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Cathy Whitlock
December 13, 2021

Interview conducted by Vincent Santucci
Transcribed by Teresa Bergen
Edited by Molly Williams

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Harpers Ferry Center
P.O. Box 50
Harpers Ferry, WV 25425
HFC_Archivist@nps.gov

Narrator: Cathy Whitlock
Interviewer: Vincent Santucci
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Transcript

[START OF INTERVIEW]

Santucci: Well, I'm going to go ahead and begin with this opening statement and then we'll jump into the questions. Vincent Santucci. I'm the senior paleontologist for the National Park Service Paleontology Program. Today we are conducting an interview with Cathy Whitlock, professor at Montana State University, about her research involving several national parks in the Northern Rockies. The interview is being conducted by telephone from Cathy's home in Montana and I am in Pennsylvania.

Whitlock: Thank you.

Santucci: Sure appreciate your time. So just for the record, could you state your name and your title and institutional affiliation at the beginning?

Whitlock: Yeah, I'm Cathy Whitlock. I'm a Regents Professor Emerita of Earth Sciences at Montana State University in Bozeman.

Santucci: Thank you. And probably the easiest question I'll ask is when and where were you born?

Whitlock: I was born in Washington, DC.

Santucci: Very good. And then where did you grow up prior to high school?

Whitlock: From Washington, DC my family moved to Syracuse, New York. My dad was a professor at the medical school. And so in my childhood we went to a couple of different places just as he was advancing in his career in medical research. So we started out in Syracuse. And then when I was starting high school, we moved to Denver, Colorado.

Santucci: Very good. So during your youth growing up and into high school, were there anything, any experiences that you had or individuals that got you interested in outdoors and in science and in earth science?

Whitlock: Yeah, my dad and my grandmother were great naturalists. My dad loved the outdoors, which was why we moved to Denver, so he could be closer to the mountains. And he loved to fish and so on. So he was always dragging us around places on camping trips and as a family we collected butterflies as we did travels across the US. He was a great naturalist. So he got me

excited about nature and the outdoors. And – but I always thought I was going to become a medical doctor because our family's kind of focused around that. So I didn't get interested in geology until I went to college.

Santucci: Where did you do your undergraduate education?

Whitlock: I went to Colorado College in Colorado Springs. And there almost in the first week, I took a geology course. That program is set up so you take one course at a time. And my first course was geology. And in the first week we got in vans and headed to the Colorado front range and started climbing around rocks and looking for fossils. And that was it for me. It was a way to combine my interest in being outside with, you know, also being a scientist.

03:33

Santucci: And during your undergraduate work, did you have an affinity towards paleontology or paleoecology? Or did that come later?

Whitlock: I didn't really know about paleoecology, but I did enjoy paleontology. And a professor there was really interested in trace fossils. And so I got excited about that, too. Looking at, especially it was, I think it was Pennsylvanian, no, no, no, it was older than that. it was like Silurian trace fossils from ancient seaways.

And upon graduation, I got a fellowship from the Thomas J. Watson Foundation, which supported me to go to Europe the year after graduation and visit with famous paleontologists who are experts in trace fossils. I spent the year after college looking at ancient rocks and trace fossils, but also spending time on beaches, digging trenches to look at how animals made tracks and trails. That was a big adventure.

Santucci: What a great experience.

Whitlock: Yeah, it was. It was wonderful.

Santucci: So your undergraduate degree, was it in geologic sciences?

Whitlock: It was in geology, yeah. Geologic, yeah.

Santucci: And so did you realize as an undergraduate that you wanted to continue your education, your graduate education?

Whitlock: I think I'd been hardwired to go onto graduate school, just growing up. So I knew that I was going to go on for a higher degree. You know, whether it was being a medical doctor, being a PhD scientist, I think it was just something that I always knew I was going to do.

Santucci: Great. And in terms of your selection of a graduate program, where did you wind up going to school?

Whitlock: I went to the University of Washington for my master's thesis and my PhD. And I can tell you a little bit about how that happened. The last summer of my college days, the summer

between my junior and senior year, I had a chance to work at the US Geological Survey in Denver with Estella Leopold.

Santucci: Wow.

Whitlock: Estella's the youngest daughter of Aldo Leopold. And she is a paleoecologist. And I got to work in her lab and help prepare samples and spent time with her. And she's an amazing woman. And it's the first time I had-had, I'd been around a woman scientist, really. I had no women faculty at Colorado College. They were all men. It was just so thrilling to be around Estella. Because she's not only a great scientist, but she's an ardent conservationist. And it was great to see her stand up at meetings and speak for the environment and use her science to, you know, help support her statements.

And so while I was in Europe, I was thinking that while I liked trace fossils, it really wasn't going to be a field for me. It just wasn't quite what I was looking for. And so I wrote to Estella, who had just taken a job at University of Washington, to see if I could study with her. And she accepted me to the program. And I was so excited to go there.

Santucci: What a great life experience. And because she had done work in Yellowstone, did that have any sort of influence in your career?

07:43

Whitlock: Yeah, she was just getting sort of started working in the Pacific Northwest. But she had worked throughout the Rocky Mountains. And she connected me up with Dave Love, who is a very famous Wyoming geologist who worked for the US Geological Survey and did the mapping around Yellowstone and Grand Tetons. And she was good friends with him from her USGS days. And so she hooked me up on a project with him to look at Miocene pollen from Jackson Hole.

Santucci: So you have all these legendary people that you've been involved with in your career. What I'm holding right next to me is John McPhee *Rising from the Plains.* And I had the opportunity twenty years ago to chat with J.D. Love on several occasions on his work. So that you've connected those names together in your career is just amazing.

Whitlock: Yeah. Yeah. Both of those are people who I give a lot of credit to my own success. And I just love them both. And Dave has of course passed away. But Estella is still alive. And yeah, Dave was the kind of guy, I swear he could sell a refrigerator to an Eskimo. (Santucci laughs) He was so good at pitching a scientific problem, a geologic problem, you know, and you were just the right person to solve it. So he got me all excited about looking at these Miocene lake sediments that were exposed on the national elk refuge in Jackson Hole. So I spent a couple of summers following his very detailed stratigraphic section descriptions and collecting pollen samples. And you know, I worked up the pollen. And yeah, I mean, I got a paper in *Science,* my first publication was in *Science* describing these Miocene sediments.

Santucci: Very good. So before we go too much further, so you finished up your PhD in Washington. And what was your dissertation topic?

Whitlock: My dissertation topic was on the vegetation and climate south of the ice sheets in Washington state. So the ice sheets got as far as Olympia, Washington and northeastern Washington. And we really didn't know what happened to the vegetation south of that. So no one had really ever worked on that problem. And there were some lakes that proved to be quite old. They're still lakes, but they had a long record. And we went and got sediment cores from those lakes and I could compare what happened on the west side of the Cascades during the last ice age with what happened on the east side. It sounds very, you know, it sounds very kind of ordinary today because there's a lot of good work going on kind of like that around the world, but it was pretty exciting then.

Santucci: Oh, absolutely. So when you completed your dissertation then, where did you go? Did you do a postdoc, or were you able to find employment?

Whitlock: Well, I was very interested in the quaternary because it's just possible to get more pollen records. The pollen is better preserved in the sediment. You can date it. So I was really kind of firmly turning into a quaternary scientist. And I should also add that when I went to graduate school, I went at University of Washington, I was also in a geology department. But my gaps were in ecology. So I spent most of my graduate studies taking ecology classes so that I could become a paleoecologist, but I would know about ecosystem processes as well as geology. That's just an aside. Go ahead.

Santucci: In terms of the timing of this work for you, I just from my own experience, a lot of the initial paleoecology studies in paleontology had to do with marine environments, etcetera. So during your time, was that sort of the beginning of in-depth look of Pleistocene paleoecology? Or was that something that previous workers had focused?

12:59

Whitlock: Well, people like Estella Leopold had really gotten the field started of looking at vegetation history and climate history. And then I also spent time at the University of Minnesota with Herb Wright, who was another big quaternary geologist, paleoecologist. And that kind of opened my mind to the field as well. And so, the reason I liked paleoecology is because when you're hiking, you can look across a landscape and it answers so many questions. You look at a landscape and you say, "Well, how old is that forest? When did it get there? How has it changed through time?". And for me it just enriched my experiences hiking around to have paleoecology in my back pocket.

Santucci: Absolutely. And it's a big picture discipline where it integrates lots of other fields of study and resources to be able to do interpretations.

Whitlock: Yeah, that's right. You have to, it's very collaborative and interdisciplinary, as you say. Because you need to know something about climate, geology, vegetation. You also need to often work with archeologists and modern ecologists. And it's the collaboration that makes it so much fun.

Santucci: Yeah. We're involved in that right at White Sands National Park with the late Pleistocene human and megafaunal footprints that are in association there.

Whitlock: Oh, that stuff is so cool! I was just reading about that. That's really cool stuff.

Santucci: The dates that we're getting go back to the last glacial maximum. (laughs) So it puts humans here at a time of particular interest, palaeoclimatologically.

Whitlock: I know. You're really pushing the arrival of people in a way that's probably pretty controversial.

Santucci: It definitely is. (laughs) So, keeping on a chronology here, was your work with the USGS and Estella when you were still a student? Or did that occur after you completed your dissertation?

15:33

Whitlock: Well the USGS work was just a summer job for me. And fortunately for me, she left the USGS and went to the University of Washington.

Santucci: That's right. Okay.

Whitlock: So I could follow her pursuing grad studies. And after graduate school, after I graduated University of Washington, I was able to get a NATO postdoctoral fellowship to work in Ireland. And so I went there and spent a year working on peat bogs. And for me, it was the first time I really had to think about human imprints on the ecosystem. Because I hadn't given it much thought. But you can't work in Europe without looking at what the impacts of many thousands of years of land use and people were doing to the vegetation. So that was exciting.

Santucci: Sure. And just to keep the chronology straight, what year did you graduate?

Whitlock: '83. And so I was in Ireland until '84.

Santucci: Okay. And then you arrived at Carnegie during the mid '80s. 1985?

Whitlock: Yeah. My husband at the time got a job there in vertebrate paleontology. So we moved there in '84, at the end of '84. And they had never had a paleobotanist. And so I convinced them that I could do the job and they brought me on as a paleobotanist. Which is mostly looking at the collection, which was like coal forest from the Pennsylvanian, these big ferns and things like that, that they had in the basement of Carnegie. And then I got a, that was sort of a halftime job. And I got the other half filled with a position at the University of Pittsburgh.

Santucci: And I remember that well because I went from my undergraduate to my graduate degree both at the University of Pittsburgh. And I'd talked to Bud Rollins, one of the faculty members there, a lot about why there wasn't a closer relationship between Carnegie Museum and the geology department. So it was very exciting to be able to have you come onboard both in your adjunct position in the university in the department of geology and also tied to Carnegie Museum. Because that was hope to strengthen those relationships. I don't know if you recall that. But I think that was a pretty significant time, bringing the university, the department of geology together with the Carnegie Museum a little better than they had.

Whitlock: Yeah, I think it was a real experiment. And also, the department had no women on the faculty. And so they were, the department had told me that they hired me so that women would have somebody to go talk to. The women students.

Santucci: (laughs) The female students?

Whitlock: Yeah. So the female students would have somebody to cry to, he said.

Santucci: Oh, no! (laughs) But that was really big. So you were part of a transition that was really important for the department.

Whitlock: Yeah.

Santucci: And welcome.

19:27

Whitlock: I don't know how well they kept it going.

Santucci: Very good. And so how long were you in Pittsburgh tied with the department and the museum?

Whitlock: I was there until 1990. At which point I was divorced and I got a position at the University of Oregon. Which was sort of putting me back west, which was something I wanted to do. A lot of the research at Carnegie was focused in Yellowstone. I got my first grant to work in Yellowstone while I was at Carnegie. I was working in other places in Montana. And it was just a chance to be out west. And also to have students that were a little more focused on western paleontology, western issues.

Santucci: And so you mentioned that while you were in Pittsburgh then, you were able to make headways and receive funding to do work in Yellowstone. So what was the impetus to that? What was the background as it related to Yellowstone and your early interest?

Whitlock: Yeah, this is kind of a, this is kind of a long story. I got my first grant to work in Yellowstone. It was to work on the vegetation history as it laid out from Grand Teton National Park to central Yellowstone by looking at lakes, getting cores and looking at the pollen in the lakes. So I was super, super excited about that. And I think I got the grant in ’87. But anyway, I went to the park – no, that’s not true. I got the grant earlier, but they gave me subsequent funding. And the initial funding, we hired horses. We had like ten horses to haul in what probably amounts to about three hundred pounds of gear. And then another two hundred pounds of mud to be hauled out. And we spent a couple of weeks in the back country in Teton wilderness just coring lakes. It was glorious.

Santucci: Excellent.

Whitlock: But, yeah. And then I had money, again, to work in Yellowstone during 1988 when the fires were happening. And it was such a hassle in ’88 because the fires were burning everywhere and roads were getting closed. And couldn’t get to a lake I wanted to get to. And you

know, I was so focused on getting these lake sediment cores so I could work on the pollen record and everything. Nothing was working out. And I didn't want to screw up because it was some of the first funding I had and I wanted to do a good job.

And so I got cores. I did what I could, but it wasn't quite a good field season because of the fires. And I was driving back to Pittsburgh and I got a phone call when I was back at Carnegie Museum from the director of research at Yellowstone, John Varley.

Santucci: Yes, uh.

22:59

Whitlock: And John said, "Well, how did your summer go?" And I started almost like apologizing to him. Like, "Well, I did my best, but didn't get everything I said I was going to," and blah, blah, blah, blah.

And he said, "Well, don't you think these fires are an opportunity?" And I think I probably just went on apologizing. And he repeated the question. "Don't you think these fires are an opportunity?" And it kind of, I kind of realized something I hadn't. And that was that I could learn a lot about fire history by looking at the fires that were happening that summer. And I completely in my sort of single-minded focus to get the job done hadn't really been open to this whole new research area of fire history. And I also hadn't thought about how important fire was as a catalyst in ecological change. You know, I'd always just looked at change in the pollen record, but I hadn't really connected it to fire. So that set me off on a whole different research direction, thanks to John Varley.

And we started on a study that went on for ten years of looking at lakes in Yellowstone that had, some of them had burned watersheds and some didn't. And we went to these lakes several times a year and got the sediments, surface sediments, to see how much charcoal they had in them. And then how the amount of charcoal changed, and how the charcoal moved around in the sediments of the lakes, and how long did it take for the charcoal to get buried in the mud. And those papers, that understanding of how to use charcoal to reconstruct past fires resulted in a series of methods that are being used around the world now. And now there's an international charcoal database that's publicly available. It must have a thousand sites in it from all over the world of people who go to lakes, get sediment cores, and analyze the charcoal the way that we do. So that goes back to Yellowstone National Park.

Santucci: Yeah. I mean, that's phenomenal work. There are people employed in the federal government whose titles are "fire ecologist." And I think that a lot of the work at Yellowstone is extraordinarily important. I think what you added to it is more of a temporal component. Because a lot of the fire ecologists look at more short-term fire history. Whereas yours was more long-term.

Whitlock: Yeah. And you know, when the fires were happening in '88, the question a lot of people were asking was when did fires like this last occur, or have we ever seen fires of this size? Because it burned about 40% of the park, a little bit less than that, but about 40%. And people wanted to know, has this ever happened before? So we could provide with our charcoal records a temporal perspective to that. And so, and one thing we could show was that there was no fire

cycle. Because people were saying, "Oh, these fires happen every three hundred years in Yellowstone. This is a 300-year fire event." But our charcoal records could show that actually fire is closely tied to climate. And as the climate has changed in the past, so has the occurrence or the frequency of fires.

Santucci: Very good. Something that as a follow up, so for each of the oral history interviews, I create an archive. And in there, if you have a list of your publications, bibliographies, that's a really good thing to have as a companion document. So I assume you probably have that compiled.

Whitlock: Yeah, I can send that to you for sure.

Santucci: Thank you. Very good. And then the other thing that stands out to me that is very significant about your work is that it wasn't science for just the sake of science and academia. It actually was integrated into park management and benefited park managers that are looking at all aspects of managing greater Yellowstone's ecosystem.

27:49

Whitlock: I think so. You know, you never, it's very seldom that one single person or one single study will change park management. You know that better than anybody, I'm sure. But I think we contributed to a better understanding of fire over the long haul. And also, just again, showing how closely it's linked to climate. And as the climate changes, so, too, does the fire frequency. We also could show that during major times of ecological change there's often a lot of fires during those periods. That fire often is the catalyst of vegetation change in the past. And both of those have really strong messages for the future, right? Because the climate's getting warmer. And it seems from everything that I can say about the past is that we're going to see more wildfires in the years ahead. And also the ecosystem's changing. And I think that's a harbinger of climate change as well.

Santucci: In terms of your temporal review of the paleo-ecosystem at Yellowstone, did you see much change in pollen, diversity of plant taxa in Yellowstone and in the Northern Rockies, from the work that you had done?

Whitlock: Yeah, most of the lakes in Yellowstone go back about fifteen thousand years ago to the end of the last ice age. And so what we can see from those records is that there's an early period of tundra vegetation. You know, as ice is leaving and there's not very well-developed soils, and the climate is still cool, you get this tundra vegetation. And then the conifers start to appear in the pollen records at different lakes around the region. And the first conifers to move in is juniper. But I don't think juniper does very well with competition. And it's soon replaced by spruce. Englemann spruce comes in. Then it's followed by white bark pine and [unclear] fir. So you have this park land initially that seems to have no modern analog. And I think it's because it's such a dynamic period. Species are moving around tracking this really rapidly changing climate. The climate's getting rapidly warmer.

And then the last conifer to arrive is lodgepole pine. And in some places, it stays as the dominant species. In particular parts of Yellowstone for the next ten thousand years to the present day.

And then Douglas fir comes in. I should say, Douglas fir is the last conifer to come in, really. It comes in about seven thousand years ago.

So you get this from the pollen record. You get this sort of panorama of ecological change. And you can see that the ecosystems today are not terribly long-lived. You know that they're just a product of what's happened in the last few thousand years. Does that make sense?

Santucci: Oh, absolutely. With the glacial coverage of Yellowstone almost to the terminal end of the Pleistocene, that must have had an impact on vegetation growth, both from terms of scouring out and perhaps denuding the vegetation. But then in terms of the recovery. Is that a safe assumption that obviously during those glacial periods where the park was covered, you're going to have changes or absence of vegetation during those time periods?

32:00

Whitlock: Yeah, Vince, I mean, you're absolutely right. Twenty thousand years ago, the region is covered by the largest ice cap in North America outside of the major ice sheets in Canada. So it's completely covered. And then the ice starts to leave. And that is ground zero ecologically. Because when the ice is leaving, there is no soil, there's no trees, there's no animals. Everything that we see in the ecosystem today had to have come in since then and formed the ecosystems that we see now.

Santucci: So in some ways, it's sort of a short-lived ecosystem evolution from perhaps fifteen thousand years ago through the recent.

Whitlock: Yeah. We're probably seeing, I mean, we're seeing the same species that exist today. But they're just in combinations that you don't see today as they're tracking climate change.

Santucci: Okay. So there's a publication, and I don't know if I'm pronouncing his name correctly, Joseph Licciardi and Kenneth Pierce.

Whitlock: Yeah. Uh huh.

Santucci: You're familiar with their work?

Whitlock: Oh, yeah. I've worked closely with both of them. They're just great geologists. Ken Pierce just passed away, actually.

Santucci: I see. Sorry to hear that. And he worked for the USGS, is that correct?

Whitlock: That's right, yeah. He did most of the mapping, glacial geology mapping in Yellowstone and Grand Teton.

Santucci: So looking at some of the maps they published in a 2018 paper, it looks like the areas that were either not glaciated or de-glaciated by about fourteen to fifteen thousand years ago would be on the western side of the park. So from the Bechler region up towards Madison. Is that correct? Or is that—

Whitlock: I don't think so. I think it's the northeastern side that gets deglaciated early. I mean, those end moraines date to like nineteen thousand years or eighteen thousand years. I don't have that map in front of me.

Santucci: Okay.

34:17

Whitlock: But that side of the ice cap is kind of a rain shadow, like a snow shadow. So if the ice cap was growing, there was less and less sort of ice advance in that direction. Which was downwind of the precipitation source.

Santucci: Okay.

Whitlock: And then the last area to be ice-free is the Jackson Lake, southeastern side. I think.

Santucci: And have you sampled enough lakes within Yellowstone and Teton that they sort of have a climatic stratigraphy associated with them?

Whitlock: Yeah. We have lakes through the whole, through most of the whole ecosystem. There's one part of the park we don't have very much information. We just got a grant proposal in, so hopefully it will go there next. But we have pretty good coverage from north to south and east to west and high to low elevations. So you get these sediment cores and you radiocarbon date the plant material in those cores. So that gives you the chronology that you can determine the ecological changes that you see in the pollen.

Santucci: And although you're not a glacial geologist, I'll ask you anyway. Do you think that because of the higher temperature ground surface because of the geothermal activity had much of an influence on the distribution of glaciers within Yellowstone?

Whitlock: This is Ken Pierce and Joe's stuff, so I'm only going to paraphrase what they've written about, but the whole Yellowstone Plateau is a function of the Yellowstone hotspot, right?

Santucci: Yes.

Whitlock: So this area of high ground that makes up the central Yellowstone, it became an enormous collector of snow. So that's where the ice caps grew, and that's why it grew so large. So it connects, in their paper they do this lovely job of connecting the volcanic history to the glacial history and the climate history. Because the moisture is coming up the Snake River Plain, so it's following the old track of the Yellowstone hotspot. And then the first high elevation areas it hits is the Yellowstone Plateau, which is the present position of the hotspot. And that's where the snow is, accumulates.

Santucci: Very interesting. What a place to focus your research.

Whitlock: It's so exciting. And it's just, everything you discover is just so cool. And I enjoy really taking students there now from Montana State because it's such a fun place to think about geology.

Santucci: Sure.

37:29

Whitlock: It's really, it's the intersection of geology, ecology, and climate.

Santucci: Mm hmm. It certainly is. And so it's not your area of specific focus, but I'd sure be interested in hearing your perspectives as well. so when it comes to the faunal component from the late Pleistocene until the modern fauna that's well known and well-studied today, we're probably not going to find a very good evidence of vertebrates from the Pleistocene within Yellowstone. Would you agree?

Whitlock: I think there, I mean, there are some older lake sediments. But I think you're right. I think that it gets scoured pretty well. there's not a lot of Pleistocene deposits. You can get some Pliocene deposits when you go down south of Jackson Hole and out into Idaho and stuff. But not in the park itself.

Santucci: Okay. And then this is just a personal question. So one of my favorite spots in the park, and you probably have many of them, is Lamar Valley and along Specimen Ridge where the petrified wood localities are.

Whitlock: Oh, yeah.

Santucci: And if you're up on top of Specimen Ridge, particularly where some of the well-known standing stumps are and you look back to the northwest toward Hell Roaring Mountain and towards Mammoth, you look down into that glacially scoured valley and there's a number of lakes. Would you consider those kettle lakes if you know what I'm talking about?

Whitlock: Yeah, a lot of them are kettle lakes. Like do you know Black Tail Pond?

Santucci: Yes. Yes.

Whitlock: Drive by—We've done a lot of studies there, partly because it's so easy to get to. But it's such an interesting site. It's got a record that goes back fourteen thousand years, almost fifteen thousand years. And we've reconstructed the climate looking at oxygenized isotope data and fire history and vegetation history. It's a very cool site. And there's other lakes like that. As you get toward the Lamars, some of them are landslide lakes as well.

Santucci: Okay.

Whitlock: So like Trout Lake and Foster Lake. I don't know if you know those. Those are more recent. They're younger lakes because they're landslide lakes. But Black Tail, Black Tail's a beauty. And then the other one is Crevice Lake, which is down in a canyon of the Yellowstone. You take off from Black Tail Pond and you head towards the Yellowstone River. And just in the canyon of the Yellowstone is a large round lake that's super deep. It's 100 feet deep, which is kind of unusual for lakes of that size in Yellowstone. And it has annual lamination. So we were able to reconstruct a really high-resolution record of climate and vegetation and fire history there.

Santucci: Interesting. So, you know, you've invested a big portion of your career towards helping to understand the paleoecology and climate of Yellowstone. What are your recommendations to the next generations of researchers that come in, given how far you've taken these studies and what new technologies may afford in terms of different types of analyses?

41:26

Whitlock: Yeah, you know, when I was a grad student, I thought this is my life's mission. I'm going to really figure out the history of the Northern Rockies. You know, kind of lake by lake. And now, forty years later, I realized I haven't come close to figuring it out and there's still so much work for the next generation of scientists to do. There's entire mountain ranges that we don't understand anything about. We don't know anything about the ecological history of them. So that's out there. There's just so much work to be done.

And the other thing is there's new techniques that are going to make it, give us new insights that weren't available. Ancient DNA and the sediments is going to open it up a lot to be more precise about our reconstructions of the ecosystem. Some of the work that was done earlier by me I think could be redone at much higher resolution and much better dating control. That just wasn't the standard in those days. There's tons of stuff to do.

Santucci: So if we put a starting date for when you began to work in Yellowstone, approximately what year was your first work? It was when you were still in Pittsburgh, I'd say?

Whitlock: Yeah, with Dave Love, I started in 1979 working in Jackson Hole. And then my first research grant to work in Yellowstone came I think in '86. Came from the Park Service, so I'm always grateful.

Santucci: So, Park Service money's hard to get. So that's great that you were able to get something to support your work.

Whitlock: Yeah. Yeah, for sure. It really got me started. And then with the fires in 1988, there was some, what they called fire money available to do research. And that got me going on the fire history studies and the calibration studies.

Santucci: And did you work at all through the University of Wyoming National Park Service Research Station?

Whitlock: Yes, I got grants from them early on as well. In fact, I think the '86 grant, the first grant, actually came from the UWNPS Research Center.

Santucci: Did you ever get a chance to stay at the AMK Ranch?

Whitlock: Yeah, have you stayed there?

Santucci: Yes, uh huh.

Whitlock: It's great. It's, what a resource. I wish there were something like that in Yellowstone. It's so hard now for researchers working in Yellowstone to find a place to stay.

Santucci: It really is a problem. Yeah.

Whitlock: Yeah. It is.

Santucci: So before we move on to Grand Teton and Glacier, was there anything else that you wanted to share about Yellowstone that we haven't talked about?

44:36

Whitlock: I just would say that over my career I've worked in other places that in some ways are like Yellowstone. They're in the temperate latitudes. But in other ways, they're a little bit different. They have a different climate or different biogeography or different glacial history. But I feel like the motivation to work in those other places has always just sort of enhanced my understanding of Yellowstone. Yellowstone's an ecosystem I know really well. And when I work in Tasmania or Patagonia or New Zealand or even western Europe, it's just like a little bit of an embellishment of my sort of mental picture of how ecosystems change through time.

Santucci: Very good. Yeah, that's a wonderful thought. I appreciate capturing that. So, was there anything else you wanted to share about Grand Teton National Park?

Whitlock: Well, Grand Teton Park was part of this transact, you know, going from, I wanted to start south of the ice sheet and then work my way north into the area that was covered by the Yellowstone ice caps. So I started, where was I? I was at Hedrick Pond, which is near, kind of near the Triangle X Ranch. Anyway, that was the first lake. And then sort of look at a series of lakes going up into Yellowstone.

In some ways, the Grand Teton ecosystem is more interesting to study because it's got a little bit of, it's got more aspen. It's got a little bit more diverse vegetation than a lot of Yellowstone. So it's been great to work there, too.

Santucci: When you're planning a study, and you look at a landscape that has lots of lakes and ponds, are there any criteria that you use to say I would prefer to study this one over another one for particular factors?

Whitlock: Yeah, that's a good question. It's sort of where one's geology training comes in. Because the first question you have to ask is why is the lake there? And lakes really only form for a handful of reasons, you know. They're crater lakes or they're glacially related lakes, like kettle lakes. Or they're landslide lakes. So you have to really look at the geology and the geomorphology to figure out which lakes are going to be old enough to answer the questions that you're asking.

And then the other thing is that you want a lake that's pretty simple. So you don't want big rivers coming into it or leaving that would mess up the sediments or the pollen introduction to the lake. And the other things is, you want a lake that's deep enough so it hasn't dried in the past. Because once it dries out, then the wind will blow away the sediments and you'll lose some of the record. So I'm always interested, for example, did it dry out during the dust bowl? If it dried out during the dust bowl, it probably dried out during other warm, dry period like the early Holocene.

Santucci: And when you're assessing these samples and cores from the lakes, are you finding any other material besides pollen? Are you finding any microfauna within the deposits?

48:31

Whitlock: Yeah, we look at, I mean, we look at the lithology of the sediments and the geochemistry, and we also look at the charcoal particles in addition to the pollen. So that's pretty routine for us. But honestly, we are looking for anything we can find. Parts of insects. We sometimes find fish scales or pieces of bone, fish bone. And each of those discoveries really helps us better understand the environment. But it's not a continuous record. So it's sort of just a happenstance to find it.

I work with colleagues who look at the fossil diatoms often. And they tell us about the limnobiota and how that's changed through time.

Santucci: Very good. Have you come upon any examples of work that you've been doing in lake limnology where you might see that there's some sort of thermal imprinting or disruption or contamination or something of the lake sediments?

Whitlock: Yeah. Actually, I'm super excited about that, because that's our newest project is we've been working in the Geyser Basin at the sediments. And we think that past hydrothermal activity around a lake is indicated by high levels of arsenic in the sediments.

Santucci: Oh, wow.

Whitlock: And when the lakes – and also, the diatoms will show a sensitivity to extreme chemistries or extreme temperatures. But when the lakes become fresh, then the arsenic content drops dramatically. And so we're hoping we can look at a bunch of lakes in the geyser basins of Yellowstone and maybe even map out the history of the geothermal activity through time by just, you know, determining when a lake had an active hydrothermal influences.

Santucci: Wow. Great stuff.

Whitlock: Yeah. It's super, it's really, it's really interesting. And I hadn't, each time I do a study in Yellowstone, something new comes up. And this presence of arsenic in the lakes that are hydrothermically active was something I hadn't, it makes sense, but I hadn't thought to look for it.

Santucci: And so then you moved north to Glacier. And what was the genesis of that work? Anything you wanted to share specifically about that research?

51:28

Whitlock: Yeah, the Glacier work came from my PhD, looking at lakes that are old enough to have been existing south of the ice sheet in Washington. And I wanted to find lakes like that further to the east into the Rocky Mountains. And so I spent time coring lakes in Glacier that I hoped would have old records and tell me about the history of the vegetation during the ice age. Because when you think about it, when there's an ice age, the trees have to go somewhere. So

how far did they go? How far south did they go? What was growing just at the ice margin, and how long did it take for the trees to return?

So that was what we were doing in Glacier. And we looked at sites east and west of the Rockies. And none of them were quite old enough to answer the question. But they are pretty interesting. Especially the ones on the east are some of the only records from the Great Plains, the Northern Great Plains.

Santucci: Excellent. And what years did you work in Glacier, approximately?

Whitlock: It was like, it was ’88 to ’90.

Santucci: Okay.

Whitlock: I was still at Carnegie Museum.

Santucci: Okay. Very good. So is there anything that we haven’t covered that you’d like to share in terms of your career, how it integrated into National Park Service resources management or anything similar?

Whitlock: Well, I’ve always done science because it’s so interesting. When you look at the sediments from a lake and you reconstruct what the past was like, for me it’s like turning the page of a really thrilling detective story. Page by page, working your way through time to see what it looked like. So that’s always motivated me as a scientist. But what I’m finding now is that it’s, the work that we’ve done in paleoecology and paleoclimate is becoming extremely relevant to park management, and also just for understanding how the ecosystems might change in the future with climate change. So I’ve gone from being probably a pretty wonky scientist to now being more of a translational scientist. And I spend a lot of time talking to communities about climate change and what we know about past climate change and why what we’re facing now going into the future is really of a concern.

Santucci: Do you have graduate students that you’re mentoring?

Whitlock: I just finished my last graduate student a couple of months ago, and they’re on their way. I’ve had about thirty-five graduate students in my career.

Santucci: Wow.

Whitlock: So it’s been fun. Each one, each individual, is different and on a different path. They’ve been fun and sometimes challenging to work with. (laughs)

Santucci: Absolutely. Yeah. By mentoring people, not only do you gain the benefits of learning from them, but also guiding their careers and their life forward in ways that may not otherwise occurred.

55:30

Whitlock: Yeah. Yeah, I've had a lot of just wonderful adventures with students. You know, helping them get the mud that they need to work on. And I have learned a lot from them in the process.

Santucci: And you carry with you probably to them things that you've gained from J.D. Love and Estella Leopold. Keeping their legacy alive.

Whitlock: Yeah. Yeah, I hope so. I hope so. You know, it really does take a village to be successful, right? You don't do it all by yourself. You get a lot of help along the way.

Santucci: And so what does retirement mean to Cathy Whitlock? Does that mean that you'll be focusing on bucket list items in your career?

Whitlock: (laughs) Well, we just released the climate assessment for great Yellowstone. I don't know, have you seen that?

Santucci: I have not.

Whitlock: I should send you the link. I'll send you the link because it's mostly available online. But it's looking at Yellowstone's past, present and future climate. It's a partnership that was done with the USGS, University of Wyoming and Montana State University and the Park Service. So that got released. And it's really, we're going around to communities talking about climate change and what we know as geologists and ecologists and climate scientists. We would like to do more of those assessments. Because the first one only focused on climate and water. But we'd like to write a report that evaluates what the impact of climate change is going to be on the ecosystem. So yeah, I'll send you a link to that. You should check it out. It's really good. I've done three assessments now, three assessment reports. And this one's really good.

Santucci: Yeah, I look forward to seeing it. Thank you. I don't know if you saw, Jeff Hungerford, the geologist at Yellowstone, just sent me a copy. But it's called *The Atlas of Yellowstone,* by Marcus and Meacham.

Whitlock: Yeah.

Santucci: Wow, that's amazing resource.

Whitlock: Yeah. Yeah, those guys were in my department at University of Oregon, so I know they do good work. And this is their second one. A revision. And actually, I wrote an essay in there on the physical environment, I think. I haven't seen his new one.

Santucci: It's absolutely beautiful. I mean, it's the size of a coffee table publication. It's beautifully illustrated.

Whitlock: Yeah. The Greater Yellowstone Ecosystem inspires so many talented people.

Santucci: Absolutely. Well, this has been a wonderful interview. I really, really appreciate your time.

Whitlock: Yeah.

Santucci: Any concluding thoughts before we end?

Whitlock: No. I think you got it all. And thanks for your questions. I hope I didn't ramble on too long.

Santucci: No, this was perfect. I learned a great deal. And thank you for your time.

Whitlock: Yeah. Okay. And I'll look forward to the transcript, I guess, when you get to it. And if you have any questions as you go along, just shoot them to me.

Santucci: Okay, great. And I'll send you an email with several links and then some questions as it relates to your interest and involvement in some capacity in the Yellowstone Paleontological Survey that's tied to the 150th anniversary of Yellowstone.

59:14

Whitlock: Yeah, I can definitely contribute to that. I mean, all of the data that we've generated is available on publicly available databases. So.

Santucci: I appreciate that very much. Excellent. Well, if I don't talk to you before, have a great holiday. And thank you again.

Whitlock: You, too, Vince. It's nice to talk to you.

Santucci: Oh, it's been great.

Whitlock: Talk to you later.

Santucci: Have a nice day.

Whitlock: Bye-bye.

Santucci: Bye.

59:43

[END OF INTERVIEW]