTunes or use iTunes at all, I'll ask you again, I know I've asked you before, but if you haven't done already, please go to iTunes, leave a rating, leave an honest review. It really, really does help in getting this content in front of other people who would find it interesting, too.

That's one of the major ways that iTunes decides whether or not to put a podcast, whether to suggest a podcast, and put it in front of somebody else based on what they're already interested in. The more people that like this, the more likely it is that other people will find it. And if you found this interesting, please spend 30 seconds leaving a review, leaving a rating. It really, really helps. Thank you very much and I look forward to speaking to you on episode 11. Take care. Cheers!