National Park Service (NPS) History Collection

NPS Paleontology Program Records (HFCA 2465)
Vincent Santucci's NPS Oral History Project, 2016-2024

Christine Turner
May 15 and May 29, 2020

Interview conducted by Vincent Santucci and Tim Connors
Transcribed by Teresa Bergen
Edited by Molly Williams

This digital transcript contains updated pagination, formatting, and editing for accessibility and compliance with Section 508 of the Rehabilitation Act. Interview content has not been altered.

The release form for this interview is on file at the NPS History Collection.

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

Narrator: Christine Turner
Interviewers: Vincent Santucci, Tim Connors
Date: May 15 and 29, 2020
Transcribed by: Teresa Bergen

Transcript

[START OF INTERVIEW]

Santucci: And then they set the stage then for the more in-depth discussion involving the kinds of topics that we're most interested in capturing. The one thing is, don't assume that we know anything. A lot of people will – when we interview them kind of glean over things assuming that we have a basic knowledge. So by capturing this interview through recording and then later we'll transcribe it, is that somebody that may have no idea about a project or who you are and all that, that they'll be able to listen and clearly understand based on the descriptions that you provide in these first-hand accounts.

Turner: Mm hmm. Okay.

Santucci: Is that reasonable?

Turner: Oh, yeah. That's very reasonable.

Santucci: Okay. Perfect. Well if you're ready, I'll just give a little background information. And then we'll jump into some questions.

Turner: Okay then.

Santucci: Excellent. So today is Friday, May 15, 2020. And my name is Vince Santucci. I'm the senior paleontologist for the National Park Service Geologic Resources Division. I'm interviewing Dr. Christine Turner, retired geologist with the US Geological Survey about her participation in the Morrison extinct ecosystem project and any other work involving National Park Service areas. We are joined by Tim Connors, geologist with the National Park Service Geologic Resources Division today. So thank you, Christine, for your time.

Turner: You're welcome, Vince.

Santucci: So we're going to begin with an easy question as an ice breaker. Can you provide us some information on when and where you were born, your growing up and education up to the time you went to a university or college?

Turner: Okay. I was born on Long Island, New York and was raised in Babylon, little village of Babylon, New York, on the south shore. And I went to work in the village. It's actually a village. Grade school and high school. Right in the village of Babylon. The grade school I had to be driven to, but the high school I could walk to. And so up until the time I went to college, that's where I was raised and went to school.

Santucci: Anything during that time period, life experiences or during your education that sort of drew you towards earth sciences?

Turner: Oh, definitely. Even though I grew up on Long Island, which is a glacial deposit, so there's a lot of sand. And it's pretty flat. But it has, as one of my geology professors later said, Long Island is just the scrapings of New England. (laughter) So it has a good sampling of, because the glaciers just scraped across New England and dumped some moraines and outwash plains on Long Island that formed Long Island.

So for some reason, I was interested in collecting rocks. It wouldn't be your normal sort of rock hunting that you would do out west. Again, because there were no outcrops, really, or not very many. Only on little islands at the eastern end. But there were rocks, railroad grade. I'd go up to the railroad, which is a couple of blocks away, and pick up limestones that they used for the railroad grade. And my dad had brought home a piece of the salt from Hawaii, and a piece of coral, when he was over there in World War Two. And so, and every time he'd go on a business trip, say to Albuquerque, he'd bring home those little cards with minerals on them. And anywhere we'd go, I'd collect rocks and put them in an egg carton. So I was fascinated. I don't know how, because it wasn't as though (laughs) I had a lot of exposure to rocks. I had to go seek them.

And then in junior high, I took earth science in school. And it was fantastic. My earth science teacher was just wonderful. And we learned so much about minerals and crystal systems. I can't believe how much we learned. It was interesting because (laughs) by that time, I had a pretty decent rock collection I'd been collecting over the years. And so one of the things we had to do was turn in a rock collection for a project. And so I turned in my fairly extensive rock collection on this big board, and I'd written it all up. And the earth science teacher was like many geologists, just a whole lot of fun and very fun-loving. So he wrote for my grade that I would get an A if I let him keep it, and an F if I didn't. (laughter) That was my start in both geology, interest in earth science, and the humor practiced by pretty much every earth scientist I know.

05:35

Santucci: That's great. So, when you applied for a college or university, did you have a major in mind at that point? Or did that determination come later?

Turner: That determination came later. I was kind of an omnivore in terms of interests in subjects. I initially, though I did not select a college to go to with that in mind, and I ended up going to the College of William and Mary in Virginia because that just seemed like a really good college to go to. In liberal arts. They're very strong in liberal arts. And I really wanted to have a good liberal arts education without having any idea what I really wanted to do with my life.

And in my freshman year I took geology and a number of other courses. And I started majoring in what they called government there, which I guess you'd call political science elsewhere. And studied that for a while. (laughs) My stories of how I chose different things in my life and the different paths I took are rather erratic. I was leaving registration one September with all of my punch cards in hand. And as I was literally going out the door of the gymnasium, I saw my 101 geology professor off to the side. And I just thought I'd go over and say hello to

him. So I went over there to say hello. And as we were chatting, I found myself saying, and honestly, I can't tell you, it just came out, I said, "You know what. I think I want to major in geology." (laughs) With a fist full of computer cards.

So he said, "Well, I'll tell you what," without blinking an eye. He said, "Go home over the weekend"—it was a Friday—"and read the syllabus and read the description of the courses. And if you still want to major in geology, come in Monday and we'll drop all of those classes and add the geology classes."

And I read the syllabus and I read the description of the classes. And I said of course this is what I want to study. And you know, I do often wonder what would my life have been like if I had not seen him out of the corner of my eye as I left registration. But that's sometimes the nature of life. (laughs)

Santucci: Absolutely. And so you complete—oh, go ahead.

08:25

Turner: Oh, yeah. So you want me to continue on with my education? Is that correct?

Santucci: Sure. Absolutely. Yeah.

Turner: Okay. Well my senior year, as a senior I decided to go to graduate school in geology. And never having been west of the Mississippi—no, never having been west of Virginia, really. I was pretty much an eastern seaboard, creature of the eastern seaboard, I applied to a couple of colleges in New England. And a friend of mine who was a year ahead of me at William & Mary had gone out to Northern Arizona University in Flagstaff. And wrote back and said, "You won't believe it out here. You've got to come." And I thought well, okay, I'll apply there, too. And not really knowing anything about it, except on the recommendation of my friend. And I did get a full teaching assistantship in geology at Northern Arizona.

And as an aside, I got an assistantship there. And just last Saturday, I was attending a virtual banquet at Northern Arizona University with two of my former geology professors and current professors and a bunch of graduate students. And on that Zoom meeting, the chairman of the department, who is now ninety, was on the Zoom meeting. And they let us old guard talk to each other after they all dropped out of the Zoom meeting and left it to us to continue chatting. And I thanked him for being instrumental in making sure I got the first teaching assistantship as a woman in the department at Northern Arizona University.

Santucci: Wow.

Turner: Yeah. He was ninety. And I was so grateful to be able to thank him for that because I hadn't really seem him since I graduated in '74. And interestingly, because sometimes you have to lead with your chin in life, and ignorance can be bliss, it turns out the professor that ended up being my advisor admitted as I left to come to my job in the USGS in Denver, he admitted that he initially voted against me having an assistantship because I was a woman. (laughs) And the chair of the department had said, "No, no, no. We have to start admitting women and getting them into the program. And she's our most qualified." And so my advisor was actually the one

that told me that story, admitting that he had been wrong. But that the chairman had stood up for me. So just last Saturday I got the chance to thank the chairman at ninety years old and it was a turning point in my life. And he remembered that. And he said, "Well, I'm glad you remember that." And so I said, "Oh, I'll never forget it." So anyway, that was kind of a rewarding thing.

Santucci: That's a great story.

Turner: But then I came home—(laughs) You know, people help you in your life. None of us make it by ourselves. Not one. It's the good people who create opportunities for you. And it's up to you to take them. But still, that was a big turning point.

So I came on to work at the USGS in '74. And worked there for a number of years. Then in '81 the USGS allowed me to go back to school, even though I was still working fulltime. So I mostly did double time or triple time and was going to University of Colorado for my PhD. And editing a volume on the Morrison and writing papers and continuing all my research. So it was a crazy time in my thirties. But very, very intense in geology. I ate it and slept it. But it was rewarding. So I got my PhD up at the University of Colorado in Boulder, and then continued working at the USGS after that. So that's my education.

Santucci: Perfect. Very interesting. Thank you for sharing that. So I wanted to go back and just dig a little bit deeper on some questions. So the first question, did you have a master's thesis project that you worked on?

13:11

Turner: Oh my gosh, yes. I sure did. (laughs) I worked on the Toroweap in the Grand Canyon, the second formation down. And that's a unit that my advisor had been working on. He'd been working on it in the western Grand Canyon. And George Billingsley, who is famous for mapping the Grand Canyon, he mapped the entire Grand Canyon and accumulated all the maps and put it together. And he's the first name on the map of the Grand Canyon. And he noticed a problem in the Toroweap Formation in the eastern Grand Canyon around Marble Canyon and had mentioned it to my advisor. And so when I asked him to be my advisor and asked if he had any suggestions for a project, he said yes, George Billingsley had pointed out this [unclear] 14:09 changed and he's not sure what's happening there, but there's something distinctive going on in Marble Canyon. And so I did my master's thesis, I measured sections in all the side canyons in Marble Canyon and hiked down from the rim. And that was my master's thesis, which was quite amazing to be in Flagstaff, Arizona and to actually do my thesis in the Grand Canyon.

Santucci: Great project. A very important project as well. And you probably are aware that last year was the centennial for Grand Canyon National Park.

Turner: Yes. Yes. What a park. And Eddie McKee, who had been the first park naturalist, or not the first park naturalist, but he'd been a longtime naturalist at the Grand Canyon. And he was actually around Flagstaff at the Museum of Northern Arizona and I was working on my master's degree. And he helped me quite a bit. And he actually had my samples sent back to the STS in Washington to be identified by the expert. So you know, it was just very rewarding because Eddie McKee had helped George Billingsley. And George Billingsley and Eddie McKee helped me.

And one of the funny stories, if you have a moment for that, is when my advisor and George Billingsley took me up to Marble Canyon to introduce me to the problem that I'd be working on in the Toroweap, we hiked down in the side canyon. And Soap Creek Canyon, which had huge boulders to literally crawl over and pull yourself up or down, depending. Well, lower yourself or pull yourself up on the way back. And so they took some samples while we were down in the canyon and kept putting them in my pack. And so as we came back out, the two of them got considerably (laughter) So I had this big sack of rocks. And as we came back out, they got increasingly farther ahead of me as I would take my pack off, lift it up over the boulders, scramble up over the boulders myself, put the pack back on, walk a little farther. Take it off again. Try to get it up over the boulders. Pull myself up again. But I was determined not to say anything. I didn't want them to know how I was suffering. So I never said a thing, but I thought, "Oh, those dirty dogs". (laughter)

So George Billingsley, he's just such a wonderful character. He said, well—later on, you know, again, I heard all these things years later—he said, "Well," he said, "we had to make sure if you were going to work down there that you would be able to carry your own samples out and get out. So that was the test." (laughter)

And I said, "Oh, you, I thought you guys were so mean to me." And I said, "But I wasn't going to let you know."

He said, "Well, if it makes you feel any better," he said, "Eddie McKee did that to me when I started working at Grand Canyon." (laughter)

17:18

Santucci: So these are the stories that we want to preserve. You know, the science stuff we can look up. But stories like this are really precious. And so thank you for sharing that. Do you recall the first time that you met Eddie McKee?

Turner: Oh, let's see. The first time probably was at the museum meetings, I'm going to say. The Museum of Northern Arizona had annual meetings. And he was up there all the time. He worked for the USGS, but he also spent a lot of time at the museum. (bell) Somebody's ringing my doorbell. We'll have to ignore it. So, he was always in the area. And I know, I don't remember the exact first time I met him. I just remember being in awe of him because of course he had written the monograph on all the units in the Grand Canyon, including the Toroweap. And I had hundreds of pages of his monograph. I mean, I had to Xerox it. In those days, you didn't have very many Xerox machines. But I had to take it back to New York over Christmas holidays and go into my father's office and Xerox the entire monograph of Eddie McKee. But I honestly don't remember the very first time I met him. But he was always at the museum meetings and there was quite a bit of interaction among the museums and the university and the USGS. Sorry, somebody's persisting knocking at my door. Oh, hang on a second. I will let her in very quickly. She's going to give me some cake or something. It's a neighbor. Sorry about this, guys. I'll be right back.

Santucci: No problem.

Connors: Those are some great stories, Vince.

Santucci: Yeah. I want to try to capture some more of those.

Turner: Okay, guys. This is why I'm doing so well in this pandemic. My neighbor made me some homemade banana bread and brought it over to me. (laughter) That's the kind of neighborhood I live in. They are, oh my gosh, just wonderful. So, yeah, again, I don't remember exactly the day I met Eddie McKee because he was sort of always around and we had lots of interactions at USGS.

Santucci: So I'll probably want to come back to Eddie McKee because we have a lot of interest in regards to him and his life. But maybe just to focus on your master's thesis. Who were your advisors? Was McKee one of your graduate advisors?

20:18

Turner: No, actually he was not on my committee. He just helped me out, but was not on my committee. No. My advisors were Richard Rossen, who was a carbonate geologist and Stan Beus who of course has been very active in the Grand Canyon and written, he's co-edited and edited a number of volumes on the Grand Canyon. And then Bill Nations, who was a paleontologist. They were all in the geology department at Northern Arizona University.

Santucci: That's quite a group. That's an impressive group.

Turner: Yes, they are. (laughs) And Stan Beus is still alive. And he was still leading adult education trips until fairly recently, from what I understand. Mm hmm.

Santucci: And because we're interested in paleontology, did paleontology at all play a role, fossils play a role, in your master's thesis work?

Turner: Oh, yes they did. I'll tell you why. The fortuitous thing about the Toroweap Formation is that unlike the Kaibab, which of course forms the rim of the Grand Canyon, the Kaibab is a fairly uniform composition and lithology throughout the Grand Canyon. It gets a little sandier to the east. But it's a pretty uniform unit, and there are not huge facies changes in it.

The Toroweap, in contrast, has dramatic facies changes. And I was so fortunate to work in something that had, [unclear] 22:08 that had so many facies changes. So in the western part of the Grand Canyon, there are limestones that had open marine fossils in them of open marine, corals and bryozoa and crinoids. And you know, just a rich fauna. And in the area I worked, part of the story was that the fauna changed significantly. And in Marble Canyon, the limestones changed to dolomite. They were dolomitized, and a lot of gypsum around in the eastern part of the canyon that affected the dolomitized limestones. And the more brackish nature of the water was reflected in the more limited fossil assemblage, which was mostly a mollusk, one specific mollusk, and gastropod. And that was it. And so they were more typical of the brackish water. So the paleontology reflected the change in conditions across the canyon and the change in composition of water. The less clear and more brackish water in the eastern part of the Grand Canyon during the deposition of Toroweap.

So, yeah. And Ellis Yochelson at the USGS in, they were in the Smithsonian at the time. Ellis Yochelson was with the USGS but in the Smithsonian, the Smithsonian building. And

Eddie McKee took my shoebox full of samples of fossils and shipped them for me to Ellis Yochelson and asked him to please identify them for me specifically because he was the expert in those kinds of fossils. And so paleontology was very important to interpreting the changes in the Toroweap Formation from west to east across the canyon.

And then, as you go south towards Sedona, the Toroweap Formation turns into a continental septa. And then it becomes 100% Aeolian and looks identical to the Coconino. But it was just a continuation of the dune field to the east and southeast doing deposition of the marine Toroweap. So it's a whole story across northern Arizona in that one unit. It made quite a story across the whole Grand Canyon and northern Arizona.

Santucci: Are you familiar with the USGS E&R reports?

25:00

Turner: Yes. Yes, I am. I don't know if I ever did those but I'm familiar with them. Yes, mm hmm.

Santucci: So they're extremely valuable to us. And I'm wondering if Eddie McKee generated an E&R report for the samples that were sent to Yochelson. Because that's typically the procedure that was adopted by the branch of stratigraphy and paleontology whenever they were going to have one of the Smithsonian paleontologists review field samples.

Turner: Interesting. Honestly, I don't know if Eddie did that or not, or if Ellis Yochelson did that. Either one. It would have been Eddie McKee, I suppose. Honestly, I don't remember if he did that or not.

Santucci: So I'm going to do a little research on that and see if we can locate any, if one was produced. And if we do, we'll make sure that we get a copy of that to you.

Turner: Oh, that would be wonderful. That would be really exciting, actually.

Santucci: Yes. Fantastic. So, you finished your master's degree at Northern Arizona University. At what point did you begin working with the US Geological Survey? Was it as a master student or afterwards?

Turner: Afterwards. I did not work for the USGS until I hired on in Denver. I really was just working on my, my teaching assistantship is really what I used for income. And I did not work at the USGS in Flagstaff, although I knew many of the geologists there. But I didn't start working formally for the USGS until I came to Denver and worked here.

Santucci: And do you know what year that was, or approximately?

Turner: Yeah, 1974.

Santucci: Seventy-four, okay. And so, did you come to Denver specifically to work for the USGS? Or did you move to Denver and then get hired?

Turner: No. I was hired from Flagstaff to work for the USGS. And then I moved here to start my job here.

Santucci: Okay. And then, what was your position at the time that you were hired?

Turner: Okay. I was hired as a project scientist. Which is a little unusual, because many people who were being hired at the time had PhDs. And I had a master's degree. And the fellow who hired me really wanted to hire me. And so they sent the branch chief down to interview me again to make sure that, you know, it would be okay to hire me, even though I didn't have a PhD. But I did hire in as a project scientist at the USGS. And then went back later for a PhD. But it was kind of interesting. Even though the guy who had the opening wanted to hire me, they had to make sure I was up to the task.

Santucci: And what branch was that within?

28:24

Turner: That was Uranium and Thorium. Branch of Uranium and Thorium Resources. If you recall at the time, uranium had made a comeback. And the energy part of the USGS hired into oil and gas resources and uranium and thorium resources. There was a lot of interest in it at the time.

Santucci: And so, you were in that position for approximately how long?

Turner: Oh, well, the branch changed names. And I got promoted along into different positions, and then worked on a number of different projects. So the branch changed from Uranium and Thorium to Sedimentary Processes. Because we became more of a sedimentary processes branch in which we studied units that were of interest for a variety of reasons, other than just uranium. Because uranium sort of went away as an interest. And the industry sort of closed up again. So, yeah, I worked on different, my first project was actually back in the east coast, working with Triassic-Jurassic Basin.

To me, it's an interesting story. I hope you find it interesting, too, is how I ended up working in those basins. If you have a moment for me to tell you the story of how this came about.

Santucci: Please.

Turner: When I was—(laughs) thanks for your indulgence here. When I was at William & Mary, there was an undergraduate research grant program that my professors encouraged me to apply for. And one of my fellow students by the name of Hope Gabies lived in northern Arizona. And she said well if we applied for these assistantships, we could both live in her parents' home in, I think it was Alexandria. And I thought well, that would work. Because I wasn't sure how I'd do this project and be able to support myself. (laughs) So I worked in the diabase in the Triassic-Jurassic Culpeper Basin. And that was my first field project as an undergraduate between my junior and senior year. I worked all summer getting samples and making thin sections and interpreting the diabase. The acidic differentiate in the diabase shot through the system.

And then that fall, I gave a talk at the Virginia Academy of Sciences and then wrote an abstract for that talk. And it was my first official talk and first abstract.

And so when I applied for the job at the UGS in '74, the person who hired me wanted somebody who was not afraid to work back east, but was sort of maybe educated in geology in the west and was comfortable doing field work and had some field experience, but was not reluctant to work back east. Because a lot of geologists want to work out west. And he told me that he went through seven hundred applications—because, you know, USGS, people always wondered how I got on. And literally, it was this abstract. He saw that not only was I educated at NAU, which he liked. Had done field geology in the Grand Canyon, which was also a plus. He also noticed that not only had I worked in the east and gone to school in the east, I'd actually worked in those very basins. Because the project was going to be on uranium in the Triassic-Jurassic Basins. In those days, it was considered the Triassic Basins. They were not yet discovered to be partly Jurassic in age. So he said he pulled my application out of 700 applications when he saw that I'd worked in those basins, which was just an undergraduate research class. And I tell people that story because I always want students to know, and young people to know, that things that [unclear] 33:18 can change your life just by sort of taking advantage and opportunity and going with it. And you never know what's going to be influential in your life when you're actually doing it. Some of those decisions just really work out well. But I couldn't have known that at the time. So anyway, that's how I got on with USGS.

When we talked, and I had my interview, the Toroweap Formation had [septa?] 33:52 deposits in it, which was a fairly recent concept at the time. And I'd applied that to my interpretation of the Toroweap Formation and reinterpreted quite a bit of the Toroweap, the eastern part, because the concepts hadn't been available before. Well, it turns out the guy who hired me had been identifying [septa?] deposits in the Entrada Sandstone. So we had quite a good discussion about sedimentology and septa deposits and how they were newly recognized. And so sometimes things just work to your benefit and you don't really know, you can't know that in advance. Some of it's just dumb luck.

34:47

Santucci: These are great stories. I really appreciate it and I'm glad we're able to capture them. So, you're working at USGS and can you explain the developments that led for you to then decide to go on for your PhD in Colorado?

Turner: Um, let's see. Why did I decide to go on to get a PhD? Well, I was thinking about it. Thinking I might go on for a PhD. And my highly supportive husband, Fred or Pete Peterson, encouraged me when I said I might want to go back. And he said, in the USGs, anyway, it's sort of like a union card. Again, not required, but he said it's sort of a union card and he said, "It will open doors for you that you do not know are closed to you." And I didn't really know what that meant. (laughs) But because it was sort of a union card. But I wanted to go back anyway.

And at the time, I had already switched to working in the Morrison Formation. Because I had discovered some ideas, I had developed the model for uranium mineralization back in the Newark Basin. And people were rather dubious about it because it was in a basin that had some shows of uranium in it that people thought well how could you possibly apply this to anyplace

else besides this odd little basin in the east that you were working in. And you know, it's not exactly a uranium district.

So the branch chief said, "You have some really interesting ideas, but I need you to try it in an elephant, where there are big deposits." So he suggested I either work in the Chinle or the Morrison Formation. The Morrison at the time had over 50% of the nation's reserves in uranium. Or resources, I guess it was. And so I ended up working in the Morrison. And that's how I ended up shifting from the east to the west and starting to work in the Morrison. It was really uranium deposits.

Well, I was well underway in my research and I was studying everything about the Morrison Formation. And fortunately for me, Ted Walker, you know, Ted up at University of Colorado, was really happy if I were to come there and actually use some of the research I was doing at the USGS and pursue that as part of my thesis for the PhD program. So it actually was fortuitous that he let me do that. Because not every school will let you do that; they want you to do what the professor wants you to do. Whereas he was very encouraging that I had my own research and that was just fine with him. I didn't have to do a pet project for him. And so I decided to go to CU, even though I had to commute. But you know, I spent my time getting up at 5:30 in the morning and commuting to Boulder and getting back to work and writing notes in both directions about what I had to do in the other, going to school or working and editing volumes. But I guess I just wanted to pursue more geology and take some more classes to enhance my understanding of some topics that I was running into in my project that I'd like to know more about. More geochemistry, I took some more geochemistry, and more advanced classes. You know, concepts always evolve. So I was able to just learn more. I always like to learn. And so I was learning as I did my research. But it was good to get some other more advanced courses under my belt, too.

38:47

Santucci: And so did this evolve into your dissertation project?

Turner: Yes. Yes, it did. I ended up having multiple projects (laughs) in the Morrison Formation. Because it, too, like the Toroweap, is amazingly heterogeneous. Which makes it to me one of the more interesting formations on the Colorado Plateau. And so I was studying fluvial deposits and reinterpreting them. I stumbled upon the alkaline saline lake deposits, and that was a study in itself. And I was relating them to the uranium mineralization, and that was another whole project. And then there was a clay story, osogenic clay story in the Morrison. I worked on that on special grant, internal grant, USGS, with Neil Fishman. And I worked with Neil Fishman quite a bit on the petrography. He did the petrography.

And so through the years, the project kept expanding, because there was so much more to know. (laughs) One thing led to another. So yes, that did become my PhD dissertation. But before I worked for the Park Service, it was more about my uranium research and the sedimentology I had done up until that point in mostly New Mexico at that point. But the alkaline saline lake took me all the way up to Grand Junction. So I had actually worked in Morrison from Gallup, New Mexico up to Grand Junction at that point.

Santucci: Very good. And who did you work with in Colorado as your academic advisors and committees?

Turner: Okay. At University of Colorado, Ted Walker was my advisor. And my committee included Mary Kraus and Bill Atkinson. He was in ore deposits. And since I was working on uranium, he was an ore deposit geologist. And Mary was a sedimentologist. And Ted was a petrographer. So yeah, that was my committee.

41:13

Santucci: And what year did you defend your dissertation?

Turner: I defended in 1987. I was going part time. So I started taking some classes in '81. But basically because I'd been out of school for a while, I actually put myself back—being a glutton for punishment, I put myself back in night school at first downtown Denver to retake calculus and chemistry so I could have a better time when I actually took geochemistry up at CU. So I was actually going part time for about six years. So I can't remember when I started at CU. I guess it was about the same time. So I'd take a class or two at a time, a semester, and sometimes night school. I can't believe it now. I'm such a slug. (laughter)

Santucci: And so after you defended, did you have a game plan in terms of both your profession with the USGS and your interests as a scientist? And did they overlap or were they separate?

Turner: No, they overlapped quite a bit. And you always had to seek funding for your projects. But the Morrison had so much in it that, for example, the clay project had turned out to be a really interesting, had a lot of potential. And it was all because the clays that I was analyzing along with the alkaline saline lake samples, the authigenic clays, were showing patterns in and of themselves that were quite astonishing. And also, there's so much in the Morrison, it's almost hard to know where to start. So the clays, just for an example, we were able to demonstrate—I worked with Neil Fishman on those clays—we were able to demonstrate that the authigenic clays changed composition without any burial at all. I mean, same kind of burial. I shouldn't say no burial. But with the similar burial conditions, the clays changed from authigenic smectite, where they're mixed layer clays with mostly smectitic layers, expandable layers, to, towards the center of the wetland basin, to 90 to 100% non-expandable layers, meaning it was illitic. And so we were actually able to document that illite did not have to form at 90 degrees Celsius the way it was used, it was being used, illite was being used as a geo-thermometer by the oil business to tell how deeply rocks were buried. And we were finding authigenic illite at basically near surface burial conditions because of the extreme poor water chemistry of the alkaline saline lake. It was a very extreme system. And so we were finding (laughs) very unusual mineralogic assemblages.

Another thing we found was authigenic albite, which again you would think only occurred high temperature in igneous rocks. And we were finding authigenic albite even occurring in the sandstone underneath an albitic tuff bed. The albite was, there were twin lathes growing in pore spaces of the sandstone right beneath the tuff beds, where they had room to grow.

So fortunately, we applied for a Gilbert Fellowship inside the USGS, where you had to have an original idea that had some applications. And so that's where we spent one whole year

just studying the clays in the Morrison Formation. As a spinoff from the alkaline saline lakes studies. And so it was one of those things where one thing led to another, and there was always some pot of money that we could apply to to pursue these interests. So, yeah, that's sort of how we were going up until the Park Service project came along. Just continuing on working in the Morrison as much as I could.

Santucci: So, up till the point where you completed your dissertation, and this could either be your work with USGS or any other scenario, outside of Grand Canyon National Park, did you have the opportunity to do any fieldwork in any other national park area?

46:18

Turner: Oh, while I was doing my dissertation?

Santucci: Any time before your dissertation was completed.

Turner: Oh, I'm sorry. Anytime, yeah. I'd worked in Colorado National Monument. I'm trying to think of where I've been. Hovenweep area. There were deposits there that I was studying. Let's see. Let me think. I'm trying to think of all the different Park Service units, and which ones I might have gone into and studied before the Park Service project. Let's see. I hadn't actually gone into Arches yet. I had studied deposits outside of Arches. But not actually in Arches yet, I don't believe. The most I would say Colorado National Monument, Hovenweep. Definitely those at that time, because I'd gotten up to Grand Junction in my studies from Gallup. Because I believe those are the parks that, Park Service units I was involved in, studied in, worked in.

Santucci: Okay. And so after you completed your PhD and you were back working fulltime at the USGS, what branch were you in at that time? Were you still in the sedimentary processes?

Turner: Yes. Uh huh. Yes. It was still called Branch of Sedimentary Processes.

Santucci: And did that branch change or evolve over time?

Turner: Let's see. Well, the big change was when they changed from uranium and put together people who had worked in sedimentary rock for a variety of reasons, whether it was uranium deposits or phosphate. You know, different things like that. So the sedimentary deposits and the application of sedimentology to them. So it evolved bigtime. And then it sort of stayed, you know, people branched out from there in different projects. But the goal of the branch stayed about the same. How sedimentary processes could enlighten us in any number of ways. So we could apply them to different types of inquiries.

Santucci: So did that branch change name or did you change positions all the way up through your retirement? Were you in another branch at any point?

Turner: Oh, no. No. Well, yes. I mean, I did some, at one point I became branch chief of that branch. For a couple of years. And I just kept my research going part time. And then I also did some stints, managerial stints, when I was requested—you know, in those days it's important to remember that (laughs) if you wanted to go into management in USGS, you probably didn't. They mostly wanted people who didn't want to go into management that they thought ought to

go into management. (laughs) We had a rotational system. And the idea was, that was a longstanding tradition in the USGS that they would look around and see geologists that they thought wanted to have, take a turn in the barrel, as they called it, and become a branch chief, say. And then they'd lobby you and guilt you into it even though you were perfectly happy doing your research. (laughs)

And so they first asked me to be branch chief of the coal branch and I said no. And then they asked me to be branch chief of the oil and gas branch, and I said no. I was still really, you know, doing some really heavy-duty research and really wasn't ready for management yet. And again, they guilted you into it, but they didn't force you. And then when they asked me to become branch chief of sedimentary processes, there's a long story there of how I ended up saying yes, essentially. (laughs) So I was branch chief of the branch I had been in. And then as I rotated out of that and went back to my research, I did a couple of stints back in Reston, the most significant one of which was oh, '96-'97, I did a stint in Reston as eastern regional geologist. And you know, they wanted me to apply for the job permanently. But I said I would do it until they found, they actually advertised it and stuff. And I actually let some other people do it. Because after six months I really needed to come home. And they were okay about that. But I was the eastern regional geologist for quite a while. And that was very rewarding. You know, I felt as though we accomplished an enormous amount in that time. But I really wanted to come back west and continue my research. And so I did.

During that time, I was up and down the eastern seaboard visiting with Saint Petersburg and Woods Hole. You know, saw a lot of the geology out east and what the geologists were doing up and down the eastern seaboard. So it was a very interesting time and I enjoyed it for the time I was there. But I needed to come home after that.

Santucci: Okay. (laughter) So I wanted to check with you. We've been chatting for almost an hour. And I know that you may have some other obligations. Are you okay to go on at this point a little longer? Or would you like to maybe reschedule for another time to continue the interview?

52:57

Turner: I'd actually like to reschedule. Only because I have to take my cat to the vet and that was already scheduled. And it takes a while to casually get him into the carrier without him knowing. (laughter) If I could guarantee he'd go in, I could talk for another fifteen minutes. But I can't guarantee that.

Santucci: Sure. Well thus far, this has exceeded my expectations and I'm very excited to hear some of the things you've shared. We do have some additional things we wanted to talk to you about in part, specifically the Morrison extinct ecosystem project. And we also wanted to talk about your significant other at the end and let us hear from you in your own words all the magical things about your relationship and working partnership with Pete.

Turner: Oh, absolutely. I'd be delighted to talk about both of those subjects. So yeah, that would be great. Yeah. And I hope you're not having to indulge me too much. Because I think most

geologists have a random sort of walk. And it's fun how things work out. And geologists are such fun people that we just, we're fortunate. (laughs) We just are lucky. I'd be happy to.

Santucci: Absolutely.

Connors: This has been a treat.

Santucci: This has been one of the better interviews. You are treading on the human side through a lot of your discussions and examples that you've presented that really make it a valuable interview. So thank you so much.

Turner: Oh, well you're most welcome, Vince. It's a joy talking with you again after all these many years. It's just a treat even though it's just over the phone. I feel like it's old home week again. No, I'm delighted. And we'll just set up another time. You let me know what seems to work and I'll put it on my calendar and be there for you.

Santucci: Perfect. Thank you so much. And thank you, Tim. Good luck with your cat, too.

Turner: Thank you so much. He's really fine but he doesn't want to go. (laughs)

Connors: Yeah. Good luck.

Turner: So thank you. It's a joy talking to you Vince. And Tim, I hope you found it not too boring.

Connors: I loved every minute of it.

Santucci: Thank you.

Turner: (laughs) Well you know, people are so much, geologists are such great people that they do factor into every story. They really do. So I'm having fun. I hope you guys are, too.

Santucci: Absolutely.

Turner: I'll be here for you whenever you—

Connors: I'll look forward to the next time.

Turner: Okay. Well, good, you guys.

Santucci: Thanks again. Have a nice weekend.

Turner: You bet.

Santucci: Bye-bye.

Turner: Thank you. You as well. Bye-bye. Bye, guys.

Santucci: Bye.

Connors: Take care.

55:54

[END OF SESSION 1]

[BEGINNING OF SESSION 2]

00:00

Turner: —speakerphone, so if it doesn't work, let me know.

Santucci: Great. Well, we're all ready. So today is Friday, May 29, 2020. My name is Vincent Santucci. I'm the senior paleontologist for the National Park Service Paleontology Program. We are speaking again with Christine Turner, retired US Geological Survey geologist. This is our second interview. The first interview was completed on Friday, May 15, 2020. The interview is being conducted by telephone from Christine's home in Colorado. And I am at my home in Gettysburg, Pennsylvania. And we're also joined by National Park Service geologist Tim Connors, who's also on the phone from his home in Colorado. So, are we ready?

Turner: Yes.

Santucci: Okay. Thank you, Christine.

Connors: Ready.

Santucci: Thanks, Tim. So, first question is, we wanted to talk a little bit about your significant other, Pete Peterson. And so to start with, as best as you can share, can you tell us when and where he was born and a little bit about his growing up? High school up to college?

Turner: Sure. Uh huh. Yes. Pete was born in Saint John's, Michigan. And interestingly enough, his name at birth was Frederick John Gwozdjak. I'll probably have to spell that for you. G-W-O-Z-D-J-A-K. And his parents were Gwozdjaks. Or his parents were sort of Czechoslovakian. And for Pete, life didn't get such a good start. He had a great start in the beginning. But his father was killed in a trolley car accident in Chicago. They moved to Chicago and his father died in a trolley car accident when Pete was one year old. And his mother took Pete's older sister and himself back to Michigan to live on a farm. It was idyllic until his mom literally stepped on a rusty nail before they had – I think it's sulfa drug to cure tetanus. And so unfortunately, she also passed away. And an aunt, who was actually a half-sister, and her husband, the Petersons, adopted little Fred and Wilma. And they adopted him and he later on took the name Peterson. So he became Fred Peterson but was born Frederick Gwozdjak.

So then he grew up on the outskirts of Chicago. Sort of, I think it's called Des Plaines area. And it was pretty far out in those days. Of course now it's all one big sprawling suburb. But he was on the edge of kind of a field area. It was pretty wide open. And that's where he spent a lot of time as a boy, out in the fields playing around and stuff. And he went to elementary school

somewhere in that area, I can't tell you where. But I know he did go to Lane Tech in Chicago for high school. Technical school. And he really didn't know, he didn't have sort of the, it was during the Depression. So they shared a garden with the neighbor on the other side of a vacant lot. So his thought was the most important thing was to get a job. And so he went to technical school and studied technical things, such as printing and a variety of things. And for a while, he moved in with an aunt downtown so he could go right to school on his bicycle. And for those people who know him, he always had a red bandana in his back pocket. His whole life. And so when people saw him from behind, they'd see this red bandana and say, "Oh, that must be Pete." Well he developed that habit while he was riding his bicycle to school in Chicago as sort of a safety precaution. If people saw the red, they might see him. So it was a lifelong habit after that.

Anyway, he, one of the big, significant points in his life was when he and a couple of high school friends, he was the young kid. And the older kid actually could drive. And there were three of them. And they got in a car and drove out west. Here's this Chicago kid with his two buddies. And they didn't have anything. They'd just, he said they'd pull over and sleep on the side of the road. And they went to all these national parks and monuments. And they got to Rocky Mountain National Park, which is probably the first one they went to, I can't get the exact order, but I think that was the first park they went to. And as they were standing on a viewpoint, one of his buddies said, "Oh, wouldn't it be fun to be a geologist? Then you'd really know what you were seeing here."

And Pete made up his mind right then and there that he wanted to be a geologist. And you know, being a poor kid from Chicago it was more of a pipe dream at that point. But it was something that really intrigued him.

So he graduated from school and was sort of knocking about, doing odd jobs. He worked in meatpacking plants in Wyoming and all over the place. But mostly he ended up back in Chicago. And one of these two buddies that he had from high school was out in San Diego and said, "Pete, you need to come out here. It's warm. It's nice. There's lots of jobs. You just ought to come out here." So Pete thought what the heck, you know? Warm weather sounds better than Chicago. So he went out to San Diego and started working out there. You know, odd jobs. Truck driving. Hauling cement in a cement truck. (laughs)

But then the draft came along for the Korean War. Fortunately for him—he was drafted, went in the army, went through basic training. And when he was through basic training, they sent him to France. Because the Korean War was winding down. It was very, very late stage of the Korean War. So they sent him to France to drive trucks. And he actually was making, he had a route between Paris and Germany. And the idea was to keep the road open from the Russians now. So it was sort of a Cold War exercise to keep the routes open just in case Russia got ambitious.

So he spent two years in France driving trucks. And the good thing about being in the army, even though he hated it—(laughs) He just hated it. But he didn't mind driving around France. He just wasn't cut out for military. But when he came home to San Diego—and again, these are all sort of miscellaneous turns in his life—he qualified for the GI Bill. And he thought, you know what? I can now become a geologist. At least I can study geology.

So he enrolled in junior college for a while and took a bunch of classes to kind of qualify for geology program, and then switched to San Diego State. And of course they've always had an excellent geology program. And he still kept working because he didn't have any money. But he had the GI Bill and lived in a couple of boarding houses where, you know, they prepared meals for them. And just a bunch of students living in a boarding house. He studied pretty much all the time. And loved it. Absolutely loved it. And he thought he was going to have to quit his job. And the guy liked him so much, he said, "Well, you go to school during the weekdays," because Pete didn't want to go at night. He did his other courses at night. But the guy said, "Well, you can just work here on nights and weekends when you can and make a little extra money."

So he got the GI Bill to go through undergraduate school. And then ironically, because he ended up, or fortuitously, I should say, because he ended up in California on a whim with his buddy saying come on out to San Diego, California had its own GI Bill, the state of California. So he got additional funding and went to graduate school. And he started out at Oregon State. And a professor there had a project for him. The professor told him what the answer was going to be. (laughter) And he said, "Well, what if that isn't the—" (laughs) Yeah. And Pete said, "Well, what if that's not my finding?"

And he said, "Don't worry. That's what you'll find." And so Pete decided no. He was the sweetest man in the world but he had a very strong independent streak, which was why the army was not a good place for that man.

So he transferred to Stanford. And this is a precursor to that. When he was going to San Diego State, he would go out in the field every weekend. He'd go out in the desert and just study things that were there. They weren't necessarily projects. He would just study everything he could. And he went to school, he was there at the same time as Jack Holden. I don't know if you know that name or remember that name. But there was a plate tectonic article that came out by Dietz and Holden. And Holden was the co-author with Dietz back in the day. One of the seminal papers. Not *the* seminal, but many of the seminal papers that came out in the early stages of plate tectonic articles that were embracing the concept and documenting it.

Well anyway, they were buddies. And I've talked to Jack several times since Pete has passed away. And Jack said they'd go out in the field together. And he said, "If I didn't go, Pete would go by himself." And he said, "We just had a ball. Just studying geology all the time."

So when he went on to Stanford, Bill Dickinson became his advisor. He had another advisor before that, but I think he retired. And then Bill Dickinson became his advisor. Oh, I'm sorry. I'm a little bit out of order here. Before he went on to Stanford, well actually when he first got to Stanford, his—I'm sorry, let me back up. I want to get it in the right order. While he was still at San Diego State as a junior, his advisor, Baylor Brooks, whom Pete absolutely adored. And Baylor Brooks was the consummate professor. Taking great interest in his students, encouraging them. And he saw the potential Pete had.

So he said to Pete junior year, "Why don't you take the USGS written exam?" Because in those days, they wouldn't make you now, but in those days, you had to take a written exam. And based on your grade, you either qualified to apply or you didn't. So Pete thought well, I'm only a

junior, so I'm probably not going to do very well. But you know, what the heck? If Baylor thinks I should, then I'm going to do it. So that's why I tell young people just say yes sometimes. Don't be afraid of failure. What's the worst that can happen?

So he took the exam. And he did well—surprisingly well. And then because he had the veteran's status as well, he got an extra, I think it's five points. I don't know if it's five or ten points. Anyway, it placed him highly enough that USGS called him to work for them as a physical science technician. You know, a field assistant sort of thing. So he worked in the summer out of the Farmington office. And then he was out in the field with the more senior geologists, just helping out. And the boss from Conservation Division, he was working for Conservation Division at the time as a field assistant. The boss came out and took a field trip with Pete's field boss. And noticed Pete's aptitude, curiosity, and his hardworking nature. And he said, "Well, if you're going to do a thesis, why don't you do something for the USGS? And we can pay you."

And Pete said, "Well, I have to go to school during the year."

And he said, "Oh, you go to school during the year and you work for us during the summers."

So by the time he had a thesis when he went to Stanford, and he worked on the Kaiparowits Plateau, which of course then was not part of the Park Service. It was not part of anything. So that's how he got started on the Colorado Plateau. He started in the Cretaceous of the Kaiparowits Plateau, rather. And he was studying coal. And he discovered pretty quickly that the coal lined up with structural features. That the structure had controlled the sedimentation. And so the beaches and the coal deposits all lined up along a major structure out there. And so that was his PhD dissertation. He did a regional project on the coal. And you know, he was out there a lot of times by himself. You know, hiking into very, very remote areas in the Kaiparowits. And sometimes taking a horse.

And so anyway, so he finished up at Stanford. And had a lot of his education paid for. I don't know if it exactly lasted through the very end. But he was pretty frugal and lived in these boarding houses. And before Pete couldn't travel anymore, one of the last trips I took him on was he wanted to go to San Diego again. And I took him out there. And we saw his two old boardinghouses. And believe it or not, they're still there. (laughter) And he pointed out the rooms he stayed in. It's hard to believe, isn't it? The area's pretty gentrified and it's got a lot of coffee shops and California style bistros and things. But his old boardinghouses were still there, and he really enjoyed that.

Now his half-brother whom his adoptive parents had later on in life told me—and I have not seen this yet—but his, what do you call, his brother Wayne, told me that he's been to San Diego State and there's a plaque there with Pete's name on it as best student whatever the date was. And I didn't even know it was there. But it's sort of typical of Pete not to brag about it. So he never even told me.

16:15

Santucci: Wow.

Turner: But he was so—yeah, yeah. And he was so into geology. He was just, his dream come true and he just couldn't believe his good fortune. He looked it as just enormous, good fortune. And doesn't really see his own role in sort of taking opportunities that were presented to him to follow his dream. So he was forever grateful for those opportunities, this poor kid from Chicago who wished he could be a geologist. And the GI Bill just changed his life. Which is why in his obituary, I always mention the GI Bill because he was so, so grateful for it.

So then he was working Conservation Division in Farmington. And then got moved to Denver. And then the same guy who hired me, believe it or not, knew Pete from the student work he was doing. Oh, one thing you have to know about Pete is that he always did his work, and he studied everything he was supposed to study. And then in his spare time, he'd study the Jurassic. (laughter) Like weekends. You know, it was like oh, okay, I have a day here, I think I'll go look at the Jurassic. (laughter) Isn't that funny? I mean, God, he was just unstoppable. So while he was working on the Cretaceous and doing all these things he was supposed to do, he studied the Jurassic while he was out there. And became quite the Jurassic expert. And the guy who hired me from Northern Arizona University had met Pete on a field trip and realized that Pete was sort of overturning a lot of paradigms in the Jurassic. And there was this sort of standard story that had been developed that everybody was embracing. And Pete said no, no, nope, nope. There are unconformities that cut that all out. None of that's here.

And so my boss noticed Pete and thought, "I need this guy in the Geologic Division". So he actually brought Pete over to Geologic Division about the same time that he hired me from NAU. So we ended up in the same section at that time in Uranium and Thorium Branch. And Pete continued working on the – that's when Pete was working on the Morrison, because we hired him [for thorium?]. So Pete was working on the Morrison in southeastern Utah in the Henry Mountains area. Well, actually the Henry Mountains area is where he started. And immediately recognized what was going on there. Because again, people were studying either the chemistry in the mine, doing detailed studies on the ore, or were mapping. But nobody was doing sedimentologic studies to see that the minute you go into a mine area, it's completely different from anything anywhere else. And it just, it's quite obvious once you see it. But it's not obvious if you don't do the regional studies and go in close and back out, and go in close and back out and say oh my gosh, this is very different. So anyway, that's how he got into the Morrison Formation in Uranium and Thorium Branch.

So again, the branch changed names numerous times. And also at various times he was always asked to continue his studies. And so he did. He mostly concentrated on the Salt Wash Member of the Morrison. And the Tidwell. He actually named the Tidwell Member that people were mistaking it for Summerville. And he documented that. Actually there's a red mudstone on the – red mudstone contact but that part of those red mudstones belong to the Morrison Formation. There's an unconformity underneath those. And now that's been adopted, and he named that the Tidwell Member. So he worked on the basal contact up through the Salt Wash dominantly. And when I came along, I dominantly worked on the west border and the Brushy Basin Members.

And so, anyway, so that's how he got into Morrison. And then mostly stayed working in various parts all over, extending the study far and wide. Doing sedimentologic studies. Depositional history. Tying the tectonics, you know, working with people to determine not only

provenance, but more tectonic history out in Nevada, California, which he also was familiar with. But always evolving, it's evolving to this day, what the tectonics in the late Jurassic were. But tying it all together regionally with tectonics and sedimentation and the control of continuing his efforts to document the structural control and sedimentation. And one paper that gets quoted quite frequently is one he calls "The Quivering Craton," where the minor structures in the, I mean, major structures in the past that were reactivated through time control sedimentation throughout the record. So he got near that a lot. And he was asked to write papers both on, summary papers and stratigraphic [unclear] 21:40 papers on both the Cretaceous in major volumes and the Jurassic. Because he and Ron Blakey, Ron Blakey was at NAU, retired now. But they were the two acknowledged experts on Colorado Plateau stratigraphy. With Ron it was more Triassic/Jurassic. With Pete, it was Jurassic/Cretaceous. And when they compared their work, they realized that they had the same sort of modern concepts applied to stratigraphy. They were basically employing more modern concepts rather than just sort of dating a bunch of measured sections and stringing them together. And really, the unconformities came back into favor because of sequence stratigraphy, when they started seeing these major surfaces going through, on the seismic lines. And they said, "Oh, you know", and it just went right back to Sloss. I mean, Sloss was talking about the Sauk and Tippecanoe and all those major, what we'd now call sequence boundaries, way back when. And then it kind of got forgotten with the explosion, a legitimate explosion in sedimentology with all the knowledge about carbonates and plastics. You know, the '60s and '70s just resulted in an explosion of knowledge. And so people got very focused on the details. Kind of lost sight of the unconformities. Well, Pete was sort of still working in unconformities and sedimentology. So he and Ron Blakey really were compatible in their ideas. And sometimes worked on the same rocks and then discovered they were kind of saying the same thing. So they were happy about that. So they were good colleagues and friends. And Ron Blakey was not at NAU when I was there. He was there afterwards, but we all became great friends.

Anyway, so Pete continued his studies. And then of course, I don't know if I told you how he ended up getting the Park Service, the first Park Service study. Because again, we were working in uranium but we were doing all these sedimentologic studies. So Dave Gillette, you probably know Dave Gillette. He's in Flagstaff now, but he works for the Museum of Northern Arizona. Well, Dave was working on the seismosaurus site in New Mexico near San Ysidro, northwest of Albuquerque. And the site was in the sandstone in the Brushy Basin Member. Dave Gillette had a meeting where he called everyone together to give talks on the Morrison Formation. So he invited Pete and myself to give talks. And Pete talked about the Tidwell and Salt Wash and I talked about the west [form?] of the Brushy, focusing on the Brushy because that was where the seismosaurus site was.

And do you want me to continue with this story? Because it's going to lead into the ecosystem story. So I can lead into that separately.

24:59

Santucci: Yeah. That might be a good idea to include it with the Morrison extinct ecosystem conversation. So this was excellent.

Turner: Sure.

Santucci: So did you have to stay up all night reviewing all this so that it came off so fluidly? (Turner laughs) That was great!

Turner: Well you know, I always admired his career and the opportunities he took. He just never, he was always so humble. Because he realized that things happened for him that he was so grateful for. And he didn't ever realize how—like Baylor Brooks took him under his wing in San Diego because he saw his potential. And just as a side note, if you don't mind me throwing this in—

Santucci: Sure.

Turner: Baylor Brooks kind of treated him like a son. And Baylor Brooks had a lot of beautiful, really beautiful Southwestern artwork by pretty famous artists. Oil colors, watercolors, that sort of thing. So he, as he got older, he would tell Pete, "Which one of these paintings do you want?"

And Pete said, "No, no, no, no."

He said, "Well, I'm going to give you this one, then." And then he would go to a gallery and pick out a couple of paintings. And then tell Pete to go to that gallery and pick out the one he wanted. So he really got Pete started in Southwestern artwork. And we have some of those paintings to this day. And they are in the living room. And I hope someday that when Covid's over I'll have a chance to have you guys over and show you these beautiful paintings that Baylor got him started on. And then Pete became quite the collector of Navajo rugs and beautiful, beautiful paintings. And when I recently was talking to people—not that recently. Six months ago I was talking to Denver Museum folks who, odd coincidence, at a luncheon with a friend of mine who's in town and her girlfriend was in the, works at the museum. And she said they're trying to build their twentieth century artwork, because they have a lot of the older ones.

And so I said, "My husband has these."

She said, "Well, name some of the artists." And so I told her and her eyes widened. And she said, "Yeah, we'll definitely take them." She said, "That would jumpstart our collection."

I said, "I would want it dedicated to Pete."

And they said, "Oh, no problem."

So when things get a little better here, I wanted a permanent home for Pete's artwork. Because it's not the kind of stuff you want to sell. You know what I mean? It's the kind of stuff that ought to be in the public sphere. It's just too classic.

So, anyway, but Baylor Brooks, Pete created his own good luck is what I'm trying to say. He was so dedicated, so honest, had such integrity. So nice and so smart. That, you know, so anyway, that's probably enough. I could go on. (laughs)

Santucci: Thank you very much.

Connors: Pete was definitely one of the most humble characters I've ever come across.

Santucci: Yeah. Yeah. I was thinking humble, too.

28:15

Connors: I loved being in the field with him and just sucking up the knowledge that he had. (laughs)

Turner: Oh, I know. People used to envy me that I'd even drive from Denver to the Colorado Plateau with him. And he'd just, [unclear] "Okay, now over here—" (laughs) So, yeah, yeah. Well, I'm so glad you had the opportunity to spend some time with him, because you know what I'm talking about.

Santucci: Absolutely.

Connors: Yeah.

Santucci: So I think what was nice about this is short of being able to Pete, I don't think we could have had a better description. So thank you for that.

Turner: He'd have been a lot more humble. So I get to brag on him. (laughter)

Santucci: I do have a couple of, just a couple of follow-up specific questions. Could you explain what the Conservation Division was for the US Geological Survey? What its mission was, or what you can tell us about it.

Turner: Yeah. Sure. They were mostly documenting coal reserves and coal resources. So they were more they, I'm going to use the word "operational." I mean, I don't know if that's the right word. But they were documenting coal reserves for the country. But also oil and gas reserves as well. So for example, he did a trip down to New Orleans and worked in oil and gas for a while, a detail, on a detail. So what they had to do was come up with estimates of coal resources. So Pete's work was to establish estimates. But the way he did it was to understand the geology so that, for example, in the Kaiparowits we showed that all the coal, through the time in the Cretaceous lines up with these major structures. It allowed him to project from the edge of the mesa inward and be able to come up with much more coal reserves than using the three drill holes they had a the time. (laughs) So a lot of the work was done on well logs and cores and things like that. But the Kaiparowits, it was an undeveloped coal field. Because it's so remote. And there was no transportation anywhere. So although it was a big coal field, US needed to understand our reserves and resources in case they ever needed them. So he used geology to evaluate, to make his estimates on coal reserves.

And so, Conservation Division was that part of an operation. And so some people just sort of looked at drill holes and well logs and things like that. And maybe some core. But Pete used the geology to come up with much better estimates. Especially when you don't have any core or any drill holes. Or a handful, maybe. So, yeah, it was more of a resource evaluation part of the survey. And they got ultimately absorbed and changed in USGS. Because those functions were taken over by the Geologic Division. And then they became, you know, the survey evolved over time. But in those days, they were doing resource assessment is what I, that's in summary what they did.

Santucci: Okay. Thank you. And the other thing, you may have mentioned it, my apologies if I didn't catch it. But Pete's date of birth and his date of passing?

32:05

Turner: Oh, yeah, sure. He was born June 29, 1933. And he passed away March 15, 2019.

Santucci: Thank you. So, you inspired lots of good thoughts when we were listening to you. And of course I'm sure Tim was smiling during some of it, as I was. Capturing these kind of things are just incredible.

Connors: I was.

Santucci: Really appreciate that. The one thing that you mentioned that made me think, when you were talking about Pete's visit to Rocky Mountain National Park and how it may have inspired him to think more about a career in geology, I wonder how often that occurs that a young person visits a national park and it sparks something in them to want to become a park ranger or a geologist or an archeologist or a wildlife biologist or something else. We should do a query within our small community of Park Service geologists, Tim, and ask them, you know, their first experience in a park and how it may have influenced their career.

Connors: Mm hmm. I would be on that list of affirmatives.

Turner: There you go. There you go. And you know what? Quick, quick story. You don't want this detail, necessarily. But my brother's stepdaughter was growing up in Florida, no place for the kid to live, grow up, I think. So she was sort of at loose ends after college and was sort of living with her mom and working for her mom. (laughs) So she, so my brother and her mom took her on a trip out to California to see the various parks. And she'd never been west of Florida, so they took her on this grand trip. Well—no, that's right, they'd taken her out here skiing with me out to Colorado, that's fair to say. So anyway, they took her to Yosemite first. And here she was, college graduated, never been out of Florida and she got to Yosemite. And they were going to work their way up the coast and go to these other parks. And she said, "No. I'm staying here." (laughs)

And they said, "Well, what are you going to do?"

She said, "I'm going to get a job here." (laughs) Well, she, I can't believe she did this, and I don't think they knew this. I guess she couldn't find any lodging and so she slung a hammock between two trees. And the next morning a ranger came by and said, "Oh, you know, you can't do this."

And she said, "Oh, I'm sorry. I couldn't find a place to stay so I just kind of stayed here."

And this young man who I guess, I don't know what he was doing over there. But he walked by and he goes, "Oh, please be easy on her. She just didn't have a place to stay."

Well, long story short, she got on with, is it Xanterra? Is that the concession there?

Santucci: Yeah.

35:30

Turner: With the Park Service. And so did her boyfriend. And they actually, of course, I don't know right now, but they worked several summers at Tuolumne Meadows. And of course it's not a career of course yet. But it turned her life around. Now she's a hiker, backpacker. Outdoors person. You know, the works. From going to Yosemite National Park. It changed her life. It's not a Park Service story. I apologize. But it's somebody who, just a regular person who is so overwhelmed by what the parks have to offer that it changed her life. So anyway, good story on that.

Connors: Good story.

Santucci: Yes, absolutely. Thank you. So are you ready to shift to the Morrison extinct ecosystem project?

Turner: Sure.

Santucci: So my question is that in as much detail as you can recall, that is including any who, what, where, when why, could you provide us information about that Morrison extinct ecosystem project? Background prior that may have led to the idea of this project? And that once the idea was formulated, how it was marketed and moved to the system? And who were the key players to get that moving? And once funding was achieved, then the details of how that was organized and who the key players were. And then finally what are the more significant findings of that? So, this could take us a couple of days. But does that sound like a reasonable approach to discussing this?

37:00

Turner: Sure. And I'll try to be, yeah, I'll try to be a little more concise and distilled, but still keep (Connors laughs) I know, I have one of those minds that goes off on tangents rather easily. (Santucci laughs)

Connors: You're fine.

Turner: I'm not sensitive. (laughs) Sure. As I was saying earlier, but I'll pick it up again anyway, just to kind of pick up the first stitch here. Pete had been working in the Morrison. I was working in the Morrison. And so Dave Gillette, still with the Museum of Northern Arizona, was working on the seismosaurus site in New Mexico. And so Dave would be listed as one of the paleontologists we worked with. I don't know if you know Dave Gillette.

Santucci: Oh, yes. Yes.

Turner: Yeah. You know Dave. Okay. So anyway, so he organized a meeting. And it was at Los Alamos. Because Los Alamos was using all kinds of fancy instruments that could be used to detect bones in the subsurface. Sort of any technique they had. Of course they were trying to find creative ways to use their equipment, and they had very fancy equipment. So he was at Los

Alamos. And so Dave knew us because we'd already interacted with him on the Morrison quite a bit because of his interest in dinosaurs and things. We'd been out in the field with him. So he knew we studied the Morrison. So he invited us to give talks. So he said, you know, "Pete, would you talk about the Salt Wash and Tidwell? And Christine, you talk about the west [unclear] of Brushy." I said sure. We said sure.

So we went down to Los Alamos. Gave our presentations. And we had a field trip. We all went out to the site near these tufts in the Brushy that were characteristic of this alkaline saline lake. [unclear] 39:00 And so anyway, that evening Dan Chure wanted to meet with Pete and myself. So after dinner, I think, he came back to our motel room. At the time I was writing five articles and editing a volume and stuff. So I was pretty tired. So I can't tell you about this discussion. But I can only tell you the result because I was sort of lying with my elbow on the bed and I guess I fell asleep. (laughter) I did fall asleep. I mean, I have to be honest about this. You know, it's like that's what actually happened.

So Pete and Dan continued discussing things. And Pete, as you know, was pretty reticent. So maybe he thought I heard or whatever. But a few months later, or somewhat thereafter, we got these forms in the mail for an RFP to work on the Morrison. And I opened it up and I looked at it and I was like oh my gosh, that's what Pete and I do. Whoa! Maybe we ought to apply for this.

And I went to Pete, and I said, "Pete, look at this! We could do this."

And he said, "Well, yeah, that's what Dan wanted us to do."

And I said, "When?"

He said, "When he talked to us."

I'm like, "Oh, is that what happened?" I said, "You never told me."

He said, "Oh, I guess I thought you knew." (laughs)

So, we applied. And so now that was the first, I don't know if you know this or not. I'll give you a history. There were two studies in the Morrison funded by the Park Service. The first one was to do regional studies, to do the framework studies. And I had moved up to Grand Junction with my work from Gallup, New Mexico. And Pete had worked up through about the same area. But he'd been on a field trip out to the Dinosaur and noticed that hmm, I recognize some of these units. So we had really been intensive on the Colorado Plateau. Particularly up to say Grand Junction as a demarcation. So Dan wanted us to continue our framework studies and do the entire Morrison, the entire depositional basin. Or at least the erosional remnants of the depositional basin.

And so our first order of business was to do the framework geology. So to do that, we actually, we had money for ourselves. We did not have much money at our disposal to, we had some extra money for field work and things. And so, I mean, we had plenty of money. I'm not saying we didn't have enough money. But it was unlike the ecosystem project, we had a little more money, which came later.

So anyway, when you mention the paleontologists, we had a German geologist, [Prochert?], and Michael Schudack. S-C-H-U-D-A-C-K. Michael Schudack. And he had approached us and wanted to work on the pterophytes and ostracods in the Morrison. And we said, "Oh, perfect. Yes. We'll collaborate with you. We will get samples and have you come over and get samples. But we'll tie them all into a mesh bag so everything we did, we either sampled it with the paleontologist or with the main educator. Whomever we worked with, we sampled right along with them or we went with them to make sure it all tied into a measure section. So Michael Schudack, a paleontologist working on the pterophytes and the ostracods. And oh, Emmett Evanoff was working on the mollusks. I'm sure you know Emmett.

Santucci: Yes.

43:05

Turner: Do you know Emmett?

Santucci: Yes. Uh huh.

Connors: Oh, yeah.

Turner: Emmett Evanoff. And he was working on the mollusks. And Bob Tschudy had worked with Pete and myself earlier when we had found these mudstones that were key to uranium mineralization. And Bob Tschudy with the USGS had looked at the pterophytes and ostracods and—no, I'm sorry, I'm sorry, he had looked at the spores and pollens. Of course, Bob Tschudy was spoors and pollen. So he was with USGS and was working into his nineties. And he was the world's expert on spoors and pollen. So he had helped us already determine the environment deposition and a little bit about the climate. Because he knew these so well. So he was very instrumental in documenting some of this. So then Rick Forester, also with USGS, was always working on ostracods and pterophytes as well. And he was not so much into taxonomy and determining age from these critters, but more interested in the geochemistry of the water that they lived in and thrived in.

So we had a bartering system set up where we'd get the sample. Mike Schudack needed the sample. But it would help him tremendously, since he was a professor and pretty busy, if we had the samples prepared here. So Rick Forester, USGS, offered his tech to prepare all the samples for Michael Schudack in the correct way. And then we bought him some kind of tube for his lab. So we sort of paid for something in his lab. And he had his assistant prepare the samples. And being Rick Forester, and the scientist that he was—I miss him dearly, he passed away, unfortunately—he always looked down a microscope after the samples were prepared and kind of had his own observations about what was going on in the Morrison, because he just couldn't help himself. It's like, "Oh, yeah, I see what's going on. Okay."

So later on, that factors back in, how much he'd actually looked at them. Of course he didn't publish anything. He was just curious. And then the samples were worked on by Michael Schudack.

So anyway, we also had Bart Kowallis and Eric Christiansen from Utah, BYU. And they did radiometric dating for us. So in the framework studies, we had quite a bit of help. We did the

stratigraphy and sedimentology and they did the paleontology and radiometric dating. And the radiometric dating is what Kowallis did. And Eric Christiansen did the petrography to work on the source of the volcanics and the type of the volcanics. We'd get the samples and they'd go into field with us again. All of our samples were tied to a measure sections. And with the Brushy, I already had all the samples, because I sampled every volcanic rock in the units. I had all these tuffs. So got to work on those. So again, we worked together. We'd get the samples, give them to Bart. Bart would date them for us. And so he and Eric got to write papers. So we were all working together to do the framework geology. And it was working on the mollusks from west to east and trace them across the Rockies. So anyway, we worked there with all the framework people. And we carried the studies from Grand Junction, let's say, as a demarcation point, north into Montana. We took our correlations all the way to Montana. So basically we covered the erosion limits of the depositional basin. And when you get to Montana, there are some [unclear] 47:07 that come in at the base. And then up in Canada, it becomes the typical foreland basin up there.

And Pete actually worked with the Canadian geologist, whose name I don't remember offhand. And he went up into Canada and did some work up there and tied it into the Canadian section. So we basically worked from the entire basin, west to east, north to south, and created the framework geology, who was correlated with whom, and all the correlations and all the age determinations, whether paleontologic and radiometric. So that was the framework project.

And when that came to an end, it was nearing its end, Bob Schuler, whom you may remember, I'm sure you do.

Santucci: Yes. Mm hmm.

48:00

Turner: Was working—yes, yeah, Tim, you would definitely know. Vince, did you know Bob Schuler, too?

Santucci: Yes, I knew Bob.

Turner: Oh, you did. Oh, that was your voice. Okay. So anyway, Dan talked to – Dan Chure talked to Bob and was telling him about this study. And Bob Schuler wanted some, you know, some really big studies that were really going to contribute to the understanding of the parks. So Bob sort of gathered up money and offered it to Dan to have a bigger project and to us. And we'd all work together. And at this point, we would do the extinct ecosystem. And that's what we proposed to do. If we could take the framework geology and now go back and study the, study everything we could get an expert on. So some people, we could pay some fieldwork. We had a postdoc. And so we had, boy, you talk about paleontology, we had Steve [Stephen] Hasiotis doing the trace fossils. And let's see. Again, I think we had Emmett helping us on that. And Michael Schudack and you know, we had samples, we just continued on with all the studies we'd already started. But now it was in terms of deposition. We were trying to establish the extinct ecosystem. We had Judy Parrish, who's a climate expert, who was also doing plant taphonomy. And we had the taxonomist as well, Sid Ash and Don Tidwell, who were more taxonomists. You know, in those days, taxonomy was important. We took them to all of our

good finds and they identified some gingkoes we had and helped with the paleontology as well. They had done quite a bit as well. So we had people look at paleosols, plant taphonomy.

And then, Rick Forester, it's interesting because he said, "You know, I looked at your samples that you sent to Michael Schudack. And I can tell you that in the front range, there are so may pteraphytes it tells me it's groundwater-fed."

And I said, "Well, halleluiah, because that's exactly what I think." It's a dry climate. But when you get far enough downstream, you actually intersect the regional groundwater table.

And he said, "You could not have this many pteraphytes throughout the section, and north and south, down in Garden Park."

You can literally walk up to this one unit and just pick them out, you know, just pick them out just sitting there, standing there. They're just all through it. And Michael Schudack had a section up near Fort Collins where every unit produced pteraphytes. Every single one of the limestone units. These would be in the limestone units, or in the mudstone right underneath them, which is where they tend to be preserved. So they're easier to work with, right underneath the limestone.

Anyway, so we were able to, so Pete and I looked at how all these experts that they were coming up with. Then we kept having meetings where we'd say, "Okay, based on what you know, and now what you've heard from your colleague, what does that make you think that you're going to do next in terms of understanding the ecosystem rather than here in your own individual study?" So we kept framing questions. Like, "What does your data tell us, and your observations and data tell us? How is it modified by what you hear from the other people? What questions do we have?"

And so we kept it going that way. And Pete and I were putting it all together in a coherent study that accommodated climate, plate tectonic positioning. Because Judy had done climate modeling where the continents were moving through the climatic zones. So we looked at that. And Rick Forester actually helped us with the dry interior. And so we all, you know, were constrained by everything that we were learning. And so that's how the interpretation of the Morrison went from in the past people thought it was these big herbivores.

And of course meanwhile, I'm sorry, meanwhile, we had Dan Chure looking at the dinosaurs. And then Tony Fiorillo was looking at the teeth of the various herbivores. So we were tying all this information together, resource partitioning. Which Tony Fiorillo showed, when he did striations on the teeth of like brachiosaurus, showing that that critter was eating coarser food stuff. And then the finer material that the other herbivores are eating, like Apatosaurus, diplodocus.

And so we had, and then we had a guy looking at isotopes. Both in the paleo soil, the carbonate nodules, and also in the teeth. So it was all kinds of stuff we were looking at to tie together. I can't remember, I won't tell you all the stuff. If I sit here long enough, I'll think of all these other things we did. But basically we were able with that project to not only work in the parks, but between and among the parks as well. So that we could tie the whole story together.

And then each park would benefit from the understanding not only in that park, but how it fit into the entire ecosystem picture.

And because I had been working with, on another project of the USGS with biologists, I should say, I actually was learning things like patchiness of the landscape. So the terminology they use, so was able to think in terms of geology, tectonics, sedimentology, climate, and groundwater all work together to create the landscape that's amenable to the plants that are in term amenable to the fauna. And so you know, just tying in the adaptations and looking at adaptations in the modern systems that morphology, basically we were saying that morphology does not determine the adaptation. So one of our points was you look at a frog today and you think, "Oh, it had to have a lot of water". And in the lake basin. Anybody who watches Nova programs see these frogs that burrow down and wait ten years for the next rain and then come up and reproduce by the millions and burrow back down again, and sit and wait for the next rainstorm.

And so subsequent to that, I actually went to Namibia a couple of years ago. Because I wanted to see lifeforms in an extreme environment. And fortunately, Namibians know their trace fossils, they know their animals and they know their adaptations. They know the elephants and how the forest ones versus the savannah ones versus the desert ones. And so, and the adaptations.

So, anyway, the goal was to tie everything we could know about landscape analysis together to reconstruct the ecosystem. And we worked in every park that had any Morrison at all. And worked with, talked to the interpretive people and the resource management folks. And told them what we were doing and worked with them. And we were able to get samples and measured sections. And then worked in between the parks to tie it all together. And had this whole team of people, which was the most incredible—even now I look back on it, it was the most incredible experience one could have. And have a team of experts who really were the best in their field pooling their knowledge and understanding and working together to put together the story.

So that's it in a nutshell. I can fill in anything you want. But I was trying to be a little expansive on parts of it, but basically we were able to cover the same territory we'd done the framework geology for. And since the framework geology was done—it took us three years to do the framework geology—it was great to then tie the ecosystem studies into that framework.

And then John Foster was a student at CU. And now he's out where, you know John Foster in Utah?

Santucci: Yes.

Connors: [unclear]

Turner: Right. And so he as a PhD dissertation took our framework studies, because we had come up with zones in terms of Michael Schudack's pterophytes and ostracod studies, and the radiometric dates. And we were able to define certain phases, or not phases. Because I don't want to use the word "zones" because that's paleontologic. Well, it is paleontologic, based on Michael Schudack's studies. And they coincided with the radiometric dates were telling us. So we had defined these zones paleontologically.

So, John Foster took those and looked at trying to distinguish between, what is it, differentiation, geographic differentiation versus vertical evolution. You know, evolution through time versus geographic differentiation. So he was able to use our data to do that. And so in other words, we tried to create a framework that people could come along and take our work and refine it with new information, new data, new understandings all through time. And at the same time, give an ecosystem approach. Which is more understandable to the average person. And to biologists who think so, you know, so dominant in the Park Service, thought maybe they could grasp that concept more easily than looking at rocks. Which of course led to a discussion that Vince and I had with the resource manager at the Grand Canyon. But that's another story we can get to if you want to. But that's basically the story of the extinct ecosystem project.

Santucci: Great. I have a couple of very specific questions. So, coordination of communication amongst the various investigators. Did you all speak on a conference call, or ever have the opportunity to sit down together as a team? Or was it the communication coordinated through a couple of key individuals?

59:45

Turner: Oh. Well actually, we would have a field trip together on the outcrop in the spring and the fall. And then we would meet during that field trip in a hotel room or out at the campground or whatever. And we'd have a, I'm trying to think if we did, how else we did this. Because I know we'd get together. Pete and I sort of coordinated all that. Sometimes we actually did meet physically. I'm trying to think if we did conference calls or not. I'm just not remembering particularly well. But I know we tried to meet as often as possible to get people thinking in terms of how their part of the study fit into the whole. Because each discipline has its own paradigm. And we were interested in seeing what really makes sense, given modern understanding in terms of accommodating what all the experts think. So Pete and I would coordinate that among all the researchers.

But also, by taking them to the field together, they'd all get excited. They were like a bunch of little kids. They'd run up on the outcrop and get very excited and talk to each other. "Look! Look! Look!" So it was fun just to have them out there together, and sampling sometimes together as well. So it was a combination of going out in the field together, roaming field trip, look at the outcrops together, and telling each other what we knew and what all the experts knew, and then some meetings. I don't know, I think we got together at various meetings and things, or anytime we had an opportunity to call everybody together. I just don't remember conference calls, but we may well have had them. I may be just not remembering them right now.

Santucci: And so, I'm not sure how much more time you have today. We've been speaking for a little over an hour. Do you have a little more time for some additional questions?

Turner: Yeah. Sure. Yeah.

Santucci: So if we looked at, just going through some of the parks, if there was any sort of wow discovery or something specific that the team was able to derive from the work in that particular

park, is that something that you feel that you have enough knowledge at the moment to comment on?

01:02:17

Turner: Oh, the team having a wow moment in a park. I'd have to think about that just a little bit because my mind is racing around to different parks and trying to visualize kind of an ah-ha moment.

Santucci: So if we started, if I just said Arches National Park, was there anything that stood out for Arches?

Turner: Oh. Let's see. Not for the whole team, I don't think, in Arches. I could think of an ah-ha moment, but it was more—I can tell you one very big ah-ha moment that was on a rainy day in Dinosaur. And I'll tell you the story and you decide if that qualifies. Because Judy Parrish is a climatologist, paleoclimatologist, I should rightly say. And modeler. And plant taphonomist. And sort of a, able it integrate things. Let's put it that way. So it was a rainy day. She and Pete and I were in Dinosaur. And we're sitting in the trailer that we had at the campground, Green River Campground.

And I said, "Judy, there's one conundrum I have." And I said, "You know, there are 240," and I'm not good with numbers, so bear with me on that, I think there's like 240ish megaflora identified. No, no, no—palynomorphs. Ron Litwin, let me just throw in Ron Litwin, because you know Ron Litwin.

Santucci: Yes.

Turner: He also worked on the palynomorphs. I'm sorry, I'm so glad you asked that question, because I forgot to mention Ron. He did an enormous amount of work on the palynomorphs, which was great. He was fantastic. So he contributed to that story as well.

So I said, "You know, there's something like 240 different types of palynomorphs and only a handful of megaflora that had been identified in the Morrison." And I said, "That confuses me because how come we have all these palynomorphs and yet only have a handful of megaflora?"

And she said, "Oh my gosh. Oh, gee! Oh, wow! Okay, great!" And like, what's going on? She goes, "No, no, no, this is important." She said that what happens, especially in sort of a resource-limited environment, or you know, more of a stressed environment is better to say, stress environment, is that there are opportunists that take over sort of the flood plain. And the megaflora need to be closer to the streams. Now that's whether they're perennial streams or intermittent streams. Because as you know, you need to fly over any place of [unclear], the trees at least and a lot of the shrubs and the understory will follow the stream channels, whether they're intermittent or perennial. Because their roots can go down to the water table. And even in Africa, that's one of the reasons I did a lot of traveling in Africa. Because you can see this happening in real time, where you have an intermittent stream, it can be a mile wide, and then there will be water holes wherever that intersects the water table. And that's where all the animals gather. And so they'll gather at an intermittent stream. And that stream can be dry for

decades. But there's still water there because you intersect the water table with a water hole. Versus perennial streams.

And so in the Morrison, just a short aside here, the dinosaur quarry sandstone we could document was a perennial stream, because [unclear] 1:06:22 was in it. And that was a paleontological contribution, a big one. And the bore holes in bones. Those contribute to our, the dermestid beetle bore holes, those really contributed strongly to our interpretation of the quarry sandstone. Plus the distribution of the bones in the cobbles and the everything.

So anyway, Judy and Pete and I were sitting and she said, "Well, this makes total sense." She said, "The megaflora will tend to congregate around streams, ponds, whatever. Intermittent streams. And then these more opportunistic, well-adaptive species, will cover the flood plain. And that's where you get kind of an abundance of palynomorphs, even though you don't have a lot of megaflora species."

And so that tied into, that was an ah-ha moment that happened on a rainy day and unfortunately not an outcrop. But we needed that time to ponder some of these imponderables. And I have a great crew that really helps. You know, we were sitting in Dinosaur. I don't know if that counts as being in the Park Service. But it was a major ah-ha moment.

And then with, and I'm sure there are others in specific parks, but I'd have to give that a little more thought.

1:07:48

Santucci: Just personally curious, I don't know if you recall. I think that there was a little bit of work done in Yellowstone National Park. There was a small exposure of Morrison in Yellowstone. Are you familiar with what may have been done at Yellowstone?

Turner: Yeah. We actually measured sections in Yellowstone. And like you said, there's not a lot there. But we actually visited the outcrops that are there.

Santucci: Oh, great.

Turner: We didn't do anything extensive. We just tied it into the regional study. You know, there wasn't much in the way of things we could sample for age determination, or palynology or paleontology or anything like that. But we did document the sedimentology and stratigraphy there.

Santucci: Great. And you actually were in the field in Yellowstone doing that?

Turner: Yes. Oh, yeah.

Santucci: Great. I'll probably have questions later for you outside of this interview regarding that. But you say you measured the sections in the park?

Turner: Yes. Mm hmm. And also, isn't there a slide area outside the park? Well anyway, we measured sections in the park and also in the area outside the park. But I know we measured

sections in the park. Yeah. And I'm scratching my head. It was a long time ago. I remember that it wasn't the most exciting section. And we had to piece it together. And I think we also took the team there to look as well. I'm not 100% sure about that. But I definitely know Pete and I measured a section there, at least.

Santucci: Okay. Great. That's good to know. So that brings up one of my most important questions. And it has to do with all the archives, records, field notes, any documents, photographs, etcetera, associated with the project. Did you maintain those? Did those go to the US Geological Survey archives? Did they go to the Park Service? Do you know where they wound up?

1:10:01

Turner: Well, good question. Unfortunately, a lot of the stuff was on Pete's computer. And they told me they backed it up. So about a year ago I went to get the archive. And they said well, something happened during the transition and they lost all of it. Which really upset me. Because we had a paper that I was going to finish on that computer. And I might have a hard copy somewhere that was like the very, very, very, very last review process from USGS. So, you know, because the last couple of years I haven't really done anything with the Morrison, I'd have to really go through with what I have with the archives. I know I was in there a couple of times making sure they didn't throw things away. And I moved them into a storage area over in Building 810. I brought some stuff home. So right now I'm going to say the best word is scattered.

Santucci: Okay.

Turner: Sad to say.

Santucci: So yeah, that will be another question that we might follow up with later. To make sure that somehow we get those archived permanently someplace. Or at least copies or scans or something.

Turner: Sure. Uh huh.

Santucci: So for example, when you were measuring sections in Yellowstone, I mean, you would have a field notebook.

Turner: Oh, yes. Definitely. Yeah.

Santucci: Do you still have that? Would you have something you could scan?

Turner: I have all my field notes. And I believe somewhere I have all of Pete's field notebooks. Again, I'd have to check with USGS and see what they have in the storage area. Because towards the end there, they were consolidating offices. Having us pack up in a day. Put stuff in storage. Take stuff to our new cubicle or bring it home. So we did it very, very rapidly, trying to make sure we didn't lose anything of value. But at the time, space was such an issue. And we were being just moved from one space to another as emeriti that literally some things had to happen very quickly. And so I know that we made every effort to keep them. I'd have to do a

little scavenging to make sure I can find all those. But yeah, we had field notes and we never, ever dispensed of any field notes, that's for sure. And I did not have them archived at the time, because I had, I sort of noticed that we were moving from a paper age to a digital age. Which is fine. I think it's great. But I've heard that they are not sure what to keep anymore. And storage becomes a bigger and bigger issue. I'm concerned about how much they're keeping in the archive. I'm just a little concerned about that. But the storage area, they promised me they wouldn't throw anything away without contacting me, and I just hope they mean that. I've been in there a couple of times, but it would take a lot more work to really go through everything that's in the storage area in Building 810.

I have all the Brushy samples. And at one point I went in there to retrieve Pete's samples and I kept anything from the Morrison. And so, you know, and I labeled them "keep these" so they're still in the core research center. The storage facility there. Because I was in there within the last two years, probably the last year. And I said, "Keep these." And I labeled the boxes "keep these." And then you could dispense with some miscellaneous samples. But I made sure the Morrison ones, I always preserved the Morrison ones.

I also had Neil Fishman's Morrison samples. And he's back now. So I have all his samples. I did not let anything from Morrison leave. But the paper copies are probably a little more scattered. And that would take some effort to put together. But I would never deliberately dispose of any of that. And I'm hoping to find that article that had been literally through, almost a director's approval. And the sad hang-up was that when we had a photo from Wikipedia, they were getting so worried about attribution that they kept saying, "You need the original source."

We kept saying, "Wikipedia's open source." And it was literally that hang-up. And then Pete got too unwell to finish up on it. It was on his computer. And one thing and another. And they told me they had preserved all of it. And then about a year ago when I asked for it, they said, "Whoops. I guess something happened and we don't have any of it."

So that's why I'm a little concerned about the way the USGS is going now that—it's not the same. Things are not the same. And I'm concerned about that sort of thing. So I can definitely follow up on that.

Santucci: Sure.

Turner: And it's going to take some work.

1:15:33

Santucci: Absolutely. So let me offer this. If you were willing to do it, Tim and myself would be happy to help you go through that. And if you would allow us to scan it, we would work to get it officially archived as part of a National Park Service archive for the Morrison ecosystem project. You would retain any originals. But if we could scan it at least, that way we'll be able to preserve all of that important data.

Turner: I would be thrilled. Yes. I would be thrilled. Yes. Sure. So I'll have to set about, I know I have stuff at home. And that's going to be a little easier. And I'll start on that. But I also will alert USGS that I want to get back in that storage area. And when I locate stuff, it will probably

be easier for me to locate before you start worrying about scanning it. But I can locate a good chunk of it. Maybe we could do it part at a time. But yes. The answer is absolutely yes. It would thrill me to have it archived in a way that was accessible to others in the future. That's my goal. I want any of it to be used for future studies, for reinterpretation. You know, new techniques come out all the time. So yeah, mm hmm.

Santucci: So you're aware—and you're probably not surprised about this—the Morrison extinct ecosystem project is singularly the most important and most highly-funded project involving paleontology in the history of the National Park Service. So we have a real interest in preserving that, something that we'll probably never, ever get funding to do again, something of that magnitude. So it's a very important, very important story.

1:17:41

Turner: It's sad to know that, in a way. I'm thrilled that we were able to do it. And I know exactly what you're saying. The chances of that happening again are so miniscule that yeah, I feel very good about preserving it because it was an incredible opportunity. But it was also incredible to be able to use concepts to pull together a story that was so inclusive and integrated and involved paleontology. You know, all kinds of paleontologists. The more we talk about it, the more I think oh, yeah, Ron Litwin. So yeah, absolutely. I'd be delighted to do that. Delighted.

Santucci: And the other really compelling justification for doing that is just as you said, what a tremendous investment of work and a lot of scientific contributions from a multidisciplinary team that I think it will benefit projects in the future. And so next year we're going to begin our paleontological inventory at Yellowstone National Park. And so perhaps the work that you did for the Morrison ecosystem at Yellowstone may not have been, rose to the highest level in terms of importance for the Morrison project, but it will certainly be a component of what we'll want to include in our work in Yellowstone.

Turner: Oh, sure. You bet. Yeah. I've made a mental note of that, that you're going to be doing an inventory. And so yeah, you're right. It should be part of the inventory, whether we were thrilled about what we found there or not. (laughter)

Santucci: Very good. So, I think this is good. We could talk a lot longer, but I think we've captured some really good information here. I had one other quick question. But maybe to be fair to Tim, Tim was there anything that you wanted to ask before we wrap up?

Connors: I'll just bring up my favorite, earliest memory of meeting Pete and Christine. It was at Dinosaur National Monument in September of 1998 when we were conducting our Park Service Geological Resource Inventory scoping. And I remember that we all went out to a dinosaur site. Do you remember that, Christine?

Turner: Uh huh.

Connors: That they had just discovered, I think they had discovered a skull or something. I forget which dinosaur it was, but I'm sure you remember. But I remember being in the field with you two folks. And I knew how kind of famous you were for the Mesozoic. So I was just kind of

obviously in awe of both of you. You know, being in the field, looking at a dinosaur that was being jacketed. I think Scott Madsen and Ann Elder were working on it.

Turner: Yes.

Connors: And I knew you were working on the Morrison Extinct Ecosystem project at the time as well. So for me, that was a major milestone of my early career, for sure. You know, just being able to go in the field with you. And then that kicked off numerous other occasions to get together with you and Pete on the Colorado Plateau at various places like Glen Canyon and Arches. Just anywhere we could get you guys to join us and then share your knowledge of what you knew about Mesozoic things. And that was a career highlight for me, and I've taken it with me.

That led to getting Pete's help at Hovenweep to help map some of the beds where they weren't mapped very well from 1950s geologic maps. And Pete just came in and said, "Yep, those are Cretaceous units. And you see the carvy mudstones?" I remember that was one of his favorite terms, carvy mudstones. (laughter) He used that all the time. And being in the field with you folks –

Another highlight I remember is right outside of Arches, near the entrance to Canyonlands, looking at the Brushy Basin and those beautiful blue beds that you described as the late [unclear] 1:21:53 deposits. Just being in the field with you and Pete was always a pleasurable experience. And definitely made me smarter for being near you, and knowing more about what was going on. So I appreciated those times.

Turner: Listen, those were great days, weren't they? I mean, seriously, the things we got to do and the time we got to spend in the field. Those are treasured, treasured memories in my life, too. So, wow. When you mention them all, I'm visualizing us on the outcrop doing these things. Like oh my gosh, yeah. Yeah. Boy oh boy. I'm actually writing about some of these things in essays, geologic essays, with my writing group. And it just brings me joy to even remember them. And if you promise the two of you not to tell anybody the name I would use for this series of essays, if I ever get that far, who knows, you know, life's uncertain. But you know the Morrison has—and I won't keep you guys, because I know you guys are working guys and I shouldn't just go on and on my [unclear] here. But the Morrison has another member called the Recapture Member. And that ended up being very, very important in the area between say Bluff, Utah and Cortez. And Pete and I did a field guide there, 2011. Another field trip there. It corrected a whole bunch of stories that were kind of getting people misled. And the Recapture played an enormously big role. And we had a definite ah ha moment in that. But I'll tell you over beer or coffee some other time.

But the Recapture, and Dick Haines was the expert on zeolites, he actually wrote the GSA memoir on zeolites, helped me with this Brushy Basin Member. He was stunned when I took him there. He said, "I can't believe this. This is like a Green River story totally untouched" when he saw the zeolites and things. So anyway, he used to joke about the Recapture, because it had no zeolites and no fossils. Well, not none, but almost none. And he said, "Oh, the Recapture is a unit only a mother could love." (laughter)

And it's in need of more study. It's intriguing now. It has more changes going on in it than most of the units. But anyway, I love the word "recapture." Because it's like recapturing my memories from those glorious golden days in the field working on the Morrison. So if you come [unclear] I share that little tidbit with you, if you ever see the name—

Connors: That's our secret for now. That's our secret.

Turner: (laughs) Anyway, I'm recapturing all those kinds of experiences, Tim. And I cherish them. I do. And thank you for cherishing them as well.

Connors: I cherish. For sure. Great memories.

1:25:08

Santucci: Excellent. So the concluding question that I have had to do with the fact, just being opportunistic, you were in Flagstaff for a number of years. Did you ever have a chance to meet the paleontologist at the Museum of Northern Arizona? Ed Colbert? Edwin Colbert?

Turner: Oh, yes. Oh, yes. Pete knew him much better than I did. Even though I was in Flagstaff, I worked more with Eddie McKee. But yes. And Ed Colbert was at all those, Ned Colbert was at all those meetings in the early days, the Colorado Plateau meetings at the museum. And Bill Reed was the geologist at the time. So I did not know Ned the way I knew Eddie McKee. I knew of him. I don't think he knew of me unless he just saw you know, one of his students at NAU. So probably my answer is sort of tangentially. I don't want to claim I knew him. But I did, yeah. Pete knew him much better.

Santucci: So it sounds like we need another call with you to talk about some other things. (laughter)

Turner: Well you know, if you think of more questions, yeah.

Santucci: So this has been fantastic. Again, far better than we anticipated. And we really appreciate you sharing this information and allowing us to preserve it. Because really cool stories.

Turner: Oh, you know, thank you, guys. Because you're indulging me in reminiscing. And you know, the highlights of my life, you know, we're doing these kinds of things, it just brings me so much joy to talk about it or write about it and share information. So you're not putting me out at all. In fact, I'm overindulging myself when you get me started on the stories. So I'm enjoying this thoroughly, both of you, I really am.

Santucci: So I'm titling this "Top Secret: The Recapture Interviews." (laughter)

Turner: Better put that in code.

Santucci: Yes.

Turner: But that's cute. That's cute. I'm thinking at some point, Vince, because you and I were there, and I think Tim was there, too. But the Geologic Resource Management meeting down in Corpus Christi.

Santucci: Yes.

Turner: We should talk about that sometime.

Santucci: Definitely.

Turner: You know the story.

Santucci: Yes.

Turner: So we can, you know what happened and we can talk about it if you want to. Or you already know, so whatever. But that's for another day.

1:27:51

Santucci: Absolutely. So I'm going to make a list of our third interview. Maybe a few weeks down the road. And we might make this a regular thing. (laughter)

Turner: Okay. Oh, listen. Nothing would make me happier. I just sit out under my umbrella and listen to the birds and talk with two of my favorite people about my favorite topic. How bad is this?

Connors: There's one more thing I wanted to interject. Vince, do you know where Christine lives?

Santucci: No.

Connors: Christine, could you tell him?

Turner: Can you believe this? I live in Morrison, Colorado. (laughter)

Santucci: Why am I not surprised?

Turner: That's another whole story.

Santucci: Why am I not surprised? I'm not surprised at all. Well, this has—

Turner: I had to tell you—

Connors: Right in the middle of it. It puts you in the mood for it, that's for sure.

Turner: It does. I can look right over at the cliff right from my house. Little [unclear] in this area, I know it's there.

Connors: Right near the type locality. That section.

Turner: Absolutely. You got it.

Santucci: Well, that's a really good way to end our conversation today. You'll get some emails from us. And we'll try to schedule something a few weeks down the road if that works for you, Christine.

Turner: You bet it does. Thanks so much, guys, and take good care of yourselves. All right?

Santucci: You, too. Thank you.

Connors: Have a great weekend, Christine.

Turner: Okay. Will do that. Absolutely. Thanks, guys.

Santucci: Thanks. Bye-bye.

Connors: Take care. Bye.

Turner: Okay. You, too. Bye-bye.

[END OF INTERVIEW]

Total time = 146 minutes