SARA PARCAK INTERVIEW PART ONE

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Hello Ars Technica listeners. This is the latest serialization of an episode of the After On podcast here at Ars. We're splitting this one into three segments, starting today. And I'll be talking to Sarah Parcak - who is a world-class astroarchaeologist.

> And isn't that the best title ever? Sarah's other titles include or have included professor of archeology, TED Fellow, National Geographic explorer, and National Geographic Fellow. And what may be disappointing news for some folks, it was for me, I'll note that space archeologists don't dig up the sites of ancient civilizations on Mars, although Elon Musk may fix that someday. Rather, they use satellite imagery to discover, monitor, and learn more about ancient sites on Earth. And though space archeology first emerged over 20 years before Sarah finished graduate school, she's very much a pioneer of this field, which has made huge strides over the past decade, as ever higher resolution images have become available at ever cheaper prices.
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> Sarah's work has pinpointed thousands of likely ancient sites, which were previously unknown in Egypt alone. And she may have taken us a giant step closer in locating one of the ancient world's most significant lost cities, a long-time capital of Egypt. She later led an amazingly comprehensive effort to detect and document archeological looting in the years leading up to and following the Arab spring. In 2016, Sarah won the million dollar TED prize to further her work. She used both the money and the platform that TED gave her to launch a citizen scientist platform, which has enlisted over 50000 people in a project identifying previously unknown sites throughout Peru. That platform and the organization Sarah founded to run it have a very bright future, although that's all that can be said for now, Rob says mysteriously.
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> Just two days before posting this episode, I was down in Alabama where Sarah teaches learning far more than I'd previously known about her work, which is saying something because as you'll hear in the interview, we first met over five years ago. We were both about to undergo the terrifying process of speaking on the main stage at the TED conference. Though she was still in her earliest thirties at that point, her credentials were already astonishing, and I watched her career with ever-growing astonishment ever since. And with that, it is a great delight to bring you a fascinating conversation with Sarah Parcak.

(TRANSITION MUSIC)

Rob Reid: Sarah, it is great to be here in your adoptive town and state of Birmingham, Alabama. This is my 49th state that I have visited in my lifetime.

Sarah Parcak: Great to have you here, and I'm glad that we are proving our reputation with hospitality. Breakfast this morning, I think was barely acceptable.

Rob Reid: Possibly the best french toast I've ever had. Ironically, not at the french toast House, but at the Pancake House, which is across the street from the Waffle House.

Sarah Parcak: Of course it is.

Rob Reid: Yeah, of course it is. I don't know if there really are french toast houses anywhere, but that was mind-blowing stuff. And I'm gonna throw a crazy suggestion at you. [foreign language 00:03:22].

Sarah Parcak: [foreign language 00:03:29].

Rob Reid: [foreign language 00:03:37].

Sarah Parcak: [foreign language 00:03:41].

Rob Reid: [foreign language 00:03:44]. So back to English. For those of you who are wondering what that was, it's a little repartee in Egyptian Arabic because both Sarah and I happen to speak that better than most non-Egyptian, non-Muslim, non-Arab Americans, by [inaudible 00:03:56] of having spent a great deal of time in Cairo. Now, we may end up talking about what first brought me to Cairo, but Sarah, why don't you start out by telling us why you spent so much time there.

Sarah Parcak: Because I have probably an unhealthy obsession with ancient Egypt that I have had ever since I was a small child. I am an Egyptologist.

Rob Reid: And you are also a space archeologist.

Sarah Parcak: That's right. I wear multiple hats, all of them slightly different shades of Fedora brown.

Rob Reid: Got it, got it. Now to start briefly with a definition of space archeology, by the way, I don't know why, but I'm always wanting to say astroarcheologist because somehow that just sounds more crazy. And I will add, astroarcheologist does not get a red squiggle in Gmail. It does in Microsoft word, but I started writing that for some reason and then you corrected me. It is space archeologist, right?

Sarah Parcak: That is correct. So I guess the more formal academic term would be a satellite archeologist, or even a landscape archeologist, someone that uses satellite imagery to map large areas that you go and explore. But I blame NASA for

inventing this term. NASA actually has a space archeology program that funds people like me. So essentially, the definition is an archeologist or scientist who uses different types of satellite imagery, both large scale resolution and high resolution imagery that you might see on something like Google Earth. And in processing the data, you may find sites, features, ancient environmental features like rivers or dried up lakes. And then you go out and you survey or excavate said features. And these are things that typically you wouldn't be able to see unless you use satellite or other imagery taken from on high.

Rob Reid: Got it, got it. And the field got started in 1984, right? There was a very specific moment where there was a meeting of sorts, a pow wow where this all came together.

Sarah Parcak: Yes, so I credit my good friend professor Tom Seaver, who for years was NASA's official archeologist and now he's a professor at the University of Alabama at Huntsville. At the time, Tom was an archeologist working for NASA and he had this conference in 1984 where he brought together a diverse set of archeologists and said, "Hey, we've got all these cool technology applications. You all should consider using satellite imagery. I think it could really help you find sites and map sites." And at the time, virtually no archeologists were really using it, so after his conference, a lot of archeologists started applying satellite imagery, and a lot of the first papers started coming out a couple years later. And thus, the field was born.

Rob Reid: This was 1984, so he was done with his legendary run pitching for the Mets. I think it was 311 wins, 61 shot outs, over 3500 strike outs, Mr. Tom Seaver, right?

Sarah Parcak: Yes. And hundreds of ancient sites.

Rob Reid: Different Tom Seaver than the pitcher for the Mets, I just had to make that little joke.

Sarah Parcak: I appreciate that, I'm sure he does too.

Rob Reid: I'm sure he does too. Now actually to get to your own path here, where the University of Alabama in Birmingham, you mentioned he's in Huntsville. So Alabama is a veritable hotbed for space archeology it seems.

Sarah Parcak: Who knew. So when I came here in 2006 to start my job at UAB, I kind of put two and two together, and reached out to Tom. He's about an hour and 20 minute drive north of us, so I got to go, and time to time I'll go and visit him. He'll usually have visiting colleagues. When I first started at UAB, we had a cooperative agreement with NASA. They were very generous, and provided some funding for my research and to help out with our students. So yeah, totally random that we both ended up in Alabama.

Rob Reid: To get to your own path to Alabama, I'd like to go all the way back. You are from Bangor, Maine.

Sarah Parcak: Yes.

Rob Reid: Very different climate, very different state.

Sarah Parcak: Very, very different.

Rob Reid: And your fascination with Egypt and Egyptology goes back to a tooth fairy's gift, as far as that?

Sarah Parcak: Yes. So most Egyptologists will tell you that they cannot tell you why they started being interested in ancient Egypt. It usually starts at ages three, four, or five.

Rob Reid: Really? Across the field, that's a common-

Sarah Parcak: Across the field, everyone just gets obsessed with Egypt at a really, really young age. And when I was growing up, this was Maine in the early timid 1980s, this was pre-cable, pre-internet. Did I see a National Geographic story and get interested? I don't know. I can't remember the moment when I became interested. My mom tells me that out of the blue, I just started asking her about mummies and pyramids, and she went, "What?" There's no reason for it. So the tooth fairy brought this amazing book on ancient Egypt when I lost one of my first teeth, and it's a great book. I just found it not all that long ago again. It was a great history book. A lot of times, kids books, young teen books, maybe they don't quite have the level of information that you might want, but it was a great little book, and that got me started. I just grew up loving Egypt and reading everything I could about it.

Rob Reid: In my neighborhood, the Tooth Fairy paid cash for teeth. I wish we had gotten fascinating books because that is such a cool story.

Sarah Parcak: It helps being the daughter of a nerd.

Rob Reid: How many roughly, let's just say in the United States, how many full-time professional working Egyptologists would you ball park there are?

Sarah Parcak: It's hard to say. For example, our big annual conference, The American Research Center in Egypt, usually there are a couple hundred people that go and give papers between the Egyptologists and grad students. Yeah, a couple hundred I would say within the U.S.

Rob Reid: Overwhelmingly involved I'm sure in academic settings, affiliated with universities and so forth. But probably a few with foundations and museums.

Sarah Parcak: Yeah, definitely. It's not quite evenly split, maybe tilting 60% towards academics. But a lot of people work in museums. Some people work in foundations, some people will say [inaudible 00:09:59] but also work in Roman Egypt as well.

Rob Reid: Got it. You went through school, you had this early fascination. Then, you got to Yale as a freshman. You thought that the tooth fairy phase and the childhood fascination was fabulous, but you were not intending to get into the field upon arriving at college, correct?

Sarah Parcak: Absolutely, absolutely not. I got obsessed with politics in high school. I loved Egypt, but I started volunteering for political campaigns, started volunteering at my local congressman's office in the fall of 1996. Then, president Bill Clinton was running for his second term, so volunteered for him, and then the next summer, ended up working for my congressman in D.C. So that was going to be my path. I was going to go to Yale, study politics or history, go to law school, go back to Maine, and run for office. That was the plan.

Rob Reid: Really? That's a pretty evolved plan for that age, I'm impressed. But it got derailed almost immediately, right?

Sarah Parcak: Total derailment. So when I got to Yale, Yale's divvied up into 12 residential colleges, and in each residential college, there are residential fellows who can be professors or researchers from anywhere at Yale, and one of the research fellows, one of the residential fellows in my college, Timothy Dwight, was a gentleman named William Kelly Simpson, who was an imminent Egytologist. And professor Simpson would provide all of the first year students in Timothy Dwight college to his state in Katonah, New York. Kelly was married to one of the Rockefellers, so he himself came from old New York money. So very kindly would invite all the first year students for a day of being at the pool and running around his estate.

Rob Reid: This was not a professor's salary type of setup. There's some older money at work at this.

Sarah Parcak: I think 100 professor's salaries would not have purchased this estate over a lifetime. So I sort of realized on the bus going there, like, wait a minute. William Kelly Simpson, not the William Kelly Simpson, and of course it was.

Rob Reid: Oh, so you knew his name from your early obsession?

Sarah Parcak: Yes, he's a legend in the field. Total legend.

Rob Reid: And he is your resident fellow.

Sarah Parcak: Right. Totally random, sheer dumb luck. So I ended up speaking to professor Simpson. There were some Egyptologists at this party from the Met, who, ironic,

they at the time, they were just wrapping up their work at a site called Lesh, which you will hear about later on. They were very kind and very helpful, and just very encouraging to me, because at the time, it's just before classes started. I was picking what classes to take.

Rob Reid: Oh, this is orientation period?

Sarah Parcak: Yeah, a couple days before school starts.

Rob Reid: You really got hijacked upon arrival. That's cool.

Sarah Parcak: Pretty much. So yeah, I started working for professor Simpson, and that was it. I started taking Egyptology courses, and sort of a 180. But kind of not really. A lot of what I've ended up doing, especially post-Arab spring has been very political. So my political interests and my ancient history interests seem to have aligned finally.

Rob Reid: Well there's actually kind of an interesting parallelism between you and I. When I went to college, similarly I thought I was gonna study political science. But I had spent a summer as an exchange student in Cairo quite randomly. It was an exchange program that had the philosophy that we don't want to be a glorified travel agency for high school kids. So you can join this group, it was called the American Field Service, and you can express your preference of where you want to go, but we're gonna go where we tell you, ultimately, because we want kids who want to see the world as opposed to want to go to Paris.

So I was really keen to go to New Zealand, and you could express a preference. They tried to honor. They said, "Great, Auckland's a wonderful city, so is [inaudible 00:13:36]. You're going to Cairo." So I spent the summer after my junior year of high school in Cairo, then I got to college. And similar thing. I didn't run into somebody in my orientation week that sort of abducted my academic interest, but I did take a class in modern Middle Eastern history, and started studying Arabic and very, very, very modern Egyptian history compared to the history that you study. But ended up going back and living in the region and so forth, so that's very interesting. Now, you went on your first dig the summer after your freshman or your sophomore year?

Sarah Parcak: It was after my sophomore year.

Rob Reid: And you made a particularly important discovery on that dig, am I right?

Sarah Parcak: Yes. Actually, if you don't mind me sharing a very funny story. Before I went on that dig, sort of put my CV together and wrote. At this time, people were using email, but that was not the way to get in touch with professors. I put together a dossier and sent this package off to dozens of Egyptologists, basically begging them to allow me to join their digs. By the way, being a professor now, I get these emails and CVs, so I respect how ballsy I was at a young age. And so a lot

of them wrote back, "Oh, thank you for reaching out. We appreciate your interest, but you have a lot of learning to do, kid. Contact us in a couple years." My favorite, though, was writing to a professor at the University of Chicago. I didn't know these professors. I knew they were imminent Egyptologists, but I didn't know anything about them. So I wrote to a professor at the University of Chicago, and I got my dossier returned with the address crossed out and the words written on it, "Deceased 20 years."

So yeah, clearly I didn't know what I was doing. But I was very lucky to get on this one excavation in the Northeast Egyptian Delta. A site called Mendes, run by professor Don Redford at Pennsylvania State University. I'm still in touch with Don, he's a wonderful Egyptologist. And so on that dig, I was responsible for excavating a mastaba, a bench tomb from about 4300 years ago. And while excavating, I was very lucky to find an intact pot. As I'm digging and digging, and the pot, it was intact, it was broken, but it was all there more or less. And there's a thumb print on it, and so it was really the moment where I connected with this idea of when we're excavating, they're physical people who lived in the past, and I didn't quite get that until that moment. It was very powerful for me to learn that on my first dig. I sort of took that as a lesson every time I'm in the field, and every time I was in the field moving. I always try to imagine the people who created the tombs or the pyramids or the settlements in which I was working.

Rob Reid: Yeah, and I've had a very novice, similar experience I guess a couple of times when I first went to the Valley of the Kings, and got deep into the tombs. It's amazing the richness of the colors as they've been preserved in these tombs that have seen very, very little light over thousands of years. But also, to be able to see actual individual brush strokes and to feel on certain things, like wow, somebody moved their hand in a very tiny arc, and you can see the relic of that. It is incredibly powerful. There was also another profound result of that dig if I'm not mistaken, right? We could call it maybe another discovery.

Sarah Parcak: It's not my greatest discovery.

Rob Reid: Your greatest discovery.

Sarah Parcak: Yeah, I happened to meet my future husband on my first dig.

Rob Reid: Which is so cool.

Sarah Parcak: At the time, I'd just finished off my second year of university. I was not exactly, I don't know, I hadn't had a lot of boyfriends. At the time, I just wanted a date. That was my MO. Not on the dig per se, but just in general. A date occasionally would've been nice. And I go on this dig, and I see this slightly awkward, bumbling British chap. And then he starts asking me to come to his unit, excavation unit, and he starts teaching me. Now at the time, I will say nothing untoward. I know now we're dealing with all sorts of fallout from a lot of

harassment. Totally innocent friendship at the start, but I can kind of look back on it now and see that we were both just completely obsessed with each other. So one thing led to another, we were friends for a year before we got together, but yeah, that was it. That was my future husband.

Rob Reid: That is a very cool origin story. Back to origin stories, so go briefly back to Mr. Seaver in this 1984 conference and what ensued after that. Because we're gonna bring together the threads here. You're now involved in Egyptology and the satellite work is about to loom into your life. So that was a long time before you were working on this dig, or I guess it was about a decade before you were working on this dig.

Sarah Parcak: Two decades.

Rob Reid: Two decades before this dig happened, your first dig.

Sarah Parcak: Yes.

Rob Reid: Was there a sustained period of interest in satellite or space archeology after that, or was there kind of like a flurry of activity and papers, followed by a petering out? Did the field just sort of blow up from that point going forward?

Sarah Parcak: So following Tom's conference and the few papers that came out, it sort of [inaudible 00:18:48] along. There was never a big explosion in the field and interest until people of my generation went to graduate school. This was about 2000, 2001, and there's a cohort of us that finished our PhD's between kind of 2003 and 2006, 2007. And we were all very lucky to get academic appointments. Not just in North America, but in Europe as well. And I would say around that time, so the early 2000s, you went from virtually no remote sensing papers appearing in journals and papers at conferences being given to all of a sudden lots and lots of papers started to be published. It wasn't just a paper, it was a panel, and then it was a conference, and then there were the NASA space archeology grants. So you saw this massive, massive growth in the mid Auts, I guess is the technical term.

Rob Reid: And was it because there was just a higher resolution of imagery that was suddenly available? Was it the fact, I guess we had Google Earth by then, correct?

Sarah Parcak: We did. So a lot of things happened all at once. A lot of the professors that attended Tom's conference and had written papers started taking on students. Because of that interest, other professors, what's this satellite stuff that people are doing? NASA satellite imagery started becoming more widely available and for free. And in the late 1990s, early 2000s, very high resolution satellite imagery started to be more readily available. Now at the time, it was very expensive to get. A single satellite image could cost five or 10 thousand dollars,

but cost started coming down. So between availability of imagery, more papers, more students finishing, the whole field started to grow.

Rob Reid: So let's talk about just a typical project that you might find yourself doing with satellite imagery. Let's say you're looking for sites where sites have not yet been discovered. What kinds of images are you looking at? I know you look at near-infrared a lot. What are some of the images that you would be looking at, and what are some of the signals that you're looking for in that imagery?

Sarah Parcak: So everything depends on where in the world we're looking. Every country will have diverse cultures, diverse things, diverse features that are made from stone or mud brick or turf, so let's just say we're working on a potential Viking site in Scotland.

Rob Reid: Okay. Potential like you think there might be a site here, and we're not sure?

Sarah Parcak: So the first thing we would do, typically being an Egyptologist, I really wouldn't choose to work on a Viking site. That's not my bread and butter, but I collaborate with scholars all over the world [inaudible 00:21:30] specialist, and whether it's the Vikings or the Incas or wherever. So I would approach a scholar, or a scholar might approach me, and say, "Hey, let's collaborate on this project. I've been working in this landscape in Scotland for 25 years, and I'm pretty sure that there are Viking outbuildings that are associated with these farmsteads, but it's just not time and cost-efficient for me to use the technologies that I have in the field to go map them and find them. I think using satellite imagery, we could." "Well that's really interesting, let's try something." So in archeology, we go from the known to the unknown.

So what I would do is work with that archeologist and get the top peer reviewed articles that show all the different kinds of features that we might come across in that landscape. So different kinds of outbuildings, milk sheds, iron processing sites, smaller farmsteads. In other words, my team and I have a good sense of the types of things that we might find. That's step one. Step two, okay, what are those things made from? Well in Scotland, it's either going to be turf or probably stone. So it's turf or stone, and here's how these things change over time, and here's their size and shape and typical orientation. And then we import into our database all the known things in that landscape. So there are gonna be farmsteads and other features that are already there.

Rob Reid: Known things, so this is a farmstead that we know is a viking site back in wherever, so that's what it looks like right now from space. So we know what these things look like from space now.

Sarah Parcak: Right, and we essentially know there are known knowns or unknown knowns, whatever that quote is. So we have our known knowns. We study them and we look and see what they're like from space. And then the specialist will say, "Okay, typically outbuildings are located within 100 meters of a farmstead."

Okay, so we have our geographic location. So now, we know the things that we're looking for, we know their size, we know their shape, we know their likely orientation, we know their building material. What are the things in which they might be located? Well in Scotland, it's dense turf. So we're looking for a stone thing or a turf thing in turf. You see we're narrowing down and narrowing.

It's never like we're gonna go look here and let's find a thing. It's a very detailed process of scientific inquiry. Okay, we're looking for a stone thing in turf, ergo that turf responds really well in this particular part of the light spectrum. Thus, we need these types of satellite images with these types of spectral ranges. So in near-infrared, middle-infrared, or the edge between red and infrared. And then we'll choose processing techniques accordingly. We'll experiment because we don't always know what will work. Features start popping out, and at that point, we share the data with a specialist who will say yes it's a thing, or yeah, I know what you're looking for, or yeah, we dug that thing. We thought it was a viking structure, building it was Medieval. Okay, then we go back to the drawing board.

Rob Reid: Got it. Okay, so you know what spectrum to look in, or what part of the spectrum to look in based on what kind of Earth you need to in some cases penetrate, if it's buried. And I know in Egypt, you work with a lot of near-infrared, correct?

Sarah Parcak: Yeah, near and middle infrared work really, really well.

Rob Reid: What does that reveal to you? That reveals things that are below the sediment layer to you in Egypt?

Sarah Parcak: The type of satellite data that I use is called Optical satellite data, so I'm never actually seeing through the ground. Radar data doesn't, not the type of data that I use. What I am seeing are subtle changes on the surface that are caused by things that are buried underneath. So whether it's vegetation or sand or mud brick or stone, we're using the satellite data in different parts of the spectrum to really make these differences pop.

Rob Reid: So there would be, let's say you're looking at a site and you suspect that there might been a retaining wall, or something in a particular area. Or you're looking at a broad area and you're trying to find features of a city that once was. Those walls, those [inaudible 00:25:25] buildings will in a sense be causing very subtle distortions on the physical surface of the earth that would escape the naked eye because you're at ground level and you're not seeing large features, or would escape the naked eye because it's in part of the spectrum that we wouldn't see, but it's manifested actually with a way that natural sunlight is reflected on the earth and you're looking at the right spectrums to reveal that?

Sarah Parcak: Right, and it also depends on the actual material. So in Egypt, for example sites in the Delta, structures are made out of mud brick. Well in some sites, you can

see very clearly the outlines of ancient cities and structures. In other sites, you can't. And it depends on the soil composition, so for sites in the delta that are really sandy versus entirely silty, satellite imagery works really, really well. For sites that are mostly silty, it can still work, but you have to get data from a different time of year. So you have to really understand your landscapes.

Rob Reid: And you are going to the database that exists of a vast number of images. You said that digital globe is the main provider. You're not saying, okay, tell the person with the controls on the satellite to take a picture of this thing in the near-infrared spectrum. There's just enough satellite coverage, imagery coverage at this point that you can say, okay, I want this turf in the near-infrared from a multiplicity of dates. And you are grabbing stuff that's there as opposed to ordering in the way that let's say an astrophysicist will point a telescope somewhere and say, all right, we're going to take an image of this particular exoplanet or whatever. You're using data that exists in the global database in a sense already?

Sarah Parcak: Sometimes. More often, it's much easier for me to go to the digital globe database and tell the person I work with for reselling yeah, I want that image, because I can get it within 24 hours. It's easy. Sometimes, I actually need an image.

Rob Reid: Really? So you do custom work, then.

Sarah Parcak: I do. I do custom work. For example in places like Cairo or Luxor, these well-known places most cities, most large [inaudible 00:27:23] areas, there are gonna be dozens and dozens of satellite images just because people in general will be interested in those places. But if you're dealing with, I don't know, a place in central Iceland or Greenland, or Northern Russia, these are not hotbeds of activity typically, so there might only be one or two satellite images in the database, and you get an image, but it might not be from the right time of year. And if it's not from the right time of year, you're in trouble.

Rob Reid: So you can actually request custom work, and that does happen time to time?

Sarah Parcak: Yes.

Rob Reid: Now how small of a thing can we see with the high resolution data that you're now working with?

Sarah Parcak: So the highest resolution imagery to which [inaudible 00:28:02] mortal such as myself have access ...

Rob Reid: As opposed to military, I assume.

Sarah Parcak: Yes. It's 0.3 meters or 11 inches. So you can see, for example, the outline of your iPad from space. That's about the resolution we're talking.

Rob Reid: So you could see a tablet, a stone tablet from [inaudible 00:28:16] but you could not read it.

Sarah Parcak: No, you couldn't. And the thing is if it were partly buried, you probably couldn't see it. But you could certainly see that there was a gray or brown thing lying on a sandy surface.

Rob Reid: And there are not a lot of complete tablets necessarily lying around on the surface, even in remote places, I imagine.

Sarah Parcak: Don't you mean iTablets?

Rob Reid: iTablets, that's right. So now that we've had a pretty good rounding in space archeology, I want to get back to your professional path. So you got out of Yale and you got a fellowship to go to Cambridge, correct?

Sarah Parcak: Yes.

Rob Reid: And that was a one-year hitch that turned into something quite a bit longer?

Sarah Parcak: Yes, so I was very lucky to get a fellowship to go study at Cambridge for a year where I did my master's degree. And then, loved the program, loved my supervisor. It was a great fit, so I decided to stay on for my PhD. I then was very lucky to get National Science Foundation graduate research.

Rob Reid: And your advisor, sorry to go back, but your advisor's kind of globally renowned in the field of Egyptology, right?

Sarah Parcak: So his name is Barry Kemp, and he is probably the most well-known archeologist who works in Egypt.

Rob Reid: Wow. And his site is generally, it's Armona?

Sarah Parcak: Armona.

Rob Reid: What is it about the Armona site that drew him to it and it is special and exceptional? Because I imagine you did a little work there by dent of working with him.

Sarah Parcak: I did. So what's extraordinary about Armona is that it was the capital of Egypt for about a 30 year period, and this Pharaoh called Akhenaten so called heretic king, people credit him with inventing monotheism. It's much more complicated than that, but he moved the capital of Egypt from Luxor to ancient Thebes, couple hundred miles away to this new place. So it's this short survived, or short lived city that provides almost a time capsule into a period of time in Egypt's new kingdom. So it's rare, there are no other cities like it in Egypt. So you can study how one city thrived, evolved, and ultimately fell. So my supervisor has

excavated the central city of Armana for some time, and I was interested in working there because the West Bank across from Armana have had some survey work, but had never been fully surveyed. And also, I was very interested to see how the Nile River had shifted and moved over time.

Rob Reid: I did a little digging and I found some interviews on YouTube. I have to say that Barry Kemp bears a remarkable resemblance to Gandalf in Lord of the Rings. In like the coolest way, because what could be cooler when you get to this sort of wizened genius stage than resembling Gandalf? And it's more than just a passing resemblance.

Sarah Parcak: Barry loves The Lord of the Rings.

Rob Reid: Oh, he does?

Sarah Parcak: Yes, that's an understatement. So at the dig house in Armana, there's actually a print out, a bit of a poster from the movie, and it's Merry and Pippin, and it's the scene where they're asking Aragon about stopping for breakfast because they're hungry again. [inaudible 00:31:23] is hungry, and on digs we have second breakfast. And so Merry is saying to Pippin, "I don't think he knows about second breakfast, Pip." So kind of an in house joke, but I mean Barry, he talks just like this and you ask him a question, he turns in back to you, which is always very intimidating. But I just hold him in the highest regard both for his scholarship and how he conducts himself in the field. I'm so fortunate that I was able to work with him.

Rob Reid: So with these hobbit references on the walls, so the Gandalf thing, that has been noted before?

Sarah Parcak: Yeah, we all quietly kind of note it, and it's kind of awesome.

Rob Reid: Good, good. So now moving forward from that, you ended up getting your PhD at Cambridge, and you started this full Egypt survey. So at this point, this was all satellite image based. The full Egypt survey that you did, so you're all in on satellite, or space. I'm gonna say space archeology because that sounds like at least there's some prospect of digging stuff up on Mars while you're at it. So you're all in on the space archeology thing at this point. This is post-PhD, the all-Egypt survey?

Sarah Parcak: Right. So my PhD focused on developing tools and techniques for mapping sites across large landscapes in Egypt. I didn't start on the comprehensive survey of Egypt until about four, five years later. And that was the result of a TV program with the BBC. So after I'd been at my university for a couple of years, I'd been a talking head once on a TV show, and a producer at the BBC-

Rob Reid: And this is now here in Alabama?

Sarah Parcak: Here in Alabama, yes. So she reached out to me, "Will you be a talking head on a BBC show?" "Of course I will, that's awesome." But we eventually ended up developing-

Sarah Parcak: Of course I will, that's awesome. But we eventually ended up developing a whole program on the use of space archeology in Egypt. So that's really why I ended up doing this large scale survey.

Rob Reid: So it was a direct result of the BBC program.

Sarah Parcak: Yes, it was.

Rob Reid: That's interesting. Did the BBC help fund it?

Sarah Parcak: Yeah. Yeah. So they were able to pay for students, for researchers for my time. Yeah, they they helped to fund it.

Rob Reid: Wow. I had not realized that. So the program is online and it's very accessible to YouTube, so I would recommend it to anybody because it is a fascinating. It's over an hour long and gets, it's pretty [crosstalk 00:33:35].

Sarah Parcak: Yeah, It's a 90 minute program.

Rob Reid: Remind me of the full title. So people would Google it.

Sarah Parcak: So it's Egypt's Lost Cities.

Rob Reid: Got It. That's so cool that they actually helped fund it. Now So the scope of that discovery, how many months did that unfold over? Like how many months were you working on?

Sarah Parcak: I can't remember exactly how long, but I had a team of four students and a full time researcher and myself, so it probably took us six or seven months.

Rob Reid: Got It. And you found literally thousands of sites or candidate sites, right?

Sarah Parcak: Over 3,100 potential sites.

END INTERVIEW ELEMENT OF PART ONE

Ars Technica listeners - That's a LOT of sites, huh? We'll dig deeper into Sarah's amazing work tomorrow, and I hope you'll join me. But if you just can't wait to hear the rest of this conversation – or, if you'd like to browse my three-dozen-plus other episodes, you can just head on over to my site, at after-on.com. Or, type the words After On into your favorite podcast player. Either way, you should then see my full archive of episodes in reverse chronological order - with Sarah's interview appearing on October 17th of last year. You'll also find unhurried

conversations with world-class thinkers, founders & scientists on subjects including genomics, synthetic biology, robotics, astrophysics, privacy and government hacking, cryptocurrency, drones, and a whole lot more.

Or, you could join me here on Ars tomorrow for more with Sarah Parcak.

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