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Jim Kirkland
July 13, 2020

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

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

Narrator: Jim Kirkland
Interviewer: Vincent Santucci
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Transcribed by: Teresa Bergen
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Transcript

[START OF INTERVIEW]

Santucci: All right, thanks, Jim. Okay, so today is Monday, July 13, 2020. And my name is Vincent Santucci. I'm the senior paleontologist for the National Park Service paleontology program. Today I am speaking with Jim Kirkland, State Paleontologist with the Utah Geological Survey. Jim has an extensive history working in National Park Service areas, particularly in the state of Utah. The interview is being conducted by telephone from Jim's home in Salt Lake City, Utah. And I am in my home in Gettysburg, Pennsylvania. So thank you, Jim.

Kirkland: Very welcome.

Santucci: So, the first question is going to be the easiest. When and where were you born? Where did you grow up and go to school before college?

Kirkland: Okay. Well, I grew up in Massachusetts. New England. On the coast. Basically got a real love of fishing in the marine systems and observing things like what happens when a hurricane hits Cape Cod. Used to go up to the Museum of Comparative Zoology at Harvard and sit and look at their skeletons and say oh, one of these days, I'm going to get involved with paleontology, dealing with this stuff.

I went to Marshfield High School, which is right on the coast of Massachusetts. Basically the home of Daniel Webster. And got to know Edward Rowe Snow, a famous writer. Sea lore. In fact, I remember one time when a basking shark washed in, a big event. I was out there and it Edward Rowe Snow talking about it's got to be a sea monster. It's got the head of a horse and the back of a dragon. That was great, the time when you're growing up in that kind of an environment.

But I had that love of paleontology. So when I got out of high school, I only was interested in heading west. So I headed to the New Mexico Institute of Mining and Technology in Socorro. Basically because I had poor high school advisement. You know, paleontology, their view was what the heck is that? Oh, it's a subdiscipline of geology. Oh, where do you go study geology? Oh, you want to go to a school of mines. So like a poorly advised high school student, I only applied to schools of mines. And because it was a cold winter, I ended up going to Socorro, which is where I first got my teeth wet in dinosaur paleontology with the great Dave Thomas, and first got to meet Jim Madsen, my predecessor here as state paleontologist.

03:05

Santucci: Very good, Jim. So let me just go back and two questions. So, your date of birth?

Santucci: Nice. So that's the day before the anniversary of the National Park Service on the twenty-fifth. And the second question is, do you recall the first time you ever saw a fossil in geologic strata?

Kirkland: In geologic, strata, boy. You know, that didn't occur till I got to—well, no, it did. No. In southern Massachusetts, Plainville, Massachusetts, my earth science teacher knew that I was pretty fantastic about this stuff. Took me on a field trip to a carboniferous plant site in Narragansett Basin. And collected fossil ferns and [stigmaria?]. You know, fossil roots of carboniferous plants. And I remember that very well. But that was my first time ever collecting fossils. And I was literally, I was in high school. You know, I was a junior in high school at that point where I really had a chance. I had a friend when I was in grade school that had a pretty nice trilobite collection. But he lived a couple of towns over where you could actually find trilobites when they were building homes and things. So, I didn't have many opportunities young. I just, biding my time. (laughter)

Santucci: Okay. So when you were looking, you were starting to talk about going to university, going to college. Did you enter college with the idea that you would major in geology to study paleontology? Or did that come later?

05:02

Kirkland: No, no, I absolutely wanted to go after paleontology. In high school, I had a short sojourn where I was a little more toward oceanography, growing right up on the coast. You know, going out fishing and whatnot and observing coastal processes. But when I went to New Mexico, and that was terrible advice. They didn't look at paleontology as an actual science there. Much more of an engineering school. But it gave me some skills and insights that I wouldn't have had otherwise. It also forced me to become a little more political. I started a paleontology club there with Dave Thomas, who you might be familiar with. His father was quite a well-known paleo artist.

Santucci: Yes.

Kirkland: Yeah. And his son Dave Thomas and I were good friends. And they were the first ones that ever took me out digging dinosaurs in the San Juan Basin with Jim Madsen back in like '73. So you know, I got started looking at dinosaurs very early on. But I have to thank them for that. And they gave money for the school. We set up field trips to the Glass Mountains of Texas, and a number of different programs. And all the fossils we collected over the years are now in the New Mexico Museum of Natural History.

Santucci: Very good. So during your undergraduate degree then, did you ever have any opportunities to go on field trips or do work in national park areas as an undergraduate?

Kirkland: Not as an undergraduate from New Mexico. We pretty much worked within New Mexico. And of course a lot of the park units, the northern part of the state. I mean, I went down to Carlsbad helping out in collecting seismic data from some seismic stations we had down there.

But basically in terms of doing paleontology within park units, I didn't do that until I started my master's.

Santucci: Okay. All right. And you said that you had the opportunity to meet and work with Jim Madsen. Was that while you were an undergraduate?

Kirkland: Yeah, that was when I was an undergraduate. Him and Dave Thomas, my college friend's dad, were pretty good friends. And they would do, you know, just kind of low-key stuff in the San Juan Basin together, work on various projects. But they were mainly social friends. But Jim was really good to me. I was probably twenty or nineteen, maybe, when I first met him.

Santucci: Nice.

Kirkland: And he was also state paleontologist of Utah. He was the first paleontologist I ever got to know at all.

Santucci: So do you have a particularly fond memory of your interaction with Jim Madsen that you could share?

08:20

Kirkland: Well, basically just that Jim was over at Dave's house in Albuquerque looking at things that we had collected. Jim IDing materials and just kind of being the friendly, gregarious guy he was, particularly back in the '70s. He was a pretty young guy then. He was definitely a lot younger than I am now. (laughs)

Santucci: Excellent.

Kirkland: Yeah, he was really good to me. I have to admit, the first paleontologists I worked with over the years were all real good to me.

Santucci: That's nice. So you completed your undergraduate education and you started contemplating going to graduate school?

Kirkland: Yeah. When I started looking at graduate school, I was interested in the San Juan Basin. I was hoping to be able to do a thesis project working on those rocks, since I was already familiar with them, to a certain extent, and knew my way around that basin pretty well. Because we would go out there every couple of months, we'd go out there for a long weekend for years with those guys. So I got a decent feel for the San Juan Basin. But I'm a fan of Edwin H. Colbert. You know, Ned Colbert had been the paleontologist of the American Museum of Natural History all the years when I was growing up. And wrote really some of the best books on dinosaurs that were serious, but for the public, during the 1960s. Late '50s and '60s, but for me mostly in the '60s. So when I found out he had retired to Flagstaff, my eyes went, I want to go there and work under Ned Colbert.

So I applied. That's the only school I applied to. Went up there to visit and introduce myself to folks there. Fortunately I got into the program. But unfortunately, once I got into the program, I realized Ned Colbert was an adjunct professor of biology. And because he was

adjunct in biology and not geology, he couldn't even be on my thesis committee. But fortunately, I got involved with the Museum of Northern Arizona. And for many years, my little office cubbyhole was right next to Ned's office. And he'd come out and just regale me with tales of Marsh and Cope and what it was like working with Osborn in the old days. And his students, Ostrom and Dale Russell. I got to meet a lot of people through Ned. In fact, Jack Horner, when he first started going around the west with his baby hadrosaurs, I remember real well when he first walked into the office with his little attaché case that he'd open up. He had in the foam in the case, a laid out baby hadrosaur. (laughs) Pretty neat stuff. Jack was a young kid then. I think he was still at Princeton. Yeah, in fact, I'm sure he was still at Princeton then.

11:48

Santucci: Very good. So you went to Northern Arizona University and completed your master's degree?

Kirkland: Yeah, that's where I got my master's. You know, we were set to work on the San Juan Basin. They were trying to push me toward working on the invertebrates, you know, the molluscan faunas, because everybody wants the dinosaurs. And I wasn't thrilled with that. But as a student, you do what you've got to do.

And right before I was getting ready to go into the field, a lawsuit. Sierra Club decided to sue, I don't know, I guess it was the BLM over the mitigation work going relative to coal mines in the area. And anyway, all work on the San Juan Basin ended for a while. So here I was without a project. It was the end of my first year of classes. What am I going to do?

So I ended up going down to Florida and working on an underwater archeologic site. A Columbian mammoth cow and its calf that had been kind of chased off into the swamp and bogged down, and then taken out by some paleo Indians. So I spent that summer working down in Florida scuba diving on a mammoth site. And that was a lot of fun. And they were wanting me to work on the mollusk down there, which weren't really even fossils in my mind. And I really didn't want to do that for a thesis. (laughs) I did not want to work on the Pleistocene.

So when I came back to Flagstaff, fortunately they had started a project on Black Mesa working in the Mancos Shale with marine Cretaceous. And one of the researchers got a, well they both ended up getting jobs. They had an NSF grant with no one to do the work. So my advisor at the time, Dale Nations asked me if I would be willing to do that as a thesis project and I jumped on the opportunity. So I got started working in marine Cretaceous.

But during that whole interview when I started to do my marine work at Black Mesa up on the Navajo and Hopi reservations, I became involved with Will Downs, who was the preparator at the Museum of Northern Arizona. And we would start to go out looking at the Chinle Formation and things on weekends. I met Scott Madsen, who was in there as an intern as an undergraduate. And we started working in the San Juan Basin together. And Tim Rowe and Lou Jacobs were kind of our supervisors, informally. They were both employed there. Lou as a postdoc and Tim Rowe as a grad student working at the museum. At the time, I think, Tim was out of Chicago when he first started there, working on dicynodons from northern Britain. But

those guys kind of got me working in vertebrate paleo regularly, which kept me pretty happy while I was doing the marine Cretaceous for my thesis work.

And basically over those years, a lot of people coming in and out. Jack Horner, John Ostrom would come in and out. David Attenborough. I remember doing lab noises for David Attenborough back in the '70s for one of his first paleo special that he did with Ned, when he and Ned sweeping up the *Coelophysis* at Ghost Ranch. Kate Behrensmeyer would come through. You know, a lot of people come through to see Ned Colbert. And Flagstaff's not a bad place, and certainly the kicking off point for places such as the Grand Canyon.

So when the Grand Canyon Natural History Association put together a project for Kay and Downs and oh, there were probably twenty of us involved with it, to do a major river trip down the Colorado looking at the Pleistocene deposits, looking at sediments that had been deposited along the margins of the canyon relative to Lava Dam. So when the river got dammed up, looking at these terrace gravels and things. Seeing if we could find any fossils. Looking at the travertine. Seeing if we could do any uranium lead dating of the travertine. Just to get a better handle on the Pleistocene history of the Grand Canyon. A marvelous two weeks of my life. (laughs) I recommend it highly to anyone. Hiking upside canyons. We had helicopter support. You know, it was quite the expedition. But we didn't find a fossil. (laughs) In fact, I don't know if they got any pollen out of the pollen samples we collected. But it was still quite the opportunity to go through there with a whole team of geologists. So all the time, you know, you're learning new things about the history of the Grand Canyon. And some of the folks on that trip, like George Billingsley and whatnot, had a lot of experience in the Grand Canyon. Of course George mapped the western Grand Canyon. So some of these folks really knew their stuff. And it was an amazing trip. It was one of the high points of my entire life doing that.

In fact, I ran Crystal Rapids with Larry Stevens, who's written one of the best books out as a river guide to the Grand Canyon. And Larry, it was his fiftieth run of Crystal. (laughs) So I got to do Crystal with someone really experienced. I ran Lava with Will Downs, who had never run it before. (laughter) So quite the contrast.

But from working with George on that trip, and George would come out with Downs and Scott and I and we'd go out and look at like the Vermilion Cliffs with Chinle, and we'd be up along Ward Terrace. You know, we had a site we worked some for the last years I was there called Billingsley Bone Bed. Got to know George pretty well. And when George needed some warm bodies as he was mapping and working on the stratigraphy of Petrified Forest, I got to go out and spend two weeks with him camped in the backcountry up in the Painted Desert, the north side of the Petrified Forest. And we spent our time looking for sites. I remember gigantic clam beds and the Black Forest area. We carried tons of water in. Basically, barely had, wore the same clothes the whole time. And almost all our carrying capacity was water. (laughs) Real thin bags in summer, so you didn't need much. Sleeping in the sand, hope it wouldn't rain on us. I don't think we even had a tent with us. But real neat time exploring the northern part of Petrified Forest. Found a number of sites.

But my greatest memory of that trip is George Billingsley standing on Agate Bridge. I'm not sure if you're familiar with Agate Bridge.

20:07

Santucci: Oh, yes.

Kirkland: Yeah, that log that went across in Black Forest.

Santucci: Yes.

Kirkland: Have you ever met George Billingsley?

Santucci: Oh, I know him. I interviewed him just two weeks ago.

Kirkland: Okay. He's a big boy.

Santucci: Yeah.

Kirkland: (laughs) Him standing on that bridge. You know, probably ten feet out from the side.

Santucci: (laughs) Do you have a photo of that?

Kirkland: It was a long expanse.

20:32

Santucci: Do you have a photo of that?

Kirkland: I wish I did. Because it was like, you know, Downs and I both, you know, I don't think Scott was there when he did that. But it was just, why are you doing that?! That's the stupidest move ever. And all I can say is, it didn't collapse. (laughter) But terrifying moment to see that. Just what are you doing? So even our great scientists, folks, we have worlds of respect for, can do stupid things. (laughter) Infallibility's just not part of the degree. We all have to keep that in our minds.

Santucci: So you had a rich master's program at NAU.

Kirkland: Oh, very rich. Incredible opportunities. I mean, the Black Mesa work. You know, getting my own permit. Going up and meeting with chapter houses, to get permission to look at the rock. Going up to Oraibi to get permits working on the Hopi reservation.

Santucci: Great faculty?

Kirkland: I got to learn a lot of things. Like toss you in and hopefully you don't drown. (laughter)

Santucci: So there was great faculty at Northern Arizona University when you were there. Who did you have a chance to work with in the department?

Kirkland: Well, the department there, my major advisor was Dale Nations. And Dale's a sweet guy and really had my back for a lot of that. Of course, I worked with Stan Beus was the first

guy I worked there. An invertebrate paleontologist as well. And Stan was good to me. But I ended up not working under him. At first, I was thinking of doing trilobites, trying to figure out what I couldn't do. I couldn't do dinosaurs directly with Colbert. I was kind of floundering there for a little bit. But Dave Elliott was my roommate for a while. Because it was during my last year there that Dave Elliott took the job as vertebrate paleontologist. And Dave came in. And the house I lived in that had several graduate students living in, a room had opened up. So he moved in there so he could settle in his first year. That's how I got to know Dave to begin with.

But when they really started bringing in some vertebrate people. This was really just before Larry Agenbroad came and Jim Mead. You know, the Pleistocene team. Because they weren't there for the river trip thing. Once we did that trip, there was a lot more interest in the college in doing some more with the Pleistocene. Because they really weren't doing things with it. So it was right after I left that they brought in those guys, set up the Quaternary Studies program.

Santucci: Very good. And did you have a master's thesis project that you completed?

23:48

Kirkland: Yeah. I did my master's on the Mancos Shale at Black Mesa. The Greenhorn marine cycle, Cenomanian-Turonian. All the way around, well, actually, the southeastern part. Was able to show that subtle structures, anticline-syncline couplets, really subtle today. If you've ever been to that part of the world, you don't see big [fold?]. But you can make out some places where the rocks are tilted a little bit. But, they had a big effect on the distribution of coastlines and lagoons as the sea came across that area. So that we had syndepositional tectonic motions that were really affecting the distribution of the Cretaceous rocks. And it was really doing that stuff that I got to meet Pete Peterson with the US Geologic Survey. And Pete basically had done, he had just finished his PhD work on the Kaiparowits Basin, the southern end of Utah. And was reporting the same things, that these pairs of anticlines-synclines were controlling distribution of sediments as the Late Cretaceous sediments came in and blanketed that area. So I actually got to thank him for first coming up with that.

But that's been kind of a note of my research ever since. I mean, I'm still doing things where I'm looking at syndepositional tectonics. You know, Pete wrote a great article soon after that time interval on deposition of quivering craton. Just that this stuff isn't just flat and gentle receiving sediments, that there's subtle depositional differences from subsidence variations, can have a pretty dramatic effect on the distribution of environments in the past. And that's been something that's been very good to me ever since. A lot of my big discoveries are actually because of local tectonic motions that create unique environments for the preservation of fossils.

Santucci: Very good. Did you have an office—

Kirkland: My last—let me just—my last big thing in Arizona, I mean, I worked Sunset Crater, taking students through there all the years as a grad student. But Hualapai one time, I stopped to look at a site that we used to visit on field trips for trace fossils. So it was a series of Moenkopi early Triassic slabby rocks going up this slope. And I think it was right on the boundary of Hualapai National Monument. And in there I actually found the only ammonite ever found in

there. And I know Mike Morales, who came in later to the museum, tried after trying to find more ammonites for many years. (laughs)

Santucci: Very good. Did you have an office? I think I recall during one of our discussions that you had an office at the Museum of Northern Arizona?

Kirkland: Yeah, yeah. I had an office for two and a half years there. Right near Colbert's office. As I said, Ned Colbert would come and chat. "Oh, Professor Kirkland, how are you doing today?" (laughter) Because he was in his eighties for some of that. You know, late seventies, eighties. And he'd just sit there and tell me these stories. He always liked to tell people, you know, my hand's like three hands away from Darwin. Because Colbert was Osborn's student. And Osborn had shaken Darwin's hand. And of course I'd shaken Colbert's hand. So my hand's three hands away from Darwin. Just that pedigree of getting to work with Ned Colbert.

And of course when I left there and went to Boulder, I basically by the fall I ended up falling in with Dr. Bob Bakker to some degree. And sadly, Bakker didn't have a lot good to say about Colbert or, of course, Ostrom as well. So that was a point of serious stress between us. Because I've always thought the world of Ned Colbert. In fact, that's why there's a Nedcolbertia, that's one of the most primitive ornithomimids.

28:41

Santucci: So it must have been quite an experience to not only be able to work closely with Ned Colbert, but I imagine there was lots of paleontologists that visited the museum that you had a chance to meet?

Kirkland: Yeah, there was a constant group. I mean, between Attenborough and Horner and Osborn, I mean, sorry, Ostrom. Dale Russell. Let's see who else. Mike Woodburne, Malcolm McKenna. You know, Malcolm one summer—Malcolm was a great fossil mammal worker for the American Museum. Malcolm was on the board of the museum. And one summer I had no job at all. I was destitute. So he came up with money and paid me and Downs, both of us, for two months to prospect the Dakota Formation across the southern part of the Black Mesa Basin. And we didn't find a bone as big as your pinky finger in two months of looking. (laughs) But it kept me eating the whole time. And it kept me in the field, which was pretty good. Even though I probably would have been better off if I was in my office writing. But you've got to still eat, even if you're writing.

But basically, about a year later, when I was doing my PhD on the north side of Black Mesa, I did find dinosaur materials in the Dakota. Up at Chilchinbeto which are all still sitting up there. It's a pretty good little bone bed up there on the other side of Black Mesa of late Cenomanian age that deserves more work eventually.

Santucci: So, one more thing before we leave Arizona to go to Colorado, when we were on a houseboat at Lake Powell, part of the Glen Canyon National Recreation Area Paleontological Inventory, you told me about a box that was under your desk that had air photos—

Kirkland: Yeah, yeah.

Santucci: —air photos or films from—

Kirkland: It was actually under Will Downs' desk.

Santucci: Okay.

Kirkland: Well, it was my desk for a while, but it was mainly Downs' desk for many years. And Downs, you know, left the museum for a while right before my last days there. And I noticed these big cylinders. And they were transparency air photos of Glen Canyon. Stacks of them. You know, these big rolls of 8 by 10 transparency films. And those were, eventually got archived into the museum library, as far as I understand. They were like under there kicking your feet for years! (laughs) You know, a few of those are from the '60s.

Santucci: So these were pre-dam, before, pre-construction.

Kirkland: Oh, yeah. Pre-dam. And maybe some during the building of the lake. I'm not 100% sure if some covered that, but I know pre-dam. I remember opening up a cylinder and pulling this, because we had no clue what was in there. But it was like, holy cow, these are beautiful! (laughs)

Santucci: So it sounds like presumably from what you said that they're probably in the collections today.

Kirkland: Yeah, they got them archived eventually.

Santucci: Perfect.

Kirkland: I bitched about that for a long time. Those things needed to be curated. Because that museum, you know, in the early days, was pretty loosey goosey. And I mean, it was unfortunate, but you always get various people, you know, people, you get all Eddie McKee's stuff from the Grand Canyon. And rock samples from measured sections that Eddie did. And I don't know if those things were boxed and stored somewhere, or if they got thrown out. But the Grand Canyon rock samples from all Eddie McKee's work in there, you know, those things are priceless. You know, tied to his strat sections. And I know they had all that stuff as well as casts of a lot of the invertebrate fossils he collected. Maybe some real stuff. But a lot of the best of the types and things from like "History of the Redwall Limestone and whatnot. Those things ended up getting a set curated at the museum there. There's some real important stuff in that museum. A lot of Grand Canyon stuff. But where it is now, I haven't worked out of there in twenty-five years.

33:43

Santucci: Very good. Thank you. So you applied and were accepted at University of Colorado at Boulder.

Kirkland: Yeah. While I was doing my master's, I started a correspondence with Earl Kauffman, who was the head of paleo-biology at the Smithsonian. Also referred to as Captain Cretaceous. (laughter) And Earl's a Cretaceous marine bivalve expert and stratigrapher. Major books on biostratigraphy and what have you. And over the years, I'd send him stuff and he'd ID it and

send it back to me. And sometimes I would say, "There's not a chance in hell this is what you say it is." (laughs) I'd argue with him, you know. And Earl liked that. So once I was finishing my master's thesis up, he ended up going to the University of Colorado at the same time, directly into the chair of the geology department at University of Colorado. And he asked me if I would be his first PhD student there. So for the next few years in Boulder, I basically was in charge of supervising and field training all of his graduate students because Earl was such a star. You know, [rose all over the board?]. You know, Earl's the kind of guy that would get like five for five NSF grants and things like that. Lots of money coming in from the oil companies, the various granting agencies. And probably had like twenty grad students. So he couldn't devote the kind of time you would like in your major professor. So he'd sick them on me. And there were probably six different students that worked on Black Mesa with me, where I was dealing with all the funding issues and whatnot. (laughs) I was the banker. Not something I'm really good at. But once again, some more experience. Running the show is one way to learn how to run the show. (laughs)

Santucci: Absolutely. So you moved to Colorado and you began your PhD—

36:02

Kirkland: And Earl wanted me to keep working at Black Mesa. I had the inside straight for working with the tribes. Both the Navajo and the Hopi and the Apache. I'd done work with the Apache tribe as well. So here's this whole region of the southwestern US. It's not something you usually sick a grad student on. I want you to open negotiations with this tribe and start a project. (laughs) So he would send the students with me, and I was in the one in charge of getting permits and organizing these projects down on the Mogollon Rim on the Apache reservation or the Hopi reservation or the Navajo reservation. So we also worked in the Four Corners region. But other people's theses projects. I just kind of ran shotgun and controlled the money. But it gave me opportunities to work in a lot of places where I fortunately wasn't responsible for the final write-up. And on almost all of them, I was the one that did all the identification of the fossils. For all his students, I was responsible to teach them how to identify Cretaceous invertebrates. Because Earl was busy. He'd look at things if I had a problem or something. But basically I spent a lot of time teaching various PhD students (laughs) how to identify marine Cretaceous invertebrates.

And through that time interval, thanks to Earl's library and a big Xerox machine across the street at Kinko's, I slowly gathered copies of every paper ever written on the marine Cretaceous of North America. So I had the references at my fingertips. This is prior to pdfs. But I had the literature. I still have the literature. I've got everything that's ever been written on this stuff.

Santucci: Okay. Very good. So, you were able to undertake your PhD research. Was any of that work within or adjacent to National Park Service areas?

Kirkland: Well, you know, some of that Four Corners stuff is pretty close to Mesa Verde. But largely it was on the reservations. The only one that had access to those areas, and it wasn't until I was finishing my PhD. And I went and taught at the University of Nebraska for a couple of years as a postdoc. And it was when I was doing my postdoc at the University of Nebraska that

Mark Leckie, University of Massachusetts, who had been a grad student with me at Boulder, worked on forams. A paleo-oceanographer, and one of the best—

Santucci: I'm interviewing with Mark on some stuff after we're done here. (laughs) But anyway, Mark brought me onto the Mesa Verde project.

Kirkland: —And he'd gotten a big grant from the American Chemical Society's petroleum research grant for two summers' worth of field work. And basically we got permits from the park. In fact, I was in charge of getting the permits on that one, too. Both for public lands, because it ran off the park, wasn't all in the park, and we started north of the road there. Worked our way across some ranch land. And then right on Point Lookout to the top of the section, and made that the new reference section for the Mancos Shale. Which is about a half a mile thick. And we probably, our trenches, all hand dug, were done probably stretched over a mile and a half. In some places, on some steep stuff. I know there was a couple of places where I was pretty scared, let me tell you. (laughs) Diving onto that mud on near vertical cliffs. But over the course of those two summers, we'd have about seven or so students with us working as well. Quite a few theses came out of that project. In geochemistry, micro fossils. But the invertebrate fossils, I was in charge, as well as description of those rocks, the field descriptions. And we chunked our way through them.

The first year, we didn't even get onto the park boundary. And then once we got into the park and started up, all of a sudden we realized the initial place we'd been okayed for had some pretty serious landslides we weren't able to identify till we got up on them. And it had taken us two years to get clearances to dig trenches through this one spot. And fortunately by that point, they knew us very well. And the park cleared us to work about a quarter of a mile away to get up through the rest of the cliff to the top. And it probably took them a week to clear it for us. So that was real nice of them. Because we had definitely gotten ourselves into a box. And didn't realize it till we're hanging on the cliff, that we couldn't complete the project where we were. We were able to follow marker beds over laterally to jump this new spot up to the Point Lookout.

But that project was truly remarkable. We got a lot of fossils in detailed stratigraphic context. The stratigraphic section we defined as something like 760 units. Maybe little volcanic ashes a half a centimeter thick. And just recorded every one of these things through there.

We also did gamma radiation through the whole trench. So we put this Geiger counter, basically, you know, sophisticated, up against the inside of the trench on the fresh rock. And after a minute or so, take a reading. And from that, we were able to tie into the subsurface data for the San Juan Basin. So we were able to tie the outcrop section of Mesa Verde into all the subsurface work that had been done within the San Juan Basin. And a lot of that data was shared with us by Kay Molinar of the US Geologic Survey. And that was brilliant that we were able to do that. Because it's given that project a lot of legs. And there are DCs on the golden brown algae coccoliths, the planktonic forams, the benthic forams, clay chemistry. I mean, stable isotopes of things. Just one thesis after another. They're still analyzing data that was collected there. It really is a very important project.

43:42

Santucci: So, when I went to Mesa Verde, when we were involved in a project there, you can see that there's a pretty significant Jim Kirkland collection of fossils in the national park collection. Can you tell us a little bit about the work that you did involving those collections, the significance of those collections, and how they contributed to your dissertation?

Kirkland: Well, it wasn't my dissertation. My dissertation is Black Mesa, Arizona. The reservation. So that project is a postdoc. I'd already finished my PhD. We published the main stratigraphic part, the part that I had the most, the strongest part in. The Mexico Geologic Society Four Corners guidebook. That's where we published all that data. And numerous people got PhDs and master's theses out of it. But that wasn't one of them. I was working for Dinamation. well actually I was still, part of the time I as at the University of Nebraska teaching at the time. And then I ended up at Dinamation, leading participant-funded dinosaur excavations in western Colorado.

And basically, when we were getting to the end of the project and trying to write this stuff up, and curating this immense collection, sitting there at the picnic table in the campground, filling out labels and working on it. And I hadn't photographed anything because we weren't set up in that campground to do research photographs. Will Elder was at, of course, Menlo Park at the time of the US Geologic Survey. This is before he started at the Park Service. And I was able to convince Will to come in with us on paper. And Will went back down to Mesa Verde and photographed all the collection. And the last few things that hadn't been curated, make sure they got curated. So he did the final curation and photography of that invertebrate collection. Which is why it's Leckie, Kirkland and Elder for the final published paper on that section.

And of course Will had many skills. I taught Will stuff when he was starting his PhD and on Black Mesa with me. And Will turned into one of our very best students of all time.

46:18

Santucci: Very good. So, let's see. Very briefly, how did you wind up at Nebraska, and then how did you ultimately wind up in Grand Junction?

Kirkland: Well, Nebraska, Earl Kauffman is a very gregarious sort of guy. (laughs) And he's got colleagues everywhere. Very beloved, Captain Cretaceous. And basically, Al Fagerstrom, who was the paleontologist at University of Nebraska, who worked on fossil reefs, largely Devonian reefs up until the last few years of his career there. Then he started working on modern reef systems in Polynesia. Well, he got a sabbatical to go to Polynesia and work for a year. And they needed someone to replace him. So I applied for the job and got the position to replace him. And then that year while he was in Polynesia, he decided to retire. So I ended up with a second year at Nebraska in a row, replacing Al. When Al left on that second year, people weren't real happy that he dropped out on them like that. So when they were going to replace him, they decided to only look at the micro-paleontologists. Because Dave Watkins, who was their coccolith guy was pretty far up the food chain on the ocean drilling program. And all his students worked on the ODP. There was always money for them to work on these projects. And I guess Al wasn't as good at funding his students as Dave Watkins was. So they decided let's replace him with another micro person. So there wasn't even a job I could apply for at Nebraska. Which was unfortunate, because I had found some nice marine Cretaceous vertebrate sites, and very

significant Permian age terrestrial vertebrate sites in the Eskridge Shale to the south that would have been really nice to follow up on. I finally turned the Eskridge stuff over to the Denver Museum of Natural History. And they published a number of papers on that stuff.

But Nebraska was kind of a filling in position. If I had ended up there, I could have definitely made a career there. Because I'd started finding some sites. But you know, if I had stayed there, I would have been doing marine Cretaceous. It would have been the way it was.

But fortunately, I'd been working with the Museum of Western Colorado a little bit. I supervised the Bolli-en stegosaur excavations. So when the director of the museum there started working with Dinamation to develop a nonprofit of Dinamation International Society, he hired me to be the paleontologist. And basically let me write the code, the moral code of the organization. So that we only worked with museums to supplement their efforts in making museum collections. And I'm very proud of the high end that we had the last few years I was there before they bellied up. Not my fault. (laughs) We had scholarship programs for students and a number of things. We were a real benefit to the paleo programs in the country at that point. Their problem was they tried to build a second museum in Grants, New Mexico, with the Park Service. You know, in partnership with the Park Service across the street was a regional interpretive center. And unfortunately, it was on the wrong side of the highway from Grants, behind a basalt flow. So they got no one going there, and building that museum with loans was a very poor move to make. And it drove them out of business and made me have to look for a new position somewhere. Which unfortunately, I spent a year working mitigation paleontology, trying to protect sites from the oil well companies.

But fortunately, Dave Gillette took the job, replaced Colbert. I guess I was on a list there, too. But Dave was farther up the list. But I got his position as state paleontologist of Utah. Which is an incredible opportunity for me. And it certainly set me up for the duration of my career.

51:28

Santucci: So I just wanted to go back for a moment to Nebraska. At the time that you were there, who else was there? Was Bob Hunt there? Mike Voorhies?

Kirkland: Bob Hunt was there. Mike Voorhies was there. What's his name, oh, I'm trying to think. He was a grad student under me at the time. Still around there doing a lot of work in those parks. Oh, what's his name? If I said his name, you'd known him, because he's certainly worked in a lot of those tertiary parks in the state.

Santucci: And then my question is, because you were in association with Hunt and Voorhies, did you have any opportunity to go out and visit or do work in any other national parks during your Nebraska tenure?

Kirkland: No work with those guys. In fact, they were, Garu, I mean, Voorhies was always a nice guy. Bob Hunt was kind of a stick in the mud. But I remember going in Bob Hunt's office right after I found the Eskridge amphibian sites. And I had the pectoral girdle and forelimb of a little amphibian on a piece of mudstone in my hand. I'm showing it to him. He's looking at it in a scope. He tried to convince me it was fish. You know, that's just fish, it's useless. Because they wanted nothing to do with a pre-Neogene vertebrate locality in Nebraska. I mean, they really

didn't. He could just see, it's like, this will take away from our work if anyone realizes there's extensive Permian amphibian sites in the southern part of the state. And they just didn't even want to admit to it. So I worked, this is right before I left. And we went out and made some, probably two cabinets' worth of stuff was collected. And they never went near any of that stuff after I left. And then the Denver Museum came in and described the stuff properly. But yeah, just not the [unclear], you don't want to go near the stuff. (laughs) It's pretty funny.

Santucci: Very good.

Kirkland: Yeah, Voorhies was always great. I was always amazed that he could have such poor eyesight and be such a good paleontologist. (laughs) Because he was essentially blind.

Santucci: Was Milan Stout at Nebraska?

Kirkland: Yeah. He was there when I was teaching there. He was pretty out of it then. I remember him giving a talk at Quaternary or, no, the Nebraska Academy of Science meeting. And he gave a talk about these Arctic ravens coming down in his backyard, how the next Ice Age was on its way. And all his data showed it was getting colder and we were going to have an Ice Age any day now. (laughs) I think Dave's got to give him a hook to get him off of the stage. So he was definitely beyond his golden years within the profession. Definitely starting to rant a little bit about his pet theories beyond, where anyone else in that university was following, no one, you know, agreed with him, we're heading into an Ice Age.

Santucci: So you moved to Grand Junction. And I had a couple of questions in regards to your work there.

55:14

Kirkland: Sure.

Santucci: So how was Dinamation, or was it at all associated with the Museum of Western Colorado?

Kirkland: Yeah. We were partners with the museum. In fact, Mike [Perry?] had been the director of the museum. And what had happened is, he started the whole paleo program there. He used to be up at Vernal and basically went from Vernal to, I guess he might have been at Boise for a little bit. Not Boise, Pocatello for a couple of years as well. His master's was in ornithology. But Mike Perry, as director of the museum, one of his big jobs was trying to find them a new museum site. You know, they had the historic museum, they had a living history farm. And they had Dinosaur Valley that he started from the old JC Penney's downtown. And since they started that, the whole thing was to try to get a much bigger museum site where they could put everything in the same building. And you know, he worked on that for some years. And I remember when they finally did the press conference when they announced a new location. And basically there were three choices that had different—there's one out at Fruita, where we ended up, Dinamation. Downtown, where they now have a Safeway store, a big grocery store, right at the head of the main street. Which is where the museum should have gone for that town. It was just a pricier location, a chunk of change for that real estate. But a supermarket is not as good a use of that land as a museum would have been. And out at the mall.

And they decided they were going to take over the Sutherlands building, which was a lumberyard hardware store just off the main mall and turn that into a museum.

And he was watching the press conference when they made that announcement. You know, the board upfront talking. You see Mike Perry's face behind there just white. Just like this is not going to work. Because as soon as they started talking about moving the museum to the mall from downtown, the entire community just went up in arms. You know, it was a horror show. And no one wanted to see that happen. So basically nothing did happen.

Eventually after a few months of the turmoil, and at this time is when I was working, I was actually running some digs for the museum at the time, with Dinamation, because Dinamation had a lot of ties with the museum. They had robot dinosaurs in the original JC Penney's facility.

But then Dinamation in Fruita, I guess Fruita went to Dinamation and said, "We'll give you the land and X amount of money if you can try to build a facility out here." So Mike finally said, well, I'm not going anywhere here. I've had X number of years to build a new museum. I've failed. I'll see if the next person can pull it off.

And I went out to work with the Dinamation. He hired me to go out there as his paleontologist. And fortunately they really let me set the ethical standards for the organization. Which set as high as any regular museum or academic institution. So we were successful. And the BLM out there loved us. (laughs) And good relationships. I got a lot of plaques here from the BLM for things I did for them over the years.

Santucci: So when you were at Grand Junction, did you have the opportunity to do any work in Colorado National Monument or any other National Park Service site?

59:33

Kirkland: A little bit. But most of the dinosaur sites, Colorado National Monument, are just to the west of the headquarters. And while I was there, I got involved with a power line survey that went right up along the western margin of the park. In fact to get to the site, you parked at the visitors' center and then hiked a mile and a half to the west. And found some sites that still should be developed over there. Microvertebrate sites low in the Salt Wash. I mean, I wish that, it was part of McGinnis Canyons Conservation Area now, or whatever they're calling it now. It's had a few names. But at the time, it was just normal BLM land. I did some work in there for a while. But nothing, my big thing was at Colorado National Monument, go to the visitors center, try to convince them they had to update exhibits.

And I actually once proposed when I was working these sites to the west, there was some other pterosaur site I was shown. And it's like man, we've got to get this stuff protected. It's being vandalized by rockhounds and commercial paleo people. And I once brought this up with the BLM archeologist in Denver while I was talking about getting some permits. And I said, "Man, we should get those few miles there put into Colorado National Monument, because it's only a couple of miles from the visitors' center. Because they'd be better at policing it than the BLM. Because you have to go through the park to get to these areas."

And all of a sudden I got the riot act. "If you ever mention this in a public forum, you'll never have a permit to work on BLM land in Colorado ever again." (laughs) I was in shock. I just, huh? What did I say? I'm just trying to figure out how we can protect these amazing resources along that border of the park. Ugh, just shut down. "Never work again!" (laughs) I remember it well.

Santucci: So you eventually then moved to Salt Lake City. Accepted a very prestigious position as the State Paleontologist for the state of Utah. I think ironically that was a position held previously by Jim Madsen, so it's kind of cool that you wound up there.

Kirkland: Oh, yeah.

Santucci: So, before we get into park—

Kirkland: And Dave Gillette was always a thorn in my side about me trying to work in Utah. Because he hated the concept of Dinamation. You know, it was like this commercial entity. I said, we're non-profit. We're tied to a group that does robots. They're not digging dinosaurs. (laughs)

Santucci: Right.

1:02:43

Kirkland: And you know, Dave's like, "Well, Jim, this is where you and I just part company." So getting that job after Dave, I mean, Dave wrote a three-page letter saying how I would destroy the state paleo program, the survey here, if they ever hired me. (laughs) I mean, they showed it to me after a few years. It was a three-page letter of venom. Pure venom.

Santucci: Hmm. Sorry about that.

Kirkland: Just so sad about that. But I've done okay. (laughs)

Santucci: Oh, absolutely. So before we get into any National Park Service specific discussion, can you tell us about your position, your responsibilities, the staff that you supervise and the kinds of activities that you're involved with in the state of Utah?

Kirkland: Well, when I was brought on as the state paleontologist in Utah, I arrived there and of course you know, I didn't have any programs going. Dave had mostly been working on Pleistocene stuff and he had an *Allosaurus* he had dug up on the San Rafael Swell. They had part of a T-Rex that I turned over to Scott Sampson because I just wasn't that interested in T-Rex. Everybody's got T-Rex. Who cares about T-Rex anyway? (laughs) And I was trying to scope my own programs out. And it was pretty quick. In terms of my responsibilities, of course we issued permits for anyone conducting research on state land. We basically, my job is to promote paleontology in Utah, that Utah has a significant fossil record that is an asset to our state and something we should care for and manage. We deal with a thing called RDCC, where any disturbance – and it's not just state land, any land in Utah – where there's surface disturbance, I need to say is it going to affect paleo resources. Which is mainly a duty that Martha Hayden, my assistant, would be doing. Then she'd run it past me. You know, she'd pull the maps out and

check the areas and what formation, if it's under the area to be disturbed. To be a liaison with various federal and state agencies regarding palaeontologic resource questions or problem situations that would arise. And to do some research into hopefully once in a while be able to discover something and write it up. So it was a pretty open position. I think when they hired me they basically told me I had about 80% of my time just to do research. Whi ch is, you know, way better than most people get. It hasn't quite been that. But it's been a very good position. I do get to work on fossils way more than many people think.

The big problem we had is we had a pretty meager lab at the time. Martha was supervising some volunteers doing preparation. And Martha's not a preparator herself. The museum at the University of Utah didn't exist when I first came on there. They had Frank DeCourten there and then they, one of the students that graduated from BYU took over from Frank. Kind of supervising their lab. But they weren't doing a lot of active field work at least until they hired Scott. So I was one of the only games in town. So we had a fair number of volunteers. When they hired Scott at the university, those volunteers flocked to the university. Because they have a much better lab that's glass front, you know, into the museum, so they could be involved in preparation before the public. You've got to go through locked armed gates to get to our lab. So it's not as friendly to volunteers as the museum lab was.

But at that time, we had some opportunities to receive some funding. We started getting money from the BLM to do research, inventory work, at Grand Staircase. And using funds from that, I was able to hire Don DeBlieux as a preparator field guy. And Don and I have been right hand/left hand in this program ever since. That happened about one year in that I was able to hire Don. And then we were able to raise money to get ventilation systems and bring our lab up to snuff. As other projects came to be, we were able to hire Jennifer Cavin, who's now, of course, up at John Day. Jennifer worked for us for several years, but her heart was always in the tertiary mammals more than dinosaurs. And then when Jennifer moved on to John Day, we hired Scott Madsen, who had just been laid off from Dinosaur National Monument. And Scott's one of the finest preparators of delicate fossils in the country. A real skilled man under the microscope. And that did our program a lot of good. So I was able to build a team up of several people. So we were prepared to do some higher level projects than they had been doing in the past.

Santucci: Excellent.

1:08:55

Kirkland: And it was during that first year that you called us about coming down to Lake Powell for that first, I think, was that the first? Or maybe it was Arches. Which was the first? The inventory where we did a scoping meeting.

Santucci: Arches. Arches.

Kirkland: Arches? Okay.

Santucci: So, let me just jump back for a minute. Do you remember what year you came onboard at the Utah Geological Survey?

Kirkland: Yeah. June 1999.

Santucci: Okay. All right. Perfect. Thank you. So you've been there for a while.

Kirkland: Oh, yeah. I just finished my twenty-first anniversary.

Santucci: Congratulations.

Kirkland: So, I've been there longer than anybody else. (laughs)

Santucci: You accomplished a millennium worth of work during your tenure. And not only is your work very extensive, but it's really important work, too. So thank you for your support.

Kirkland: Well, I've been really fortunate. There's no doubt. It's like, I mean, being in Utah, and how little work has been done in Utah! I mean, it staggers my mind. When I started realizing – you know, I remember even the first year, looking at the Morrison. There's hundreds of miles of Morrison Badlands that not a single scientist has ever looked at. And that's how it was when I first got here. It's hot here in the summer. Okay. Everybody worked Wyoming, Montana, up north. And Utah was barely being touched. You know, there was commercial, the bad guys are out there, amateurs digging up fossils. But scientists? There was no one working out in those rocks. We had Stuart Sumida doing some stuff on the Permian. I mean, a little bit here and there, but nothing much. And certainly no one touching the Jurassic or early Cretaceous.

And the Grand Staircase was a plum. Because when that happened, there was seed money. Not a lot of money. But seed money for a few groups to get in there. And look what that did. You know, we were getting like twenty grand. You know, here to work for the first few years at Grand Staircase. And we found a couple of new dinosaurs. And we were smart enough to know we were a small group, so we went to Wahweap and let Scott Sampson and the University of Utah with their students, an army of volunteers, work the Kaiparowits, which we knew was more fossil there [unclear] rocks Jeff Eaton back in the '80s. You know, back when I was at the University of Colorado, I went out there, had my first experiences of those rocks. And in the Cedar Mountains, was working with Jeff Eaton.

But that money that came in from Grand Staircase, and then the monies that you were able to generate for Park Service projects, that fed my whole program. Because we couldn't get NSF money. We don't qualify as a government agency.

1:12:12

Santucci: Sure. So, there's a lot of ways we can approach this, but why don't we start by focusing on the parks alphabetically that you provided support. And for Arches National Park, you helped us twice in terms of doing field paleontological inventories at Arches National Park. So do you want to try to cover those?

Kirkland: Sure.

Santucci: Cover Arches first?

Kirkland: Sure. Well, you know, you brought us into Arches for a few days. I don't know how many days we did that project. It wasn't a real long project, but we did it for a few days. And of

course my interest at the time, because we were finding things like Utahraptor in the vicinity, was looking at the Morrison and the Cedar Mountain Formation thoroughly there. Because no one had ever really looked at that. And so we focused kind of on those rocks. I remember you teaming up with Fran Barnes to go look at and try to track sites some of the days we were walking the Morrison. But basically walking those outcrops, there had been a locality on the trail to Delicate Arch or Delicate Arch Viewpoint, I think it was. You know, where there was some dinosaur bone that people had found. You know, certainly coming out there, piled it up on rocks. Shifted all over. I don't know what the condition of that site is now. I looked at that site.

And then we started prospecting the outcrop belt. And I remember walking toward Fiery Furnace. We were well to the east of the roads. And as we were patrolling through there, Roland—oh, Roland's last name [Heath], one of the volunteers was up in front of me about a hundred meters. And we'd been seeing petrified logs and things coming out of the Poison Strip Member of the Cedar Mountain at that point. And then all of a sudden he hollering up ahead going, "Hey! Got something up here." Look up and look forward. And he may be a football field ahead of me. And you can see Roland standing there looking, and big dinosaur vertebrae just laying all over the ground. I mean, a hundred yards away. It's like whoa, there's a dinosaur there. It's sticking up out of the ground. It's pretty remarkable.

So we went in there. It was the tail end of a big apatosaurus. I think it's Apatosaurus ajax, given the nature of the bones and where it is stratigraphically, that Scott Madsen and I were trying to stratigraphically figure out where it was relative to Cedar Mountain. And it turns out that that dinosaur was on a hill of Morrison under the Cedar Mountain. So you went to the east of it twenty feet or to the west twenty feet from the dinosaur and there was Cretaceous going further down section significant ways in each area. And the sauropod itself had some carbonate encrusting, so it was kind of on a hill on the paleo soil surface. Except being on the hill that it was located on, it wasn't getting all the salts we typically see forming on that unconformity. But a remarkable site. I mean, the dinosaur was probably the thing preventing erosion of that hill of mudstone away. (laughs) Because these verts were as big as basketballs. I mean, these are big, solid bones and they would have been quite resistant to erosion. So this dinosaur was holding this hill in relief there. A remarkable site.

And later we brought in the Museum of Western Colorado and salvaged the site. Dug down. There was part of a pelvis. Because of the great dip of the rocks, that animal was probably going down deep. You'd need a backhoe in there. And that would be a tough thing to do within the park. So mainly the tail was collected. But we know it's there. And really unique locality. Pretty exciting.

On another day, of course walking the Cedar Mountain Formation, I remember coming in from the end where the hike to Delicate Arch was. That parking area. And walking down the hogback to the west, toward the viewpoint. And there was a group, there was you, me, I'm not sure who else, in there. But walking down there I remember this one dipping surface and saying, "I think that's an iguanodon track." You know, big, ugly, maybe yes, maybe no type of thing. And then there was, it looked like a crocodilian trace. Pretty obvious to me it was crocodilian resting, what we now call resting trace going up there with oh, the, oh, what's his name? Oh, our trace fossil guy.

1:18:13

Santucci: Martin Lockley?

Kirkland: What? No, not Martin. Martin, that was another story. (laughter) No. Works in Georgia.

Santucci: Tony. Tony.

Kirkland: Tony, yeah, Tony Martin. Because he was showing me crocodile traces. At the time I didn't realize it was a resting trace with tracks. And a little bit further, all of a sudden that's when we saw those ornithomimid tracks in there. Probably something very close to Rebecca's *Arkansaurus*. Some real nice, very shallow. I remember sitting there all day, to get the last rays of the sun coming across that face to get some decent pictures. Because it wasn't something that was easy to photograph. Photogrammetry would do a much better job on it. I'm not sure we ever did photogrammetry to those traces.

And then of course the feeding traces. And those things we're still working on writing up. I still get on Tony Martin's case. Martin wasn't interested in them because he couldn't figure out what was going on. He said, "Oh, they're invertebrates." Tony agrees with they're vertebrate traces. (laughs) No doubt they're feeding traces of some sort on an algal film surface. Maybe they're stirring up brine shrimp or something that are the main food source, or eating both, but those semicircular little – the circles of grooves about a centimeter and a half long each, pretty distinctive. And when you start looking at low light, you realize that whole surface is kind of scooped out from that. So there's actually two levels of bioerosion of that surface. Pretty neat thing.

So eventually that's going to get written up. And Tony says now that he's locked away, he's working on it. Like come on, Tony, let's do it. You know, there's things we'll never be sure of. If it was bird or pterosaur, we're never going to be sure.

1:20:31

Santucci: And in that same little section, where the Cedar Mountain was exposed, that's where there were some dromaeosaurid like footprints.

Kirkland: Yeah. Well, there was the one dromaeosaur that Martin found in that real [trampelite?], stratigraphically up a little higher. And then went back in, Tony and myself, with Andrew Milner. Maybe Tracy Thompson was with us. And just shown the site. And we were going through there and Andrew, at the same level as the feeding traces and those ornithomimid traces, found a beautiful clear dromaeosaur track. Shallow. You know, not as deeply impressed as Martin's thing. Martin's thing has always been a little iffy to me. This is clear. Perfect. Just like the Mill Canyon ones. Same critter, I'm sure. That's probably another part of the same lake system. And on the ground below it, there's a slab – I think we turned it upside down – with the counterpart of that trace. It's still out there, as far as I know. Dromaeosaur track. Perfect. You know, two toes. Just perfect dromaeosaur trace. Laying on the ground there upside down. And we found another level a little higher with some dinosaur tracks. It was like four levels of dinosaur tracks on the margin of that pond there. It's an important site. There's no doubt about it.

And of course Martin, told Martin about it on the phone and said you know, we first found it and I definitely wanted in on it, Cedar Mountain stuff. But I wasn't expecting to be the lead author or anything. You know, and he presented a paper SVP on it without even telling me with one of his students. That really bugged me. (laughs) It's like, what part of I want to be a part of it did you not understand? Just classic. But you know, he put my name on the final published paper. And I fixed the stratigraphy because they had it so bad. They were calling the Poison Strip the Buckhorn Conglomerate. I mean, it was just, Martin, Martin, Martin.

But it turns out that site has got strong ties to the Mill Canyon track site. Same stratigraphic level. Though might be a little higher. About the same level. And certainly the same big Lake Carpenter system. And the dromaeosaur tracks right down the road. The ornithomimid tracks are pretty much identical. But maybe there's a few little bit bigger ones at Mill Canyon. But they're the same kind of track. I mean, they're distinctive in terms of the pad orientations and things. But that's a remarkable site. It's one of the most diverse track sites on the continent. Ten different kinds of animals making tracks on one surface. If I was the BLM, I'd put a building over the site, personally. But they don't talk to me. Just let people walk all over it. But it's got turtles, birds, crocodilians, iguanodons, nodosaurs, ornithomimids, dromaeosaurs, big carnosaurs. All in one site. (laughs) Pretty remarkable site.

Santucci: One more specific—

1:24:17

Kirkland: But it's the same system as in Arches. Same system.

Santucci: Okay. One more specific question regarding Arches. So do you remember when we communicated probably about eight or—

Kirkland: I can say a little more once, that was just that first season. (laughs)

Santucci: Oh, okay. Go ahead. I'll save my question for later. Go right ahead.

Kirkland: Well, you know, we looked at that stuff. Very neat. But a few years ago, I said we should go in and look at the Chinle a little closer there. Because we hadn't really done much, and the Chinle has been a gold mine everywhere we look at it, almost every one of the parks in terms of its fossil content. And I was also really intrigued by the lower part of the Glen Canyon group there. Because instead of forming the giant single cliff that the Wingate tends to form above the Chinle, there was a whole series of steps. And some of the steps looked very much like they were fluvial, as opposed to aeolian. So I was really wanting to start looking at that stuff.

So working with you, we got a project where we went in there for another couple of weeks. And you'd pointed out to us some Tertiary things that needed to be zoomed in on. And that became really significant, because we were able to show how there is late Tertiary and Pleistocene tectonic motions as depositions occurring within Salt Valley. These places inside the valley that were turned up and folded and then truncated across the top. As that whole thing collapsed, as salt was remobilized and started moving back up into things again. That was pretty interesting. And we started finding, of course we found a lot of track sites. Great ones in the Navajo, great burrow systems in the Navajo, tritylodonts, and whatnot.

But Don found some transitionary fossils going into the Wingate pretty clearly. I mean, maybe you might argue is it Rock Point or Wingate. But phytosaur teeth and things that show that there was indeed a transition there of Triassic fossils going up into the Glen Canyon group. And that was pretty exciting. So that project was pretty good. We found some neat things. We found some good Navajo track sites, the burrow horizons that go through the region. You know, there's two horizons that are regional in extent. And some of the fossil sites that we found in the Chinle. The – whatchamacallit – the *Sanmiguellia*. We found one of the oldest *Sanmiguellia* San Miguela's ever found, this Triassic plant. Sid Ash got pretty excited about it and wrote it up. Big possible ancestor to angiosperms. Interesting plant. And of course, not too far after that, Zion, they found [unclear] up into the overlying Moennavi. As the youngest San Miguela ever found. We've expanded the range of that thing quite a bit.

But that was a neat project. And we're actually got a grant proposal with BLM to follow those rocks to the east of Arches along the Dome Plateau above the Colorado River. And I'm hoping we get funded. Even if we don't get funded, I'd like to do another week in there looking at the Kayenta Formation, largely. Because as we found with the Cedar Mountain, salt tectonics might have been affecting deposition at Kayenta. Because when we did that – oh, I didn't even mention, we found the first big therapod dinosaur ever found in the Kayenta in Arizona there. And Adam Marsh of PEFO is actually describing it right now. It's in the collection at Arches. Unfortunately we found the dinosaur way too late. But it was a skeleton at one time. Just found the last dregs of it. So we're going to start looking east of the park, see if we can find more of it. And certainly the park should just keep their eyes open for more Kayenta skeletons in the park, too. But that is pretty exciting. Because that was the first dinosaur ever found in the Kayenta of Arizona.

Santucci: Very good. So a specific question related to Arches, and you already mentioned a little bit about it. And it has to do with John Hanley, who worked for the US Geological Survey.

1:29:22

Kirkland: Oh, yeah. Yeah.

Santucci: He had passed away early in his life. And I had shared with you some USGS E&R reports that were tied to some collections that were at the USGS Fossil Repository in Denver.

Kirkland: Yeah.

Santucci: And these were attributed to Green River gastropods.

Kirkland: No question it's Green River *Gyrolis.*

Santucci: Yes.

Kirkland: Yeah. We found some more further down the valley back where those were found. That was the place where we found the rocks have been folded and then truncated.

Santucci: So you and myself were able—

Kirkland: We went down the Salt Valley to the north, a couple low hills in the flats. You could barely come up, maybe ten feet higher than the surrounding flats. And if you hike out from the road and walk on top of those, you'll find rocks with those snails in them.

Santucci: Yeah, you and myself did that. We went directly straight out from the Wolf Ranch Road, cutoff road.

Kirkland: Yeah, that's where we found the fold.

Santucci: Yes.

Kirkland: Where we actually found more of the snails was about five miles down from, you know where the road comes down below Fiery Furnace and goes north to the north entrance in the big flat valley. There's some like low hills. I mean, not even hills. Like just berms about ten feet higher than the surrounding flats. And on top of those, the lag was chunks of limestone with those snails on it. And Green River age, for sure. Chunks of Green River. I think there were also chunks of Mesa Verde there, too.

Santucci: So when I first reviewed those E&R reports and looked at those collections, I contacted you. And your first reaction was, this park was just mapped by Hellmut Doelling and there's no Green River in there. And so—

1:31:26

Kirkland: And there isn't. There isn't any mappable in place. It's rocks. I mean, are there class—

Santucci: But there's evidence within the park, within that Salt Valley anticline. What sort of significance is that?

Kirkland: Well, what it's showing us, for sure, one, the Pleistocene in there, because of the anticline we found, you know, salt was moving, that place was collapsing. And as it was collapsing, of course, the Book Cliffs were eroding to the north. You know, back eroding northward. The high wall. And some of the rubble that actually came down into that drainage, the Salt Valley. And it was draining. Remember, that stuff drained for that north entrance out to the river. So rubble landing in Valley City, say, right on the edge of the park, on the north end. Still had the potential in a big flood to be washed down into the valley. So you've got this Pleistocene sediment, rubble, coming down into the valley as it's subsiding. And within that are clasts of Cretaceous, Mesa Verde Group and limestone chunks from the Green River Formation. And those rocks are basically reworked, I mean, those little flat hills, probably the old river bottom of the stream when it was going down to the river and the Book Cliffs were a lot closer to where they are today. Because you don't see chunks of that stuff very commonly. But if you stop at Mount Carmel Junction at the rest area, you know that terrace there where you can go up and look over at Arches, they're a class of that stuff there in the terrace. But that last, that whole slope probably, you could almost probably just draw a line and angle that down all the way down into the valley into Arches. The old valley floor, probably 150,000 years ago.

That one thing, we mention in that report that we found out later, that folded rock, there's an ash in those rocks that have been dated, in that fold, by someone else working in there. And it's an ash that's one of the major ashes dating the terraces along the Book Cliffs. And that seems to occur right in that fold there by Wolf Creek Ranch. So you've got a dated ash that shows 150,000 years ago that that stuff was flexed and truncated. I mean, it was flat, since 150, those rocks were folded and then truncated. (laughs)

Santucci: So you've done important field work north and to the east of Arches National Park.

Kirkland: All around it. (laughs)

Santucci: You've been working on the Dalton Wells Quarry and the Poison Strip and many other areas.

Kirkland: We have hundreds, we have hundreds of sites around Arches.

Santucci: Significant contributions.

Kirkland: Significant sites. Probably fifty bone beds as big as Cleveland Lloyd.

1:35:10

Santucci: So you want to put that into a perspective overall in terms of what lies around Arches National Park in terms of paleontological significance?

Kirkland: Well, one of the things that we discovered, and I published in 2016 the first time that I actually said it in a publication is when you look at the Cedar Mountain outcrop belt that wraps around the Salt Valley anticline, basically there's a few chunks of these rocks in the Salt Valley anticline. But they're not very fossiliferous rocks. They tend to be on the outside. On the north side of the park, dozens of sites. Type localities of, you know, ten different kinds of dinosaurs up there. On the west side of the park, you've got another five or six type localities of dinosaurs in those sites along there. But the reason we have those Yellow Cat dinosaur sites is salt tectonics. The salt, when it was forming Salt Valley anticline, the old literature always talks about happening up into the Triassic. But if you actually read Doelling Hellmut – Doelling in his Arches geology paper, suggested it was going on into the early Cretaceous. He doesn't give you any evidence. Just kind of states it. But it absolutely was. And we end up around Arches. We have the two oldest Cretaceous dinosaur faunas in all of North America. Because the salt was coming up into the Salt Valley anticline. And probably sucking to the south as well along the axis of the anticline. There's local subsidence. And a whole bunch of lakes and things formed in that interval around there. That was kind of a closed basin. Subsiding there everywhere else is erosional across the western part of the US. And those two faunas separated by a very distinct paleosol that marked the beginning of the rain shadow of the Sevier thrust belt, basically preserves the two oldest dinosaur faunas in all of North America. *Yurgovuchia* -Mierasaurus fauna and the overlying *Utahraptor- Moabosaurus* multisaurus - *Gastonia* fauna.

But both of those faunas, the only reason they exist—they're only in Grand County—is salt tectonics. What made Arches preserved these dinosaur sites uniquely there and nowhere else on the continent, that we know of. And that's cool. I mean, it really is. That's why I want the

Utahraptors State Park so bad. (laughs) Doesn't look like it's going to happen for a while. But these things are unique. It's a unique story to that area. And we now know the lower part, this oldest fauna is 140 million. It's probably the first fauna anywhere following the Jurassic extinctions. You know, so it's Valaginian, 140 million years old. Before, we thought the oldest Cedar Mountain's 125. So it's just given us another 15 million years of history. That's like Miocene to recent. That's a big hunk of time that we've added on. And it's only because of the salt that gave us the structural grain that eventually allowed us to have Arches National Park. It's really cool. I mean, it's all linked together. But that runway around the park is unique. Because we have hundreds of sites. It's one of the most fossiliferous places. We have more kinds of dinosaurs in that strip around the park than they have in Grand Staircase for diversity. You know, we've got like 35 species in there of dinosaurs .

Santucci: And so in addition to the bone record for dinosaurs, there's a tremendous megatrack site around Arches as well. A little bit inside but around the area as well.

Kirkland: Yeah. Well, you have the megatrack site associated with the coastline of the Summerville Sea, you know, Wanaka Sea depending on who you want to talk to. Where the waters came in over the Moab tongue of the Curtis. And so that's kind of late middle Jurassic. Actually, younger the Curtis, that's the beginning of the upper Jurassic. They've got dates now in the Curtis that are the early Oxfordian. So basically that megatrack site is basal upper Jurassic. In fact, the upper Jurassic has got a lot of sediment accumulated in a short period of time. And of course it goes through Summerville and then up into the Morrison. But yeah, the megatrack site is, you know, where do you want to walk? Do you want to walk on the beach? Or do you want to walk through sand dunes? Or do you want to walk in the ocean? I'll pick the beach. So all these animals were cruising along the beach at that interface over a huge area. I think calling it a freeway as Martin does is kind of misleading. It was walking along the coastline, is what it is. And it stretches for a long ways and you say okay, we can follow it for a hundred miles. Well, so let's call it a freeway instead of a coastline. (laughs) That's what it is.

1:41:25

Santucci: Well, let me ask you a quick question here.

Kirkland: And then the lake sediments, the upper, the Ruby Ranch, the upper Ruby Ranch of Lake Carpenter, that only occurs in the axis of Salt Valley anticline and to the west for about 10 miles going off of Arches. And that's where the Mill Canyon track site is. And we've got something on the order of 50 meters of lacustrine with fishes in it and all kinds of things. But it's only on the west side of Arches. We know rocks aren't even that age on the other side of Arches. So at that phase of salt motion, it was sucking salt only from the west side and not the east side at all. Which is pretty neat. But that's probably middle Aptian age. But those are the first rocks that would preserve a Cloverly fauna. As opposed to a Wealden fauna. Poison Strip, and there's three Wealden faunas below that. And from the rocks around Arches we've been able to determine there's a mass extinction you can tell across the northern hemisphere in the lower to mid-Aptian that separates the Wealden dinosaur faunas from the more restricted endemic Cloverly faunas. And that seems to be tied to major oceanic basalt flows in the Indian Ocean Basin. Oki-Java flood basalts in the Indian Ocean cause a rapid chilling of the world's temperatures. And mass extinction. There's a lot more to learn. We just discovered this mass extinction five years ago.

(laughs) But it's a big one. It's as big as the one at the end of the Jurassic. And that's only known in Grand County. (laughs) For dinosaurs. The marine realm [unclear] too.

Santucci: So, I'm going to ask you a question here. We've been chatting for a little bit over an hour and a half, about ninety minutes. Are you able to continue on?

Kirkland: Oh, sure.

Santucci: Or do you want to try to reschedule part two?

Kirkland: I usually don't eat 'til two.

Santucci: Okay. Well, let me give you a clue of the additional topics for discussion. So alphabetically, Bryce Canyon would be next. I'm not sure if you've worked there or not. Canyonlands—

Kirkland: Bryce—

Santucci: Well, before—

Kirkland: We're doing it alphabetically, Bryce—

Santucci: —before you answer, I just want to go over the outline.

Kirkland: Sure.

1:44:12

Santucci: So, Bryce Canyon, Canyonlands, Capitol Reef, Dinosaur, Glen Canyon, Zion. And then there's a couple of topical things. I wanted to talk to you about the Chinle Ecosystem Project, which you've been pretty much the advocate for. Talk to you a little bit about the Morrison Ecosystem Project, although you weren't directly involved, I wanted to talk to you about that. And then I also wanted to talk to you a little bit about illegal collecting. So that may be too much to cover today, but I just wanted to give you a general idea of some of the other discussion topics.

Kirkland: Sure.

Santucci: So, Bryce Canyon.

Kirkland: Bryce, I've done, Bryce is one of the most beautiful parks in the country. I love going to Bryce. I've spoken there several times. They have their dinosaur fest there and I've taken part in it several times. But I always think of it as that pink, unfossiliferous junk. (laughter) But there's fossils at Bryce below the Claron Formation. And so if you're sitting there by the main Bryce Canyon looking down section, what you're seeing at the bottom there is the middle part of the Wahweap underneath the Claron. You're looking at rocks that are about 180 to 181 million underneath there. Maybe even closer to 180. So there's no Kaiparowits, no Canaan Peak no Pine Hollow, none of that stuff. There's almost a mile of Cretaceous that exists at Powell Point that

doesn't exist at Bryce across the Paunsaugunt Plateau. Twelve miles apart. You've got a mile of rock strip [unclear] the Paunsaugunt Plateau. That is also remarkable. But down there, Jeff Eaton's done a lot of screen washing and in fact, named a number of critters down there. Named a sawfish after Bryce down there. *Texipristis brycensis*. But Bryce, even though it's got a nice Wahweap at the base, it hasn't been worked much. I always give Gayle Pollock when I see him a hard time because they have a mosasaur skull on exhibit there at the park. And you would not find a mosasaur skull of that type in Bryce under any conditions. (laughs) There's no marine rocks of that age, for one thing. They need to get a *Diabloceratops* skull. Because you could get a diablo at Bryce in the Wahweap. But very interesting stuff. And just south of the park—and I've done some work in there. You know, I've hiked in and Jeff Eaton's shown me sites and whatnot. Really all under Jeff's permit.

But then we've gone down south of the Cannonville, right below the park, on this little, tiny speck of private land that I wish could end up in Bryce, surrounded by nine square miles of Forest Service and then Bryce, that has Coniacian and Santonian dinosaur faunas that still haven't been developed. Every species, at two levels, would be new. Right off the edge of Bryce. You know, Gayle Pollock, oh, we should get that into Grand Staircase. He's all no, we should get that into Bryce, I'd like to see some dinosaurs in Bryce. We have hadrosaur skeletons there, therapods, turtles, giant spiny sharks, all kinds of good stuff. Which is exciting. But it's basically a group of polygamists on this tiny third of a square mile of bottomland and forest. And they pretty much keep us out of the fossil country. And they're probably ripping things off. Since they know we've been in there trying to do work. But the only way in is through their land. But it's real exciting. If you ever get one of the big conservation groups. Because these people apparently are thinking about selling their land, that buy that land to preserve it. You know, I'd talk to the Forest Service and say let's put all this into Bryce. Because it is a really important place. Hewert Canyon, very important place. But right on the edge of Bryce. So, anyway, that's my soapbox, I've pushed this one, you know, with Dave Polly Pauly and a bunch of people over the years. We have got to get this into public hands.

1:49:17

Santucci: Question. In terms of Jeff Eaton's career, he's done a lot of great work in and around Bryce Canyon.

Kirkland: Oh, yeah.

Santucci: He was at Weber State University for a while. And when he was on sabbatical, there was something that happened to some of the collections from Bryce. Do you know anything about that?

Kirkland: Oh, man. (laughs) Yeah. The Bryce stuff didn't get hurt. But the collections from a lot of the Grand Staircase collections, shark collections, the stuff I was working on, got thrown out. Apparently he had a student working on those. I mean, they were in my lab here or in Salt Lake. For several years, I was working on it. But Jeff had the good photography equipment to photograph that stuff. And Jeff said, "Why don't you bring it up here? I've got a student who wants to work on the rays. We can photograph it up here. I'm all set up. I've been shooting

animals like crazy. He's just a machine shooting these." And I thought okay, you know, then we can return them to the Museum of Northern Arizona. Because they're mostly MNA specimens.

Well, bring them up. Everything all copacetic, you know. I had everything all organized. You know, trays of drilled things on pinheads. I knew what I wanted to photograph, too. It was all laid out. And he had this student working on this project. And then he got a sabbatical thing to Czechoslovakia. And took off to Czechoslovakia for a year. Came back. These collections were all gone. Apparently this student left them in the microscope cabinets or something. And at some point, when they started the new school year, the faculty, whoever's in charge, said, "Clean all the cabinets. Throw all the junk out so we're ready for the year." And they threw it all out. Is our guess what happened. I mean, Jeff was so upset when he figured out what had happened to his rocks. He was like ready to quit paleo. He was really, really heartbroken. I was just relieved it wasn't my fault. (laughs) But totally disappointed because there were some really nice specimens. Probably could have named another five species if that stuff hadn't been tossed.

1:51:45

Santucci: Your understanding that there wasn't any Park Service collections that were lost.

Kirkland: Yeah, it was all Grand Staircase. The Bryce collections were kept separately in another place.

Santucci: Great.

Kirkland: So all the Bryce stuff was okay.

Santucci: Perfect.

Kirkland: In fact, half the stuff I described was from Bryce. That existed. (laughs)

Santucci: And how many types did you describe from Bryce?

Kirkland: I don't know, three or four from that. You got a copy of the paper quickly.

Santucci: Yes. Mm hmm.

Kirkland: The stuff on the Wahweap, pretty much every type specimen from the Wahweap level is Bryce.

Santucci: And so as we did for Arches, what would you say the significance of the paleontological resources from Bryce would be?

Kirkland: One of the things, of course you have this middle Campanian fauna, which we have in the lower Wahweap and Grand Staircase as well. But you know, it's poorly studied fauna. All we know, and you've got a bunch of mammals and things. I'm not sure what his final faunal lists are because I was only working on the shark part of it. But real nice middle Campanian assemblage of microvertebrates. And there were some sites where there were dinosaur bones. Because I wanted to find some dinosaurs. And he took me to a couple of places but they were pretty much

broken up bones in river channels that weren't very favorable to just start whacking into. I think if someone was working in there, in Bryce more carefully, they might find some things that were worth excavating. Like a skull near the surface or something like that. But it's the microfaunas that really shine from what—you go a little further down, you hit the Drip Tank ledge, and there's almost nothing on the drip tank. And below that, the Straight Cliffs. Pretty much you're getting out of the park as you get down to that stuff. So really only got Drip Tank and Wahweap. And the only area I've looked at, at the bottom of Bryce Canyon, you know that big amphitheater area. You know, clanked all over there. But I haven't been further south toward Hewert Canyon and these other sites that we know of that are below the park. Except I know they're full of dinosaurs that haven't been described.

That's one of the things we want one of those conservation groups to buy that property. I've got my inside person, Madi Serich, down there. She's just going out on mission, but she's going to University of Utah now in paleo. She wants to be a paleontologist. And she's from Tropic. Born and bred in Tropic. Her great-grandfather established the Ruby Inn (laughs). But they're keeping their eye out, because they know we want to know whatever's happening before it's too late. If I can find a sugar daddy to buy the property. I do have a connection who's a billionaire, but I don't know if I can talk him into buying that land. (laughs)

Santucci: Okay. Very good. So, Canyonlands is a project that we're currently going to begin work on. We have a cooperative agreement that's moving through the administrative process. So what is your vision for Canyonlands, and what can you tell us about the paleontological resources overall for the park?

1:55:46

Kirkland: Well the big stuff I know about, of course there's the big cladodont shark spine that every time we talk about the park, someone pulls out a picture of it. (laughs) Which is a beautiful spine, should get replicated. It's evidence of a big shark. But basically on the east side of Canyonlands, Indian Creek, a lot of that country that became a new monument, or you know, a fragment of the Bears' Ears stuff. There's some really important—that's where a lot of the Hasiotis crayfish stuff came from. I mean, some of this stuff I've only realized in the last year or two. Usually always talk about it being from Canyonlands but it's largely from right along the border of the park where the University of New York, Buffalo, had their field camps. And it was a state section they used to camp on and go up this hill behind their camp and collect fossil fish. Triassic fish and crayfish. And the kids would keep them. And they've been doing that for twenty years. The college, Buffalo, Hasiotis' group. I know that now. I know where the site is. And it's totally butchered. Andrew went in there, there's just pits everywhere. They were just hacking this hill apart. I expect that stuff goes right into Arches, right into Canyonlands. But no one's followed it into Canyonlands as far as I know. So it would be interesting. But there are definitely fishes and crayfish in abundance at this level. This is some of the stuff we're hoping to figure out up there at Island in the Sky. You know, I really hope we can get permits to fly a drone just to make a stratigraphic framework for that area to plug all the sites into. I think we'll find that stuff over there.

And Don went in there a month ago now doing an oil and gas survey. You know, down by the river there's a number of old uranium mines. These are just outside of Canyonlands on the

north end, I think. But in that area, he was told about a Wingate block that had some tracks on it. He found that and then seven others right against the edge of the park that he said would make an amazing interpretive site. You hike around these blocks and there's tracks all over that have come off the cliffs. And that's along the north edge of Canyonlands proper, right near the road. I mean, these blocks, they're just turned the wrong way so you don't know about them if you're on the road. You have to hike back to turn around and see them. But beautiful track stuff all over them. That's one of the things we want to promote but it is off the park. But we'll find that stuff in the park, too. You know, I expect there's going to be a really good Triassic record there. And of course it's not till you're up on the rim do you see the Kayenta but fortunately Wingate comes down and blocks, so we should be able to find some good Wingate sites below the cliffs.

Santucci: Very good.

1:59:34

Kirkland: And the Paleozoic stuff, don't ask me. I am not a Paleozoic worker in this state. And I'd love to get Jeff out there. But I'm figuring I can do the section as well as anybody. But we do want, I figure one right along the road. You know, you do the strat work right along the road. And then if we can get permits to fly a drone, we take marker beds and just trace them all through the north end of the park. And when sites are between, at this bed and this bed, you know, they are the section. So we can put together a nice Triassic history for the park. And like the other parks, the Triassic, the climate record is, you know, needs to be talked about Capitol Reef and at Canyonlands, that the beginning of the Upper Triassic, we were basically in rainforest on the equator. You know, the basal stuff. And then as you go up section, it gets drier and drier, PEFO you start getting savannah-like soils. So eventually you hit the Wingate and you're in a desert. So you have this incredible climate record preserved in single outcrops. You know, going from rainforest to Sahara Desert. And that's pretty cool. I mean, I always look at that outgrowth across the street from the headquarters of Capitol Reef like you should just have a place for people to stand there with an interpretive sign of that outcrop across the street. And just explained, "Do you want to see climate change, folks? This is climate change." (laughs) Because it is. It's an incredible record right there at the headquarters. But there's a good one, similar record, up on the north end of Canyonlands as well. It's just not worked as much.

Santucci: Great. So, let's see. Moving on to Capitol Reef. You've been there a couple of times for some fieldwork.

Kirkland: Yeah. I first started at Capitol Reef with George Billingsley. When George was mapping Capitol Reef and doing his cross-section with Capitol Reef Natural History Association, I got to go in with him to field check the maps. And we flew all over that park. Because he went in to do the main work, and then there was just a huge flood. We get in there and I remember a stop sign covered with tumbleweed. You didn't see the stop sign. You know, we were coming across, out of a side canyon into the Fremont Valley there. Big, big flood. So you couldn't drive anywhere we wanted to be. So we ended up flying most of it and field checking the maps. Which was fun. (laughs) I spent a week probably four hours a day in an airplane going downside canyon. We were flying like down canyons. You guys probably wouldn't approve of this now, but it was the only way to field check the map was from the air. That first geologic map, that was the result of that project.

As it turned, out, we found out that the whole north end was mapped wrong. And Hellmut Doelling had mapped it wrong, too. It turned out to be a very well-camouflaged (laughs) error that any person would have made the mistake. We were just lucky enough. They had the tool, you know, working on Cedar Mountain as much as I had, to recognize the problem.

But when we went in that second time, I wanted to look at Cedar Mountain. And Margaret and Scott Madsen had dug up some dinosaurs right on the edge of the park at Blue Flats. And you could see along the west side of Blue Flats, you have a whole Cedar Mountain/Morrison Outcrop Belt that went across. And I had been brought in there at one point around 2000 by—what's that ranger's name? Duffy—

Santucci: Sean Duffy.

2:04:16

Kirkland: —yeah, Sean Duffy brought me in. Because at that point, I guess the park basically didn't accept that there was any Cedar Mountain within the park at all. And if you go south along the road, you know, the Notom Road, look at the Morrison, the Naturita Dakota sits directly on the Morrison down there along that road At Notom there is Cedar Mountain. But where you get in close to the park again, there is no Cedar Mountain down there. So we were looking at northern end to see. And there was a group from Port Hayes University that did their field camps in there. And they had found part of a *Camarasaurus* in the park, in the Morrison. And he wanted me to get a chance to see that dinosaur, see what I think. So I knew there was some stuff in there, so I wanted to go in and look at that. But I knew there wasn't that much. Because I'd looked at the Morrison down south and it was really barren. The Morrison is not as fossiliferous everywhere, there is no doubt. I didn't realize that the northern stuff would be as bad as it was. It had some decent sites. But you know, it's not Dinosaur Monument. It's not the Arches region. It's ten times more fossiliferous around Arches than it is at Capitol Reef. Of course, it goes to zero as you get to Grand Staircase.

So we said okay, let's look at the Chinle as well. Great Chinle outcrop belt, and it hadn't been looked at much. And we were a little bit, thinking a little big for our britches on how much strat work we did, but we got three sections done. Thanks to Jeff Martz. And found some really good sites. There are sites that we found that are very worth interpreting. You know, of course we refound the *Equisities* grove. That site is really remarkable. And it should be interpreted. And we have fossils from that site that are beautiful. The best looking fossils of anything like that I've ever seen in my life. I mean, you see all the details of the nodes and the edge of the trunk. They're beautifully preserved things. You know, they're in the report, but the report doesn't do them justice. In fact, I have a question for you. Is the museum, Utah Museum of Natural History, ever going to get an agreement with Capitol Reef?

Santucci: Yeah, I can't answer that on behalf of the park.

Kirkland: I hear Randy doesn't want to put an agreement together unless he has an agreement for all the parks in the state. In regarding how specimens are curated and all that, which I don't think you guys are ever going to give them.

Santucci: Yeah, I can't speak on that. But my question is—

Kirkland: I know you can't speak on it. But it's an important issue.

Santucci: Oh, yeah.

Kirkland: Because we're sitting on a lot of fossils that should be curated. When I retire and Don retires, then we can start heading into some problems, you know.

Santucci: Right.

Kirkland: And I'm wondering, and I'm serious now, if these things could go to Arches. And you know, some of it go into an exhibit. I mean, the *Equisities* are gorgeous things.

Santucci: Yeah. So what I'll do is, I'm making a note now so we can talk about this.

Kirkland: Yeah, let's talk about this.

Santucci: Outside of the interview.

Kirkland: Yeah. Because we've got everything ready to curate.

Santucci: Yes.

Kirkland: And there's some beautiful specimens. But if the U is not going – originally I think they were going to be a separate agreement. And it sounded like Capitol Reef's all for it. But the park, their registrar and stuff, [unclear] they didn't like the way things were going with Bryce with Jeff Eaton collections, I guess.

2:08:27

Santucci: So let's save that for later. I wanted to ask you a question—

Kirkland: But I did want to bring it up before I forgot.

Santucci: Yeah. Thank you.

Kirkland: Because that's something that's important to me right now.

Santucci: So, the locality with the standing stumps, that was the locality that we had Jack Wood do the photogrammetry, is that correct?

Kirkland: Yeah. Unfortunately there were a couple of holes in this photogrammetry. You know, that should be reshot you know? Because my view is like you take that photogrammetry and then 3-D reconstruct it in a smaller scale that you can fit into one of those cases there and then have some of the fossils and stuff. You know, Chinle stuff in front of it. I think you could have a beautiful Chinle exhibit. I mean, it's really well worth thinking about. But you know how the parks are. You get some, they're all for it. And then next time you're at the park, there's not a single person that was there last time. "Who are you?" (laughs) Which drive you nuts if you work with parks. "I've worked here for years." "I don't know you. I've only worked here three years." (laughs) but I would love to see something done. Because the Chinle is the paleo thing

for Capitol Reef. There is no question. There could be some great interpretation there. You know, the Cedar Mountain, yeah, it's okay. If we get this skeleton finish prep and it can get mounted eventually, it might be worth, because it's only about half a mile from the park where we collected it. It might be neat. It's got *Deinonychus* coprolites in that we're looking at for feathers. From preening. Pretty neat fossil. But the Chinle is the stuff there. Just keep that in mind.

And of course the Wingate. It's a cliff. Navajos. Cliff. (laughs) So the Chinle is—and of course the Moenkopi story of the traces is another important story there. But that's the one, paleontologically, that's the one I'd focus on.

But for your visitors, and you know how the visitors are, they're seeing only past Caneville and Factory Butte as Capitol Reef. You know, all that marine Cretaceous, they see the whole region. I still think it's worthy of interpreting the region in there because it's so amazing. I'd like to see Capitol Reef expanded, personally. It's my favorite park. It really is. It's just the borders are just in all the wrong places. For paleo. Not for scenic beauty.

02:11:40

Santucci: Good. Are you good to go on?

Kirkland: Yeah.

Santucci: Okay. So although there's been some challenges for working at Dinosaur, had you ever done any work at Dinosaur National Monument? And can you talk about—

Kirkland: Let me finish Capitol Reef. Oh, sorry, I didn't finish Capitol Reef. And you know, because we've done the reports, we found a major area, many square miles across the northern part of Capitol Reef that was mipmapped as Jurassic. And it's Early Cretaceous as over a vast area. Where Buckhorn Conglomerate was mistaken as Salt Wash. Where it comes down and sits on the Salt Wash. And the upper part of the Chinle, I mean, the upper part of the Cedar Mountain Formation, was interpreted as being the upper part of the Morrison, the Brushy Basin Member. It's all Ruby Ranch. And all of that is being remapped right now by Grant. It's one of the things he's working real hard to get completed before he retires is to get that whole northern part of the park corrected. Because it's a big area. (laughs) And it's significant. And it's going to eventually, my next big paper on the Jurassic/early Cretaceous is going to include data from that project as well as data from Grand Staircase. And that is pertinent to it as well. So we're going to try to put all that together from that part of southern Utah into a paper on the Jurassic/Cretaceous unconformity as you lap out of the Colorado Plateau toward the border with Nevada. It's interesting. It's kind of a neat story we're putting together. Anyway, just want to make sure that's included in here because that is really interesting.

Santucci: Thank you. Very good. Dinosaur National Monument?

Kirkland: Yes, Dinosaur. Of course working out of there for years, I mean I first worked the Pipeline Road with Jeff Eaton in the '80s, '84, I think that's when I made enough money to buy myself my first computer and to buy my first Kirkham's tent (laughs) But doing the pipeline inventory and the collections, of course, from all that work are at the University of Colorado

Geologic Museum collections. But mostly invertebrates, ammonites, and stuff. Jeff did a monitoring project on one of the channels. I think it was one of the channels up north where Marsh found the first allosaur in Utah. And monitored them, cutting through that bone bed that crosses the pipeline. And realized all that does is destroy the bone. You don't get anything good, there's no point if you're going to let someone trench through a bone bed for a pipeline, write it off. Or where in Wyoming, they make them do an inventory, collect the fossils to below the depth of the pipeline. Which costs a lot more money. But given how much money's going to flow down that pipeline, it's trivial. But that pipeline, there's been four different cuts through that bone bed (laughs) on that side of Dinosaur through that bone bed that obliterated everything. And it's a bone bed that is as dense with skeletons as the quarry bed at Dinosaur, you know? So to watch what happens when trenching machines go through something like that is pretty sad.

But that's where I started, doing that around that side of Arches. That's when I first met Dan Chure. You know, had Dan give me the tour of the face of Dinosaur. It was pretty entertaining. But then the pipeline went all the way out along the road heading to Colorado. We found those Eocene Raven Ridge sites. We found a lot of important sites on that inventory. Unfortunately, we didn't find Sue Anne's *Haplocanthosaurus* (laughs) But it was on the pipeline, too.

So next time I worked in there, really, we used to go up, when I was at Dinamation, we used to visit all the time. You know, Scott was working at the park. And we'd go up there through the summers every other week with a group of people. You know, we'd just take up and tour the park. And during that interval is when they found the *Allosaurus jimmadseni*. So got to watch that entire thing get excavated and some of the work go on at Dino, what was that, 1996? The Cedar Mountain bone bed they've got up there. Got to watch a lot of that stuff and look at the results of those excavations. Scott would show me that stuff. Really, really exciting period of time for that park. Rainbow Park. Scott would take me up to show me some of their work up there on microsites. So I got to see a lot of the Jurassic in the park and around its margins over those years. And in the early aughts, yeah, early aughts. Around 2000 or so. That's when I started working with University of Iowa. And Nebraska Survey's Matt Joeckel and Greg Ludvicksonon the Cedar Mountain Formation in the park, collecting geochemical data. And we did a section over by the *A. jimmadseni* site and another section over by the Cedar Mountain dinosaur site. And kind of redefine where the contacts were in there. And some of that work has been published. And some of it we're able to tie into the work that Doug Sprinkle had been doing in the region. So we got some nice stuff published on the Cedar Mountain Formation a few years ago. We combined both data from the park and data on the margins of the park.

You know, so much of the best fossil country around there is outside the park. I was looking at the Marshasaurus skeleton that Joe Sertich is working on describing from, that Scott dug up right from the edge of the park. And that's a beautiful skeleton. (laughs) That is an amazing site. Unfortunately, that wasn't in, most of the prep was done at the park. But it ended up going to Denver. You probably know more about that than I do. Why the park didn't hold onto that since it's right on the edge of the park.

Santucci: Anything else for Dinosaur?

2:19:49

Kirkland: That would be about it. The geochem work, publishing Cedar Mountain stuff, digging up dinosaurs on the edge of the park. But none of it in the park. Always a guest. (laughs)

Santucci: Okay. Ready to move to Glen Canyon National Recreation Area?

Kirkland: Okay. This is a biggie. We're going to scratch that place.

Santucci: We can save Glen Canyon if you want to go to Zion next.

Kirkland: I'd say it's whatever you want.

Santucci: Yeah, why don't you go ahead and talk about Zion in case you tire out on this?

Kirkland: (laughs) Okey doke. Well Zion, which is also a park I think very highly of, we got started in there because it was this grant that was awarded to, I'm trying to think who it was awarded to to work on some marsh deposits. You know, up on the canyon here where the Virgin River's heading toward the Narrows, behind some of the rock falls up there. There's a sequence of marsh deposits. And all of a sudden oh, we have like ten, twelve grand here that no one's going to spend on the proper use. Maybe we can turn this into the beginnings of a paleo inventory. So we used that money. That money was awarded to us then. And we began the work on the Chinle, mainly, in the park. And looking up at the Moenkopi as well around the park. And working with your intern, oh, what's her name? She's teaching in Georgia Tech now.

Santucci: Christy Visaggi?

Kirkland: Hmm?

Santucci: Christy Visaggi?

Kirkland: No, oh, man.

Santucci: Erica [Klaits?]?

Kirkland: No. This is before that.

Santucci: Josh Smith?

Kirkland: No. This is after Josh. Right in between there, [unclear]. Real nice. She really worked out well for us because she was doing an inventory like in the winter. We worked there like January, February. And she was there doing an internship same time of year. And basically went out with us once she showed up, every time we went out. And I think she feels, we're good friends still. That's why, I'm so bad with names. I feel ashamed of myself. (laughs) Just drop the name in the transcript. (laughter) I know, because I'm embarrassed, you know, I shouldn't – I remember a fossil like it's sitting here next to me, but people. It's just, I'm one of those guys, I remember the name of a person, I'm going to forget the name of a fossil. (laughs) Got to have priorities. But anyway, she came out quite a bit with us.

Of course Josh was there when we first started that project. He showed us a few of his sites. I think he was pretty much done. I mean, you gave him some more money to try to do the write-up. I remember you wanted him to be the senior author on that write-up. And we learned that Josh isn't the biggest guy for write-ups (laughs) out there. As are many. You know, some people don't write things up that much.

Santucci: He's very good in the field.

2:23:47

Kirkland: Oh, yeah. No, he's a good guy. I mean, I like Josh a lot. And he's got a good eye, too. But yeah, he's not one for writing final reports. (laughs) That's for sure. But yeah, I remember him having some problems with a couple, I think, of your seasonal rangers. Where he learned he probably shouldn't show seasonal rangers all the sites. (laughs) There was a little bit of problem there. But certainly—oh, man, I'm killing myself. I keep thinking Marilyn, Monica, her name. But anyway, she worked out real well. Worked with the [Scolap?] Canyons and a number of sites. And we got some really good Chinle sites. In fact, the Chinle Trail, which used to be the Petrified Forest Trail, starts off at Anasazi Estates there at Rockville, they were just really starting in Rockville. And heck, there were phytosaurs and stuff coming out of where there are houses now around there. There's a major bone bed about a hundred yards from the park boundary right on the edge of the development that I keep pushing that needs to be excavated. And if there's justice in this world, the BLM would turn those two sections over to the park and let it be part of the park.

Santucci: Jenny McGuire.

Kirkland: Jenny McGuire! Yes! She was great. I mean, she was. She was such a pleasure to be around.

Santucci: Oh, yes.

Kirkland: She's wonderful. And real good. I really enjoyed working with her. Man, that was killing me. (laughter) But she worked on mammals. That's her problem. (laughs) But we've had dinner a few times at SVP and stuff. We're all good friends. That was a good season together. But we found some pretty good phytosaur stuff there including along the trail heading out to the Petrified Forest. You know, log jams on top of the Shinarump out there. And we found that area where the people had been cutting the fence and driving in and stealing logs. I don't know what that place looks like now. But certainly unless you folks have gone out there and picked up those spools of barbed wire and stuff, they're probably still sitting there. People just have their barbed wire spools, cut the fence, go drive in. You can see the road going right across, overland to the outcrops about a mile in. And then come back and rebuild the fence. And it was just so obvious. But there were a lot of Chinle sites over in that part of the world. [unclear] 2:27:23 an important section. And Mount Kinesava another important section with sites going up the hill. Andrew found some pretty nice stuff on our second stint in there.

Santucci: Andrew Milner.

Kirkland: Going up that hill. In fact we got a good strat, part of a strat section there, lower part.

Santucci: Sure. I just want to clarify for the record, Andrew Milner is who you're referring to.

2:27:46

Kirkland: Yeah. Yeah. Andrew. He came out the other time, too, and would help out. Andrew's such a good hand on all this stuff. Great eye. Even though he's only got one that works, it's a really good one. (laughs) Yeah, Andrew found some good stuff over in there.

And when we did that second project for the BLM, the wilderness areas on the edge of the park, Eagle Crags, that's when we found that giant phytosaur skull. That was right at the edge of the park. And it occurs in the park, too. We've got fragments of rock coming from this giant phytosaur. And the skull we got was almost two meters long. Randy was telling us it's probably the second biggest phytosaur ever found anywhere in the world. And it's the only one of its kind ever found on the Colorado Plateau. Because one of the things Jeff Marts contributed to this whole thing is, in figuring out the diachroneity of the Chinle rocks as you go from Capitol Reef to the west, to Zion. And I haven't heard the result of Lake Mead. He has done the Lake Mead work?

Santucci: He's done some fieldwork. He hasn't written up that information yet.

Kirkland: Did he measure a section, do you know?

Santucci: I believe he began to, yes.

Kirkland: Yeah. Because that's going to be very telling, what that section looks like.

Santucci: Yeah. The western edge of the Chinle.

Kirkland: Mm hmm. Yeah. But the Zion section is so different. And given the historic thing, which I've been playing with Gregory some on the Morrison, where Gregory used the Zion project as a chance to name the Petrified Forest Member, has led to a lot of confusion regarding the Petrified Forest Member. Because we would all assume it's at Petrified Forest National Park. But he named it, talking about the logs and things and the mudstone [unclear] the Chinle. And just kind of threw out, "And we should call these the Petrified Forest Member, since it is well developed at Petrified Forest and it's similar to what we see here." Which it's not even the same age. (laughs) Petrified Forest Member at PEFO.

And we made a decision that instead of destroying that as a member of the Chinle, which probably a lot of people would have done, that basically is his statement that it's typically developed at Petrified Forest. You know, we're talking about the extent, it extends all the way around Ward Terrace. And it's typically developed at PEFO as well. That he intended that, since he used that name, to make it the Petrified Forest member. But I think that trail might have already existed then. It might have been the Petrified Forest Trail then when he named it. But we won't pay attention to that. (laughs) Would you hate to lose the Petrified Forest Member?

Santucci: Yes.

Kirkland: (laughs) For a technicality? That gave us a lot of heartburn. But I think we came up with the appropriate decision. Just a casual reference to Petrified Forest Member is why it's there.

And one of those sections, old Jeff Martz' down at the park, should actually be declared the new type section. Or reference section for the member. It needs to be done. Make a note to talk to Adam about that. But it should be done just to clarify this is the type section. Because there isn't a type section, not at this point.

2:32:09

Santucci: Very good.

Kirkland: But Zion, you know, you've got some really good sites. The road, what is it, Kolob Reservoir, heads north. And we were there in kind of the winter, so you only go so far. So we got snow ends the road, there's like four feet of snow on the road. But we found some sites in the Kayenta, right along the road. In fact there was like an abandoned road below the paved road. And along that abandoned road there's some really good Kayenta track stuff in slabby shale that's just weathering out into slabs all on the side of this abandoned road cut. Including things with four toes and some really neat things. And there was fish material there as well. And I still consider that one of the more important sites we found in the park. You know, an area deserving more work. We were there part of one day. And it's a place where I could see going in there and studying it for a week or so. I could see someone doing a thesis on that outcrop. Very, very interesting stuff.

But Zion, Zion's an interesting park. It's a tough one because it's so steep. But it's got some important fossils in it and around it. And I'd still like to get a phytosaur skull cast — skulls on there reproduced for the park. Because that's probably the biggest vertebrate fossil that occurs in the park is that animal. And maybe [unclear] I don't know, maybe he'll be Zionasaurus once it gets described.

Santucci: And who will do the description on that?

Kirkland: That will be, I believe, oh, what's her name? At Virginia Tech. Sterling Nesbitt's wife. And he's the collateral job. She's the one that's got the real job there. Oh, what's her name? Michelle, okay, that's her first name. I'm just remembering her first name. But she's a phytosaur person. [Michelle Stocker].

Santucci: Okay.

Kirkland: And there aren't many of them. And I'm assuming, I mean, you don't know with Randy. Randy's always a little tricky to figure out. (laughs) But Randy might just say, take one of his students [unclear] you're going to describe this for your thesis. Because it's a worthwhile thesis project. But having her do it since she has looked at everybody in the world. She described the Middle Triassic proto-phytosaur from China as well as looking at all the European stuff, she'd be the best person to do it. But it's close to augustorhinus. It's a very neat skull. And lower jaws, enough for the teeth that you could fill out with all the teeth into a reconstructed skull. It would be a great looking mount that is real big. And it's very different than the Petrified Forest

stuff. It's a lot older. It's older than anything at Petrified Forest. I mean Jeff and all those guys think this is the oldest, the stuff there at Zion is the oldest Chinle stuff on the plateau. Which is pretty interesting because of the diachroneity as you go west. Heck, if there's any real Petrified Forest Member, it's only the top ten or twenty feet of the Chinle section there. And then it's truncated under the unconformity at the base of the Moenkopi. Which is interesting.

And of course there's a good Moenkopi section there. We've been able to drag Selina into that area. And you've probably got copies of her stuff.

Santucci: Yes.

02:36:33

Kirkland: Celina Suarez has published on there. And I'm really happy she's taken over some of that work. Because that's basically that's section Moenave there. In the western US, that's the most important Triassic/Jurassic boundary sequence is that stuff around Zion. It's real nice having that geochem work that she's done, and the new radiometric dates that she's published. Very, very important section.

Santucci: Great. So my estimate is that there's probably about one hour more of conversation left. Do we want to try to reschedule a time to go over Glen Canyon and then miscellaneous topics?

Kirkland: Sure.

Santucci: Okay.

Kirkland: Whatever you want. I am getting hoarse. I probably should have some lunch.

Santucci: Do you want to take a thirty-minute break and come back? Or do you want to do this another day?

Kirkland: It's whatever you want, what's convenient for you. I mean, I've got stuff I'm doing. I'm working on my monograph on Jurassic ankylosaurs and the new phylogenetic thing for the Thyreophorea. Right now I'm trying to figure all the 300 character states so that they're unambiguous. The older you get, the more unambiguous you want to be. Because life is ambiguous. (laughs) And more so as you grow.

Santucci: So it's 1:40 mountain time right now. Do we want to get back together at two o'clock mountain time? Twenty minutes?

Kirkland: Twenty minutes?

Santucci: Yeah. Or do you need longer?

Kirkland: How about 2:30?

Santucci: Okay. I'll call you at 2:30 mountain time.

Kirkland: Sounds good.

Santucci: Thanks, Jim.

Kirkland: All right. Take care. Bye.

Santucci: Bye-bye.

02:38:31

[END OF RECORDING 1]

[BEGINNING OF RECORDING 2]

00:00:00

Santucci: All right. So today is Monday, July 13, 2020. And my name is Vincent Santucci, senior paleontologist for the National Park Service Paleontology Program. This is the second part of an interview with Jim Kirkland, state paleontologist with the Utah Geological Survey. Jim has an extensive history working in the National Park Service, and particularly within the state of Utah. This interview is being conducted by telephone from Jim's home in Salt Lake City, Utah. And I am at home in Gettysburg, Pennsylvania. And so we spoke earlier today, part one of this interview. And covered lots of information in regards to Jim's work in national parks. We have a few more topics that we want to focus on, including work that was done at Glen Canyon National Recreation Area. So Jim, all yours.

Kirkland: All right. Well, Glen Canyon is a spectacular park to work paleontologically. Obviously it includes almost the entire Mesozoic section for the central Colorado Plateau. I always like to, I use it as an example very often of how much we can do, Don and I, relative to inventory work. Even though there were other people on that. But we did, one of our inventories, I forget, we were out there for ten days. And it might have been the one where Don had to go home early because he cut his foot. But we actually doubled the recorded sites in ten days that had been recorded. At least the sites that we were privy to. And obviously with the lake levels going up and down, new sites appear all the time. So it's a very dynamic park in terms of the paleo record goes.

But let's see. The first year we went out there, we did a three-day scoping project. We're out in the boat with Dave Gillette, Ron Blakey, Larry Agenbroad and going out to look at the overhang with all the Pleistocene coprolites. That was a pretty interesting scoping meeting because it was quite a group on that boat that day. And I think a lot of ground was covered. But it really wasn't until oh, I don't know, a few years later, that the survey did our first inventory project out there. And that would have been the one that was set up with Martin Lockley and Richard James from Cinema Group. He underwrote the stuff. I think we used his houseboat and support facilities for that. Martin had gone to him and convinced him that Andre Delgalvis had found the Rosetta stone for dinosaur tracks in the southwestern US. And that we had to go out and immediately save all the sites that were near the water line before they were submerged again. And I do have to admit, I've never seen the lake that low again in my visits doing paleo out there. Lake level's always been a bit higher. So I know the lower tracks in the coastal

sequence there I never saw again. But they should be underwater there hopefully safe. There's a couple of them that were certainly worthy of salvage, as we said in our reports. Quite distinctive things. And going up and down on a lake water line would not be good for their long-term survival, just the nature of freeze-thaw, wave action and all the rest.

But when we did that next inventory with those guys, looking at the sites, we found quite a few sites. Andre, we didn't find them, actually Andre Delgalvis took us from site to site to site. And we were very impressed with what he showed us—

Santucci: Hey, Jim? Jim?

Kirkland: Hmm?

05:01

Santucci: Could you identify who "us" would be?

Kirkland: Okay. Yeah, when we were going up there, Andre Delgalvis would report a lot of sites. And basically a group from the Utah Geologic Survey, the Park Service, Martin Lockley, the University of Colorado, Denver. I'm trying to think who – if there was anyone else out there with us. Were you there for that one, Vince?

Santucci: I was not there for that particular one, no.

Kirkland: In some ways, you were lucky. (laughter) I mean, I learned a lot and whatnot, but it was definitely something, too many talking heads not talking to each other, I think. I feel happy that we were actually invited back after that one. (laughs)

Santucci: And can you explain what happened?

Kirkland: Well, basically, they [Martin] were insisting that certain slabs on the coast be collected. Jim Cross had volunteered his barge. That was one of the things we had to work from, also, was we had this barge that Jim was using with the Park Service to raise sunken boats, you know, sunken houseboats and things. Quite a serious piece of equipment. And Jim Cross, you know, he's not a paleontologist. He's a marine salvage operator. So he was out there helping any way he could. And Martin's directing orders, captaining the ship. I know some of the folks in the Park Service were not real happy the way Martin was trying to run things over the park.

But at one point, he was trying to get us to collect some slabs with the winch on the back of the boat. And literally Martin was setting it up and didn't do it properly and the chain snapped. And I know Jim Cross got real upset. The park folks were real upset. Because someone could have got hurt. And Jim Cross was pretty upset with himself for even, for letting Martin get that far in the whole thing where someone could have been injured. Since Jim was responsible as the skipper of that particular boat.

But we were collecting stuff to bring in. And we weren't getting approval. You know, we were just doing it. And what's sad is some of this stuff, where the problem were, wasn't worthy of salvage, in my mind. So I really couldn't understand, why are we trying to salvage this big,

huge chunk of rock with this real worn track on it, when there's these other two slabs that should go into a museum and are being weathered at the coast, on the lake. You know, in ways that aren't good for long-term. I never understood how that whole thing came to be. But once it was all over, I was wondering if we'd ever be invited back. (laughs)

And of course the Utah Geologic Survey, we were invited back to do some additional work. We brought Grant Willis out with us on that particular trip. And we went after looking for sites in the Chinle Formation. Went way up the San Juan Arm, past the real tight fold there to get up to the Chinle outcrops up there. Found some really amazing log sites in the Shinarump Foundation some real scary evidence of how the Chinle is slumping along the coast of the lake, making these giant earth cracks. Looking at those things, I thought that if anyone ever fell in one, you'd never see them again. I mean, very dangerous. In fact, I think if I was running that park, I would have not allowed people to walk on that terrain because it was just too dangerous with these big cracks. But no one had been in there. I don't think anyone knew how bad that country had gotten.

And we looked at a lot of it. We looked at some areas where it looked like that stuff could collapse and actually bring Wingate cliff sections down into the lake. Actually, it's pretty scary to see what the lake does to the Chinle. You know, mud and water don't mix real well. But we found some good Chinle sites, sites with bone. Found some stuff with fish. Found some plant materials. We did really well. That was there an eleven-day trip where we found a lot of sites, and we were pretty excited about it.

We also came in on our own on a second trip tied to that same project and went up through the blue gap and looked along the lake, up in the northern part of the lake. And in that case found petrified logs all along the lakeshore. And it was there and at the Rincon you realized that there was a phenomena that we could track. A visitor rockhounding very readily, and that's by looking at stacking, that's where, that trip, I think it was Rincon we first started documenting this proper, you could see where people stacking up sections of petrified logs on boulders, places they would never be normally, spent probably looking to come back, pick the best-looking log section out of the pile of pretty good ones that they had found, and take it. I think it was good evidence that people were vandalizing, stealing stuff out of the recreation area. Pretty easy for someone to bring down to their boat and put it on their boat and carry it out. And anywhere you saw stacking, you knew people were looking at the logs pretty carefully. And sorting them. Clearly sorting the prettiest ones away from the uglier ones. I saw that both there and at the north end of the lake. And we've seen it later at Capitol Reef and other places. It's a good indicator that any park ranger should be aware to look at for when they're out in the parks. But we saw a lot of that. And that was a bit disturbing.

And we found some great track areas and developed a monitoring plan for a site we nicknamed Lockley's Cove that he found on an earlier trip that I was not a part of, where they had a whole series of tracks of two different main levels with clam beds, etcetera, that they had interpreted as being from the Kayenta Formation. We had Grant Willis with us who mapped that area of the park. (laughs) And Grant was able to show me that indeed that wasn't from the Kayenta Formation. That that level was basically an oasis within the Navajo Desert, within the Navajo Formation. Probably about 400 feet up from the base of the formation. So we interpreted,

Martin had and I would have gone right along with him, had interpreted it completely incorrectly.

And that was a very exciting site because it had *Anomoepus* tracks *Grallator* and *Eubrontes*, and these big beds of freshwater clams. And the freshwater clams are very significant because they require fish in order to reproduce. It's an obligate relationship. These clams cannot reproduce, and never have been able to reproduce, without having fish as an intermediate [host], larvae can embed in the gill filaments. This shows us that this area within the Navajo Desert, probably the largest desert we have preserved in the rock record, there were clearly open waterways that allowed fish to come through into the middle of the Navajo Desert and transport these clams. In fact, this is a site that also deserves a study and a write-up by somebody. We measured a nice section out there.

But on that site, because of its significance, we put some monitoring stations. Did go back on occasion to check and saw no evidence of weathering or expansion of cracks with these crack monitors, the monitoring. But one of the monitors had been broken off. Somebody obviously saw it and didn't like it and smashed it off the rock, leaving a few pieces of it still attached. And I have to admit now with techniques of photogrammetry, I would never do that again. Crack monitors are, as they say, old school. We can monitor these cracks just as well with photogrammetry. And that's what we all would do nowadays. But this was more than a decade ago. So we didn't. We can say we didn't know better. (laughs) But I wasn't a big fan of the results. I was all for it until we did it. And had a lot of doubts after that.

We also investigated a site found by some visitors that we refer to as the megatrack block. They had reported this block to me a year earlier. We used this opportunity to go out and find it, an amazing Navajo track block with some very interesting things. And as I understand, the write-up on that block is nearing completion, which is good to see, with Andrew Milner and the team from the St. George Dinosaur Discovery Site. So that's real exciting. And it's a site that, in my mind, should be interpreted. Some of these track sites really do deserve interpretation. Stabilization, of course, to make sure no one can hurt them. But some of them are pretty durable and would make good interpretive sites.

But basically, that material, that was a successful visit. And we did have a return visit. Found some additional sites. And there have been subsequent ones by other groups. A St. George team led by Andrew Milner that have also found additional sites. Glen Canyon is a true treasure trove for fossils of lower to middle Jurassic in age. And again deserves ongoing work, there's no doubt.

Let's see. The last thing with Glen Canyon is state lands adjoin the edge of the park toward Big Water. They were shooting a movie up there. And it was reported to me by the park that there had been some thefts of fossils by the movie crews. They were shooting the movie *John Carter.* Apparently they had found a plesiosaur and literally ripped the plesiosaur out of the ground and a bunch of the crew ended up with parts of it in their luggage. [unclear] I never did get down there, just the distance from Salt Lake and funding, et cetera, to see the problem. But it was reported to me by several people I have a high level of trust in.

17:59

Santucci: Great. So let's revisit for a second, just to put things into context, so there was a paleontology scoping meeting in 2000.

Kirkland: Was it in 2000? It was a while ago. Okay.

Santucci: Yeah, it was in 2000. I'll go over the list of names on there just so we have that recorded. There was a visit by you and Lockley where you had some problems. And I don't know what year that was.

Kirkland: Yeah, Jim Cross, it was quite a bit later. It was 2011? No, it might have been earlier than that.

Santucci: I think it was before our 2009 paleontological monitoring.

Kirkland: Okay. Yeah, it was before that one. Because that one, Grant came on. And he wasn't on this other one.

Santucci: Okay.

Kirkland: Yeah, I just joined. And this guy Richard James, who basically just donated money and equipment toward it. Jim Cross was already down there doing a project with Glen Canyon, so he had his barge down. And Jim has helped me on numerous digs, projects. Really good person, good heart. And he's only been involved in these things to help out, do what he can to be a benefactor to the research going on. He's a real good man. And he got kind of caught up in this stuff with Lockley. Lockley is, you know, a pied piper. He's surely flamboyant and he can get people all stirred up and ready to go. And I think he kind of pulled Jim Cross in. Jim didn't know me so well then. But trying to collect some of these junk blocks that we tried to collect, made no sense to me whatsoever. But it definitely created some heartache for the park. I know that for a fact. And I felt really bad about it.

20:04

Santucci: Okay. So I'm going to go back to the 2000 meeting where we pull together a team, a multidisciplinary team of paleontologists. We rented a houseboat. That was the three-day excursion onto the lake where this team visited several sites. We talked about both scientific and resource management considerations as it relates to the paleontology of Glen Canyon. We're going to read off a list of names of participants, just so we have it in the record. So: Jim Kirkland from the state of Utah; Greg McDonald, who worked for the National Park Service at the time; Ron Blakey, he's now retired, he was a professor at NAU University; Larry Agenbroad, also from NAU, who is now deceased. He was a specialist on proboscideans, mammoths, mastodons; Alan Titus, young in his career at Grand Staircase-Escalante as the paleontologist; Steve Hasiotis who works on terrestrial trace fossils. He's at University of Kansas right now; Deb Michillson, who's sort of a freelance individual, who was a graduate student at the time doing work on Mesozoic fossil tracks.

Kirkland: She's like out of it. Now she's like retired.

Santucci: Yes. There was one of the paleontology interns from the National Park Service, a young woman by the name of Chris Thompson; Dave Gillette, the previous Utah Geologic Survey state paleontologist now at the Museum of Northern Arizona; ex-National Park Service employee Ken Cole, who worked on Pleistocene/Holocene vegetation change; and then we had also Pat Monaco, who served as our cook and our host, who made our dinners for us on that trip. And then of course myself, Vince Santucci.

So that was a lot of fun. A lot of good, experienced people contributing to planning on how to go forward with dealing with the paleontological resources at Glen Canyon, both from a scientific research and resource management perspective. We visited lots of localities. We were able to go to Bechan Cave, a Pleistocene locality that Larry Agenbroad had published on in the past. We visited various track sites. So anything else you recall from that get together, Jim?

22:41

Kirkland: No, other than it really felt like a successful venture. I mean, three days, I think we really did get a lot of information about, everybody knew so much, had their own perspectives of things going on. You put it all together, it was quite the list. (laughs)

Santucci: Absolutely. Yeah. But thanks for participating in that. And then the 2009 venture, we were able to develop a cooperative agreement with the Utah Geologic Survey to get support from Jim and his team—Don DeBlieux and Scott Madsen—and we were able to get out for a week.

Kirkland: Yeah, Grant Willis was real important on that one. [mapped geology]

Santucci: Absolutely.

Kirkland: Yeah.

Santucci: And visited a number of localities. The primary objective was that in that same year we published, through the Geologic Society of America, guidance for how to do paleontological resource monitoring in the National Park Service. And so we selected Glen Canyon as our prototype paleontological resource monitoring park, in part because of the rich fossil track occurrences from the Mesozoic. Mostly the Kayenta, somewhat of the Navajo Formation.

Kirkland: Yeah, the Navajo was the one that we really put our [unclear] to the two Navajo sites that we did monitoring on.

Santucci: And through that, we established the first official paleontological resource monitoring locality for the National Park Service. Through the efforts of the entire team, Jim and others, who eventually published a report on that work. And that was our first opportunity to see what is referred to now as the John Wesley Powell track block. That's the one that Andrew Milner is helping to publish. And it was discovered by some visitors that reported it to Jim and his team. So we went out and actually found it. And it's a very impressive site.

Kirkland: No question. Not sure how far you are with the stabilization, but there's a lot of tracks laying around on the ground at the base—

Santucci: Yes.

Kirkland: —that need to be picked up before you bring many people there. (laughs)

Santucci: So Jim, one of the things that stands out to me that I recall is that we went down the San Juan Arm and we went as far as what is called Zahn Bay. The reason we went there is to look at the Chinle.

Kirkland: Mm hmm. Yeah.

Santucci: Do you recall anything about that?

25:23

Kirkland: Well down there we found some places, I mean, I remember photographing—I'm not sure if you were with me or if I just showed you the pictures later. But there was like Shinarump ledges just above water line way down on the east end of that bay that were just filled with petrified logs. Sometimes they were weathered back so there were kind of holes going in. Other times, you could see the logs better. But that stretch in there, the Shinarump, was just packed with fossil logs. I mean, big logs, crisscrossing all through that, right at the base of the Chinle. There were lots of those.

Then when we went back into the mudstone badlands, we did find some bones. Nothing exciting. Phytosaur, osteoderms, junk like that. Nothing super exciting. But for me what was most dramatic were these gigantic earth cracks. You'd be going up a slope and all of a sudden you'd turn and there's a five-foot-wide hole, a slot, going down, and you can't even see the bottom of it. And it's just, holy cow! If you were way up high and like, you know how people slide and skid down that stuff, just because it's generally soft rock, someone could die in there. I mean, these were big cracks. And if you fell down in there, you could get stuck in such a way that unless someone happened to find you, which would be pretty remote, you'd be dead. No phone would get you out of there. You'd be in big trouble. And those things, you know, from what I could see, they're forming because of the lake. The lake waters, water comes up, goes in, gets in cracks on the Chinle. Lake levels at this time were actually fairy high. It's the only reason we could get up that arm. So high. But they were still down from what they had been at the past. And I think that's when these cracks opened. So no one had probably ever even seen these things. So I think you could use air photos and map them pretty readily. Go in the afternoon, they'd be these black lines, you know, the shadows across the Chinle. But those things, I think, need to be—and we talked about that quite a bit. And it was also in the report that that's something to really consider. Once I saw enough of those, I got like, I don't think I want to be out here that much more. (laughter) It's like in a glacier, you get ice cracks. And there can be dirt going across one. You're not even going to realize and you break through and you drop into one of those things. There were some pretty scary stuff. And it's totally because the Chinle is not used to that kind of water. It's not what you get out there in the desert.

And there were a number of things. We recognized the carbonate on the bench below the Navajo. We sure have become much more aware of that. And what's going on there is rainwater and stuff comes down on those miles and miles of Navajo around the lake. And then it seeps out on the base on top of the Kayenta. You know, there's little clay partings and stuff in the Kayenta

that would be seals and deposits travertine down at the base. And this comes all the way out to the shoreline of the lake all over the place, and is encrusting all over Kayenta track sites. And it's obscuring a lot of the sites out there. And that became a pretty obvious thing. You walk over, it's like walking across corn flakes. It's real brittle and just breaks up under your feet. Just huge areas where it would cover almost everything. And secondary carbonate coming out the base of the Navajo. And that's probably also a lake effect. Well, yeah, where it's coming out, probably a lake effect, to some degree. But the water coming into it's probably rainwater. You know, etching out carbonate and bringing it down to the base of the Navajo. But there was some real interesting stuff like that.

Of course we did a study of the Kayenta on a dip surface, following it probably twenty, thirty feet. So we sampled pieces of the sandstone ledge, you know, thirty feet above water line and all the way down again to water line. Just to see if there was any data to suggest different weathering of the sandstone relative to water saturation. And we didn't really come up with anything on that. But observationally, you've got so many of those crack sites at water line we recognized were really soft and brittle. That easily you walk on some of those. And they would do this. You walk on some of these slabs and they just break under your feet. And it's probably from cement holding the rocks together, leaching out, while they're underwater. It was one of our debates with the Park Service at the time was how much damage does this artificial lake cause? And I think quite a bit. Nothing you can do about it. No one's thinking about preserving track sites when the lake went in. (laughs) It makes it a natural laboratory relative to future planning.

31:49

Santucci: Very good. So, yes. You and myself were together at Zahn Bay area on the San Juan Arm, when we came down through a drainage where through that drainage the erosion had exposed this little area that exposed this logjam of petrified logs that were exposed in cross section.

Kirkland: Yeah, in the Shinarump.

Santucci: Yes.

Kirkland: Yeah. There were a lot of logs in that area.

Santucci: Yeah.

Kirkland: They were big logs, too. It's pretty nice stuff. And it would be one of those things where I would say oh, we should interpret this. But bringing people into that country is probably not safe.

Santucci: Right.

Kirkland: It's just the nature of it. But yeah, there's amazing petrified logs up there.

Santucci: Yeah. That was really—

Kirkland: And the Rincon. Do you remember the Rincon site that you found?

Santucci: Yes. Yes.

Kirkland: You found that big dicynodont track area.

Santucci: Yes, uh huh.

Kirkland: Yeah. That's an important site.

Santucci: Right.

Kirkland: I don't know if Andrew's ever documented it. It really hasn't been, we didn't, you know, I think you made some sketch maps. We didn't do anything super detailed. But that's an important, because you don't get, what is it, Pentasauropus or something, the name of that thing?

Santucci: Yes. Mm hmm.

33:14

Kirkland: I've never seen another site like it.

Santucci: Yes. So I wanted to ask you, now that you've spent considerable amount of time in Glen Canyon, what would you state is paleontologically significant about Glen Canyon National Recreation Area?

Kirkland: Well, Glen Canyon, the big thing is the track sites. There are so many track sites that are readily accessible. And basically, part of it's our bias. We're looking along a lakeshore. I want to get a helicopter and look at some of the big Navajo flats where you have to hike miles to get to them. But if we could get dropped on with a helicopter here and there occasionally, I'd love to look at those lacustrine vertebrates. But, we didn't do that. (laughs) What we could see, were track sites. Along the lakeshore, all the way from the Moenkopi up through the Navajo, there are significant track sites in each one of those rock units. You know, the Pentasauropus stuff you found, that was in the Chinle. That would have probably been the Mossback Member of the Chinle there. But those things are the real gold for Glen Canyon.

There's bone sites, too. You never know. Andrew, I know, has found a couple sites since then that he thinks are really well worth salvaging. He's found some fish stuff in there more recently that sounds really exciting. But the big thing are tracks. Track blocks.

Big observation, though, is how many people are still looting. You know, the wood stacks. That's not a good thing. Scientifically, in my mind, it's not all that significant. But it's just the idea of people stealing petrified wood out of a national park or recreation area is not something that we want to let keep happening, or there won't be any more pretty wood. And there's a lot of areas of stacked wood around there. In the Rincon, you know, we hike up, way up the side of that thing. And there's just, you know, way up. And that's why they're stacking it. Because they're only going to carry one piece out. You know, there's wood all over the place. All of a sudden they say oh, here's the best piece, and that's what they're doing. That was an

area we saw a lot of stacked wood. I don't think I would call it a petrified forest in there so much. But I would certainly want to try to figure out how, educate the public, don't take the wood.

36:15

Santucci: So, Jim, when you say stacked wood, do you mean like rock cairns with petrified wood?

Kirkland: Yeah, they're stacked. Petrified wood up on boulders, basically. You know, you've got those slopes and those big boulders of sandstone. And the wood generally is smaller chunks in between them. People pick up the wood and put them on top of the boulders. Which is not natural, you know. (laughs) You've got a boulder with five or six big hunks of petrified wood on it, you know that was done by the public. And they're not doing it decoratively. They're just doing it so they can find it again. You know you're looking at trouble when people are doing that. And it's a sure telltale sign that people are in there wanting to bring home a piece of petrified log.

And you know, Capitol Reef, we're down on the south, where I was, south of the Burr Trail, where I comes up through the monocline. And beautiful log sections. I mean, hundreds of them. But sure enough, people are stacking them up. And it may not be heavily impacted this moment. But give it a couple hundred years and there won't be any left. And it's sad.

Santucci: Excellent. So, one last just memory from the 2009 venture. We had an opportunity to go back to Rainbow Bridge and take a look at that area. There was one therapod track that's not very well preserved that's at the base of Rainbow Bridge.

Kirkland: Yeah. It's a very famous track.

Santucci: Have you—Was that your first time—

Kirkland: I've actually helped them create some signage for that site since then, too.

Santucci: Great. Was that your first time to visit Rainbow Bridge?

Kirkland: Oh, yeah.

Santucci: What was your impression overall?

Kirkland: Oh, it's a neat place. But it's like you couldn't take a boat up to it when we were there. We had a long walk, as I remember. At least, the last time I was there it was quite a hike. But, yeah. That track is pretty neat. I would interpret tracks on the lake, for sure and other sites. But, yeah. I mean, Rainbow Bridge is okay. (laughs) There's a paleosite – you know, there's one track.

Santucci: Yeah. I think for me, what's sort of impressive with Rainbow Bridge is that you meander up this canyon, then all of a sudden it opens up and there you see in the foreground, Rainbow Bridge. And in the back you see Navajo Mountain behind it. It's sort of an impressive geologic view for me.

Kirkland: Can you drive in from the res [reservation]?

Santucci: No.

Kirkland: No, okay. I was thinking you could.

Santucci: You can hike in, but you can't drive.

Kirkland: Yeah, okay.

Santucci: Well, very good.

Kirkland: [unclear] in the lake is tougher with lake levels low.

Santucci: Yes. Very good.

Kirkland: I guess when they're high, you can take a boat right up to it.

Santucci: Yes. So, that's sort of our tour of the national parks of Utah. So I have a series of more general questions, if you are okay with that.

Kirkland: Sure.

Santucci: All right. So, let's see. Let's start with the Morrison Ecosystem Project. Although you weren't involved in that—

40:12

Kirkland: I watched it with great interest. (laughs)

Santucci: Yeah. What is your overall opinions about that work?

Kirkland: Well, to some degree, right off the thing, it was pretty obvious to a lot of people involved or not involved with it, it was a club. You know? And the Morrison, you know, there's definitely different groups that don't like each other, in the past. That's not so much the case now, I don't think. But there were some real schisms in terms of I'll work with that person, I won't work with that person. It's pretty sad. So it was kind of like the good old boys' club on it. Which, okay, you had a limited number of people that could afford to be on a project anyway. So, sour grapes, don't worry about it. But it really, it was so chaotic watching it. Because I got to watch people in the field from some of my own dig sites, you know? Every day, all summer, when George Engelman was doing Arches National Park, he camped below the Gaston Quarry. And we worked there all summer and he was there all summer camped down there, and prospecting Molly's Hogans and all this area that really, to the east of Arches. That's why I couldn't believe he missed that big dinosaur at Arches that we found. This was after that. It was like, how did you miss it? You could see it from a hundred meters away. (laughs) But basically, he didn't find that.

But I remember when they all showed up. Pete Peterson, Christine and Hasiotis; the whole crew. And he drove them around and they all hiked on into the Molly Hogan area and

came out. And I said, "Yeah, there's some pretty nice bone in there," and whatnot. But the trips were like everybody went out and did their own thing. And each year they had a week where they would—and people would be working all over the whole southern interior. You know, Wyoming south. I don't think they worked in Montana. But all over. And everyone's working different places. So you got a week and people are showing you the highlights of what they found. And there was just no solid integration of the stuff. You can read the papers and they don't interrelate to each other at all, you know? It's just separate lines of research. And you had that opportunity, you know, in the title of the project, Extinct Ecosystem Project. The Morrison Extinct Ecosystem. It's like, we should look at it as an ecosystem.

As Jeff Moritz and I have talked, and a number of us, how would you do it? We would do it where what you do is you go out and periodically get a reference section established. Measure a really good section. Do photomosaics so you can show over a big area. Look at air photos. How certain beds, you can tie in your section over large geographic areas, so when anything's found, you can tie it all in temporarily. Get the paleobotanist, the geochemist, all the different groups, integrating it on the same framework. So we're looking at the history of this ecosystem. And if it's done properly, all the data could be integrated. And the way that project was done was just, it's like random theses on the same formation. There was no integration of it at all. You've seen the final report.

Santucci: Yes.

44:08

Kirkland: Yeah, I've got a copy of it, too. (laughs) And it's a complete hodgepodge of stuff. It's like man, they would never have allowed me to do that out of the survey. (laughs) You know, like no, no, no, we cannot let you publish stuff like that. That was really tough. And as you and I had talked, it's like man, you could do the same kind of project, and better, because the Morrison isn't as well-developed in the different parks as, say, the Chinle. Chinle's way better developed in the parks, because it's more kind of in the middle of the red rocks.

Santucci: Yeah.

Kirkland: And the parks are set up because people like red rocks. They're not set up for their scientific importance. They're set up (laughs) for being pretty. And that's the way it is. The Chinle is in the middle of the red rocks.

Santucci: So we're going to talk about the Chinle projects next. But I wanted to just—

Kirkland: That's where I think it would be done right. The Morrison one, there's some data. I think it could be done again sometime better, you know? There's no doubt about it. Maybe at a different scale. You know, I mean, just the stuff that was done at Dinosaur National Monument. Here you've got this big race track. And of course, a lot of the Morrison there is not in the park. It's one of the things where you just have to consider the park versus, you know, but look at the rocks as an ecosystem. Same way for managing modern biologic ecosystems. Political boundaries aren't going to have effect on the biology.

Santucci: Right.

45:52

Kirkland: You know, you've got to look at where the rivers go. (laughs) Migration pathways and things. Not political boundaries. Oh, the elk have gone to another state. Okay, well, they can shoot them there. (laughs)

Santucci: Right. So, you know, I love the National Park Service and I don't want to be too critical—

Kirkland: No, no, [unclear] happened by chance where—

Santucci: No, I wanted to say, though, I wanted to interject with something very important here.

Kirkland: Sure.

Santucci: Is that I love the National Park Service and proud of it. But one of the things I'm tremendously disappointed about is now that we've been looking for all the archives and records associated with the Morrison Extinct Ecosystem Project, the highest amount of funding ever to support any paleontology project in the National Park System, the records are not maintained appropriately. We've looked in all of the various repositories and there's a lot of things missing.

Kirkland: Wow. [You could see that?] day one. I mean, Colorado Springs, I told the head geologist for the Park Service, this stuff has got to be tied together. "Oh, yeah, yeah." You know, and he wasn't working on the project. He's all, "Oh, yeah." It's like, no. (laughs)

Santucci: But there's a responsibility that when you're using federal dollars for scientific purposes to pull together data, that somebody needs to preserve that data so that scientists in the future and the public can benefit from that. And right now, we're working hard to reconstruct where some of that material might be. And we're coming to the conclusion that some of it we may never find.

Kirkland: Capitol Reef. What are the sites of George's on Capitol Reef?

Santucci: Yeah. So that's the questions that we're asking now. We're making a little bit of progress in a couple of different areas. But the data management for this was very poorly managed, unfortunately.

Kirkland: Yeah. It basically needed to be considered before any money was spent.

Santucci: Yes.

Kirkland: Have a plan. I don't know anything about the initial proposal, you know, that Dan and George Engelman put together. Just the right place at the right time or what. But how do we approach this? It wasn't done upfront.

Santucci: No.

Kirkland: And you had to say, "If you're not willing to do this, we'll find someone else."

Santucci: Right.

Kirkland: In terms of integrating the work. Because you can't be like Ken Carpenter. I'm not going to work with this, because no one's going to know what I'm doing until I publish.

Santucci: Yes.

48:33

Kirkland: Sorry. (laughs) You know, that's the way it is. We are a mixed bag. But you've got to decide, I'm on this project, I've got to play by a certain set of rules to be a part of this project, you know? And you set some rules. And people have a right to publish your stuff. But there's a certain framework the stuff is going to be tied to. It's like, okay, I'm latitude/longitude, I'm using UTMs. (laughs) I'm going to use inches, I'm going to use centimeters. You set standards ahead of time so that people are on the same page.

Santucci: Sure.

Kirkland: And that project, to me, I mean, it's classic. And the thing is, in your position, I would use it and say we're going to do it better. Because it is, it's a classic example of, there were some really good scientists on that project, you know? Don't get me wrong. Hasiotis is a smart guy. Steve Good working on the mollusk faunas. Tim Dempko. Brian [unclear]. You had some good people. The Petersons. There was some real talent there. But no one was working together.

Santucci: Yeah. So we're investing a lot of time now to try to reconstruct those archives where they should have been put together originally and preserved and maintained as a collective archive.

Kirkland: Yeah. I appreciate it.

Santucci: So I wanted to build on what was basically your idea. And that was to take the lessons learned from the Morrison Extinct Ecosystem Project and develop it into a companion project on the Chinle extinct ecosystem. So since you're really the person that generated that idea, do you want to talk a little bit about that, and some work that's been accomplished?

Kirkland: Oh, sure. Because I'm a good ringleader on that because it's not—I mean, I work on Chinle some. But it's not my, you know, Cedar Mountain and Morrison are more my formations, you know? So the Chinle, I don't have as much of my ego invested in it. (laughs) You know, so I'm a good one to talk about the Chinle. Because you know, I'm not looking for a piece of a pie when it comes to the Chinle. As I told Randy, we find anything good, you'll be able to put with the Park Service in case you want to work with it or whatever. We're not here to feather our own nests. [unclear] So the people that were coming up to help, Tracy Thompson, whatnot, we're going to do a good inventory, we're going to record this. And then the park will decide what will happen next. And that, to me, you know, for this project and this point in my career, makes the most sense. Let's find out what's there and then report it so people can actually follow up on, people can then apply for part of that to follow up on. Anyway.

Santucci: So has there been any work accomplished focusing on the Chinle on the Colorado Plateau? Outside of Petrified Forest.

52:04

Kirkland: Yeah. Well, the work Jeff did on that guidebook, basically what you've been funding a little bit here, a little bit there. But nothing like the Morrison project, you know?

Santucci: So there's been some Chinle work done in Zion, Arche, Glen Canyon, a little bit of Lake Mead. And then at—

Kirkland: Capitol Reef.

Santucci: And Capitol Reef.

Kirkland: Yeah. Dinosaur. Randy's done a little bit of work at Dinosaur, as has Scott Madsen. But Dinosaur National Monument is not the best place for the Chinle. (laughs)

Santucci: And so you're going to lead a venture coming up at Canyonlands.

Kirkland: Yeah.

Santucci: And you're going to be looking at a little bit of Chinle there as well.

Kirkland: Yeah. Well basically, my view is that the, what's the name of that road? The big Canyonlands guy [the late Don Rasmussen]. Oh, I'm trying to think of the name of, well, you know, the bench. The road there, on the bench. White Mesa. Not White Mesa. Whatever that road is that runs along the north end.

Santucci: Dead Horse Point?

Kirkland: No, below Dead Horse Point is this big dirt road that you can come in through from the Moab side and drive all the way across. Or you can come in from the north and drop down to it. But it's, oh, it's the White Rim Trail. It's the jeep trail everyone drives down there. But it's right on top of the Paleozoics. So you've got Moenkopi starting right there, Chinle, and then the Wingate's pretty much a vertical cliff. The upper Chinle's a vertical cliff, too. But there's plenty of area we can get to over a period of, what did we figure, in twenty days of a few of us doing fieldwork, we'll be able to keep pretty busy. But yeah, so the Moenkopi, Chinle, Wingate, mostly determined from blocks, because that's just how you've got to see anything good in the Wingate. Just got to roll down, break open. But that's the real thrust of what we're looking at across that whole twenty-something miles across the north end. Where the Colorado River comes into that western side where you flip the name over to Glen Canyon.

Santucci: Great.

Kirkland: It's a good-sized area. It's a good, great exposure. Not much reported from in there. I think there's an aetosaur, Spencer's guys report from over by Upheaval Dome. But that's about it. So I think, and [Mazermas?] you guys are going to find a fair bit of stuff. I mean you've got

lots of stuff. We always do. But it's certainly not a place that's already been worked over too much.

Santucci: Good, good. We'll look forward to that.

55:28

Kirkland: Yeah, I think it will be, I think it will be a good section. And the road coming down, what I want to try to do is put together a composite full section along the road coming down into it. That way people have access to what we'll have as a reference section for the area. And we'll be able to tie sites into it. Because context is everything. If you don't have stuff in context, it's meaningless. And nowadays, we have abilities to do things really simply. To put things in a much better context than they used to be. But I don't know why some of this stuff wasn't done better in the Morrison. I just don't, well, I think to some degree it's because George Engleman's a loner. you know, good guy. I mean, I've always liked George. But he's much more of a loner. He'd go out by himself. That's the way he likes to do it. And we need a thing where you've got a lot more groups that are willing to work as teams. And you know, if you're doing a section, you should have your geochemist there at the time, your micro person there, so they can be looking for pollen and do the section. Collect integrated data. You know, all that chemical and micro stuff should be done together. And then filled in with select sites that you discover as you do inventory work. Like a good plant site. We've got a site on the Bear's Ears right now, it's probably the best plant site ever found in the Morrison. It's one we describe a giant water bug. A gingko forest. It's amazing. Insect eggs on the leaves. I mean, it's just an amazing site. I hope to get out there this summer and work for a little bit. But that site is not going to be in Bear's Ears. The new boundaries will keep it out of Bear's Ears, unfortunately.

Santucci: Right. So I'm down to the last five questions.

Kirkland: All right.

Santucci: So basically, these are miscellaneous. But the next one is, can you briefly describe the database for paleontological localities you maintain at the state survey?

57:49

Kirkland: Okay. Well the database was started as a literature search by Jim Madsen 25, 30 years ago, with Martha Hayden. And they were going through the literature and recording US Geologic Survey bulletins or whatnot, recording where sites are. Back then they were, at best, quarter sections, to where sites were located. At worst, some sections are less, where a site was. But they got all that data and created a database where things were approximately known. And as new sites were mapped, they added to it, added to it, added to it.

So now we use UTMs. In fact, we're beta testing at Canyonlands our new digital locality collection system. We use tablets, and we've download the geologic maps and air photos into the tablets. As we walk around, you just follow yourself on the air photos on these tablets. Find the site. Bang, take a picture, record your UTMs wherever you took the picture. Dropdown menus, fill out all the locality stuff on the tablet, and download it into the computer. And our goal for this is that all people doing mitigation—and BLM's been funding us to do this for the last few

years—will be having to do this. Basically work on BLM land. And it just makes the most sense with dropdown lists. You don't have the errors and misspellings and things like that. And you can buy a tablet for a hundred bucks now that will do this. So it works best if you have a nice Apple tablet. But we'll be beta testing the system. So you come out and visit us you'll have a chance to check it out. But this is, we're getting better and better. The newer the data, the more accurate the data. (laughs)

And I'm always fighting with the BLM and with BECA. I would like to have the most questions possible answered. You know, if you've got a big site, you have a selection of things that have to be answered. But if you can say oh, it's fluvial channel on the outside of a point bar, say that in the database, if it's possible. And for most of this stuff, we have dropdowns. I mean, I have a lot of dropdown lists in this thing. And then you've always got a place called "other" that you can fill in. There will always be other (laughs) if it doesn't fit what you design for it. And that way, in the future, people can do analyses of this stuff.

But we have the older database that goes all the way through the USGS, the early surveys, government surveys of the west. That's all in the database. I don't think any other state in the country's got anything like this put together. Those sites aren't so well-defined. But in places like the Uinta Basin, you've got people like Sue Anne Bilby who's been trying to locate all the original Marsh sites out there and things and has been locating a lot of them. She's got all these old historic sites and they were starting to get these things tied into a square meter. And that's been exciting. You know, it's been Sue Anne Bilby's hobby for years is getting that data done. Kind of like Darren C. up at Tyrrell, recording sites at Dinosaur Provincial Park. Let's make these sites better. Let's try to find, where was that person?

I relocated the type section of the Brushy Basin Member of the Morrison. I'm real proud of that. I know right where it is. It's awful, but it's totally the type section. (laughs) That's where Gregory described it, walking up the road. And of course, he described it walking up a road. That was the only access he had to Brushy Basin.

But I think our database is really quite good. And its localities are, all localities—this is my new philosophy on this stuff, too—are polygons. As opposed to points. Because even if you pick up a piece of turtle shell, the turtle shell itself would have been a little bitty polygon. Of course as you're recording sites that are that small, it's a point. We understand that. But conceptually, all sites should be thought of as polygons. Because most of them have some kind of stratigraphic delineations. Go into the hill so far. And we need to start recording them in polygons. Which works a lot better in our new system. So you can, this area, this is a site that covers a half an acre along this outcrop above the road between this debris spill and this pile of rocks. But define these things as polygons. And I just think that makes a lot more sense management-wise.

And some sites, like Lockley's Cove in Glen Canyon, multiple sites that can be thought of as part of a megasite are paleontological site complexes (PSCs). And that you can give a big polygon to and then have sub-localities within it. You know, like [unclear] at Dinosaur National Monument. You've got an apatosaurus here, you've got a stegosaurus over here, but the whole thing's a site. Some of this stuff, I think, is going to be really, really good. And we're trying to make it as easy as possible. Which is why doing it on a tablet's going to be the way to do it.

Santucci: Very good. So, let's see. The next question, you had the opportunity to work with both Scott Madsen and Ann Elder during your career.

Kirkland: Mm hmm.

1:04:26

Santucci: From Dinosaur National Monument. Do you have anything to share about those two legends in the Park Service?

Kirkland: Well, I haven't done much with Ann. I mean, I've worked with Scott for 35 years. I knew Scott since he's been an undergraduate. In fact, in terms of field paleo, we had some of our initial training together. You know, with Farrish Jenkins and the Harvard guys. But Scott, you know, Scott's a great field paleontologist. If you have someone that's going to find sites. But he can be really sloppy. Where Ann, I worked with Ann, Ann's not sloppy. Ann's more fastidious in terms of data collection than Scott is. Scott's an amazing preparator. One of the very best. But if it's like a dinosaur bone, he doesn't care. (laughs) It's like, "Oh, that's ribs, oh, we can break that, throw it away." He doesn't care. If it's a mammal, oh, man, this thing is a diamond and exquisite care. But Scott could be sloppy. You've got to stay on his case with some of this stuff. And I could see Dan having had some problems with Scott. Because I know how Scott is. I guess I'm a little more diplomatic. I can work with Scott better than Dan ever could. (laughs) Because you've got to keep them corralled. This is, "Scott, we know you like mammals. Rich Cifelli trained you to like mammals. And we're doing dinosaurs here. (laughs) Or we're doing plants." Scott's a little biased that way in terms of his focus on things. But you know, he's one of the great field guys there ever was, in my opinion. Definitely, if you've got a bunch of money and you're going into the Congo and you've got to find something good to justify your existence, you want someone like Scott with you. Or Don because Don's good that way, too.

Santucci: Unfortunately, we lost Ann early by a tragedy. But one of the things that she had been working on in her career when she was at Dinosaur was to try to help to build a partnership for a depository in Vernal, Utah. Do you know anything about that?

Kirkland: A little bit. I know the promises, because I've certainly had state parks people up the chain, I know what they're talking about, bitch to me about this over the years. But as I know, the whole original thing was going to be a collections partnership between the Park Service and the state of Utah, which I'd like to do something like that with Utahraptor State Park someday, too, is we need more collections facilities. And they're expensive, and they're personnel-heavy because you need registrars and collections managers and things. And they say, well, if I've got that money, I'd rather have a field person. We're protecting a park. We've got landscape to watch. Instead of watching stuff in drawers. So having partnerships that way to me makes sense, you know?

And I'm really hoping now that Rebecca is at Dinosaur, that partnership can be reinstated. I mean, people need to accept that everyone has a different vision of what should be done. But you know, we have professional standards. And that's bottom line. You've got to have, everybody's got to stand up for the professional standards when caretaking these materials. And it's a pain in the butt, you know? I mean, that's why all of us gripe about registrars all the

time. Because a good registrar is going to give you a hard time if your Ts aren't crossed the right way and your Is aren't dotted. And that's their job. And find a good registrar, you're going to find someone that's highly anal retentive. But that's the only way it's done right. You've got to have it clean.

That's why we're trying to do the tablets, so you get people like me, who I'm dyslexic. So you know, getting it right is tough. But dropdown menus help a lot with that kind of thing. How can we make this stuff as bloodless as possible (laughs) is part of our trying to get the database. It has people gripe. Scott, mapping in the quarry. Don and I just draw the bones out real careful. Scott just draws big circles. (laughs) I mean really, it's awful.

Santucci: Very good.

1:09:37

Kirkland: You know, the fossils are going to come out beautiful. But the map data! We're going to publish that. We're going to clean it up and publish it. (Santucci laughs) And you've got a big circle around where the jacket was. You're supposed to draw the bone before you jacket it. I love the guy, I really do. Incredible amount of respect for him. But Don and both sometimes are just like looking at junk. (laughs)

Santucci: So the next question is one we'd could probably talk hours about. But I just wanted your gen, big picture view, particular as it relates to Utah. The issue of illegal collecting of fossils on public lands, state or federal, what's your general feeling about that activity in the past and recently? Is it an issue?

Kirkland: Yeah. Definitely an issue. You know that project I completed a couple of years ago, just published, on the Bears' Ears/Morrison inventory and then the Blue Hills inventory. Two inventories, same area, twenty, thirty square miles. Bears' Ears, more remote country. One site out of fifty where it's clearly vandalized. One site. Blue Hills? One hundred percent. Every site. That's near Moab. Hundred percent. Every single site, it had people digging on them. Very often, I knew, because I had an inside thing there because my family, my wife's family, had picnicked in that area since the '60s. So when we started dating, they showed me tons of sites. And I wasn't really working on the Morrison. So, and I wasn't working for the state of Utah, either. So it was like oh, interesting. But I remember sites. I can't remember names, but I remember where stuff is. And what it was like. And I'll photograph things as well. And every site they showed me is either a hole in the ground now, or, if it's a big site, is a hole in the ground with more bone going in. But 100% vandalism.

And you know, I've been just telling people, okay, you're looking at a place like Bear's Ears and you're looking at the Blue Hills, which one should you preserve? The virgin site? Or the one that's been raped ten times? (laughs) Let's try to protect that virgin site, keep it as virgin as possible. (laughs) But it's an incredible difference between those two sites. And it's sad. I mean Blue Hills stuff still has plenty of important areas, where there's fossils. But it is holes, almost as big as my house, that are sites that are like the Mygatt-Moore Quarry or Cleveland-Lloyd I mean, there were a lot of big sites in Utah. I know of at least fifty sites on the scale of Dinosaur National Monument. You know if you dug in. Or bigger. There's a lot of them. It's like

Egypt. You've got Egyptian sites everywhere. (laughs) We have a lot of really hot paleo sites. And most of them are just being ongoing raped. People just go out there and grab a bone here, grab a bone there. And they could do it for thousands of years because they're big sites. And it's pretty sad to watch. It's one of these things. We have it and others don't.

I'm not against giving a permit to the University of Tokyo to come in and work a site for X number of years in a legitimate scientific manner, you know? And caretake the materials. I'm not against that. It's basically these sites are being destroyed. And you're only going to have so many people keep so many sauropods. I mean, the Hanksville-Burpee site, I think those guys have dug up ten Barosaurus now. There's a lot of *Barosaurus* there. Juveniles and there's other things, too. But it's a gigantic site. There's a lot of Barosaurus. And after a while, how many *Barosaurus* can you hold in your museum? Because the square foot of curation space is worth X amount of money. That's the way it is. If it's in a building, out of the rain, there's a dollar value on that space, that cubic footage. And how many of these big dinosaurs are you going to put in them? Doesn't mean they're not important.

But I'd like to see Hanksville-Burpee worked more ongoing. So would the BLM there. You know, the tours they've been giving there when they're digging have been hugely popular. Capitol Reef is always telling people, the visitors, to go out there and have the tour. They have a big line of people that do that every year. And it's a real successful thing. But Hanksville-Burpee's getting ready to pull up stakes. Because how many more animals do we need from this site, you know? The Carnegie Museum doesn't bug Dinosaur about more bones, do they? (laughs) No, there's just so many. But, I'd like to see work go on. So how do we ensure work goes on? We may need to try to encourage more places to collect. With protocols. You've got to be doing legitimate science. Mapping, recording, permanently curated where public would have access to the materials. With proper standards.

And I'm not against stuff going to another country under those conditions. In fact, some of these countries, the Brits are now doing a big dig up in northern Great Plains, a Morrison site, on a ranch. And it's like, that site's going to be done as good as any site's ever been excavated, I expect. And it's like, why couldn't they be doing that on public land, too? I'm not against it. I know the BLM always felt, no, Jim, never going to happen. I'm also pretty good at dealing with reality. (laughs)

Santucci: Sure. So the next topic, it's another big one. But I'd just like to get your 30,000 foot perspective on a discussion we can talk about again for days. And that is, what are your observations as it relates to Native American perspectives involving fossils?

Kirkland: Well, it's frustrating, you know, some of it. You've got Kevin Maximus Madalena, Jemez Pueblo. You've got Native Americans that are supportive of paleo work. The Pueblo people tend to be. But the Utes and Navajo, anything dead is *chindi* you know, turtle. It should be reburied with prayer feathers. As a scientist, you know, it's like dealing with a creationist. As paleontologists, we generally think we don't have to be kind-hearted when we talk about those danged creationists (laughs) keeping our society back. But it's the same thing if you believe in Native American religious faith, to your heart. You know, this is my reality and these things, you know. And it's a tough thing. Because my reality is I think it does more good if it's teaching us something about the way the world has been. Where for other cultures, you know, don't touch it.

Period. And it's a hard nut to crack. Right now, the political sense of things, basically everything should, we should bend over for Native Americans on all issues. And if it's their land, it's like if it's your ranch, I think, yes, because it's your land. This is America. Private property rights are the way it is. But when it comes to public land, I think we've got to maximize the public good. And I think knowledge that can be shared across cultures is more useful.

And to educate kids. I mean, I think using paleo to excite and educate Native American kids – I mean, I've dug on the res [reservation] for years. Thirteen months of my life, a tent on the Navajo and Hopi reservations. So I've definitely worked with the tribes a lot. And I've had tons of kids come out to our camp. And shown kids how to find teeth in anthills and things. And the kids, they really just get into it. Paleo, as a turn on toward science and education, is as good with Native American kids as it is with little white kids. And I think it's still a valuable thing. And the more opportunities we can provide for Native American kids to get in paleo, I think the better off we'd be. You know? Because we've got to move the next generation. You're not going to change an old Navajo woman saying monster slayer killed that thing and we should respect it, leave it alone. Well that's, you know—(laughs) You're not going to change her mind.

1:19:24

Santucci: So that brings us to Bear's Ears and the controversies associated with it originally being established as a monument, and then those boundaries readjusted.

Kirkland: Oh, yeah. And Biden's going to make it a monument again. He's already said that, if he gets elected, it's going to go right back to where it was.

Santucci: And so your general thoughts, having to live through all of that.

Kirkland: (laughs) Yeah. Well, seed money did me good. I got a nice publication on the Morrison out of that. (laughs) Not a lot of money, but I was able to do some good science. Now, Bear's Ears is mostly archeology, the way it's set up now. I mean, the archeologic resources out there, I mean, that inventory's in a big area. It's staggering how many sites there are. I mean, I climbed all over these cliffs and things for several weeks over a few years. And holy cow, there are sites everywhere. And metates and manos. And the amount of archeologic material out there is staggering. And it's been robbed continuously by locals for a hundred years. And there's still tons of stuff out there.

But paleo, we did an inventory of the Morrison. There's some stuff. Nothing super exciting. But there's some good stuff here and there. The plant site really is the best site we've got, in my mind. Because it's going to tell us, we're going to get more insects there, I'm sure. We know nothing about insects in the Morrison. But basically, Bear's Ears, for much of it is mostly archeology. But there is a lot of Chinle.

My favorite area out there for Chinle, though, is Red Canyon. And they kept Red Canyon out of Bear's Ears because there's some active uranium mines in there. And it's still, I think it's one of the most beautiful places in Utah. Rainbow Canyon, Red Canyon, it's just an awesome, awesome area. And there's some great fossils in there. Found the first Moenkopi vertebrate site in there. And I guarantee you, I can find more. I drive down the road and it's like, "Stop, I want to go look at that! There's a site." (laughs) And no one looks at the Moenkopi there. But yeah,

there's got to be good paleo stuff in there. But we really do have to respect our Native American colleagues. Because archeologic sites, burial sites, it's, you know, it is amazing how many sites there are there. They talk about 15,000 archeologic sites are recorded. I had no doubts to that at all, what I could see. And paleo sites aren't as dense. But you know, we definitely want them to allow us to do some paleo, you know? Grand Staircase has way more fossils than Bear's Ears.

Santucci: So, I'm biased on this subject. And I certainly am very respectful of our BLM paleontologists. They have a lot of challenges and they're doing some really great work across the board. But I wanted to just get your opinion because I personally believe that when a monument is being designated to preserve paleontological or archeological resources, that in some ways there are some advantages of designating those areas as a National Park Service monument versus a BLM monument. The first reason is that under the Paleontological Resource Preservation Act, casual collecting of fossils can occur on BLM lands, where they never can occur on Park Service lands. And—

1:23:43

Kirkland: Personally I think collecting invertebrate fossils for kids is critically important.

Santucci: Mm hmm. Sure.

Kirkland: That's how kids get interested.

Santucci: Sure. Sure.

Kirkland: I mean, you know, my grandkids have been digging in their backyard looking for fossils. Oh, man, I've got to take you somewhere where there's actual fossils.

Santucci: Oh, I agree with you. I agree with you.

Kirkland: You know, it's how to get that proper blend. And I don't think they should be doing that in parks. I do think – but I think there should be a whole hierarchy of some of that BLM stuff should be parks. And you know, there's probably some areas in the parks that should be more like monument. You know, there's different, and some of this stuff should be considered like wildlife. I think we should be looking at ecosystem units more than these artificial political units we construct. What are the migration routes of elk? You go out to [unclear] 1:24:43 You go out on the side of Boulder Mountain. Those elk range through eight thousand feet of terrain each year. And it's like, yeah, you've got to make this so these wildlife, the bear and everything, can live their life. Doesn't mean you can't drive a vehicle across that land. But you need to protect it and you need to make sure the vegetation can be surviving at levels for a valid ecosystem. And we need to be thinking that way. In a lot of ways, it's ecosystem to me more than anything else. Paleo, we're scratching in the dirt do not make a big disruption.

1:25:28

Santucci: My hypothetical question to you though is if Joe Biden was elected and he was to redesignated Bear Ears, would there be advantages of designating it as a Park Service monument over a BLM monument? And for the reason that I said that Park Service doesn't allow casual

collecting. And the other thing is that if there was ever a movement to abolish monuments again, probably from the public opinion perspective, it would be more difficult to abolish a national park monument—

Kirkland: Oh, sure.

Santucci: —than a BLM monument.

Kirkland: Well, Bear's Ears, archeology is a much more fragile resource than paleo. You know because it is serious superficial. Paleo sites do go into the ground. As I said, 100% vandalism, but the big sites just keep going. (laughs) I mean, there's holes as big as, you could drop a house into some of them, where they've been digging for years. I don't know how they get away with it. But anyway, they have.

But an archeologic site, you strip that, you're not going to get another one. You know, it doesn't, you don't just go behind it. Oh, there's more stuff behind those sandstone ledges. And I can see Bear's Ears as a national park just because it is so covered with archeologic sites. Paleo is among them. And I do think if you're going to dig up a paleo site, you do need to consider are you going to be hurting an archeologic site in the process. Archeology always has priority and it bugs me very often. Because they'll stay stuff, and like there is no archeologic site where I want to dig. It's not an issue. But I do think that should have some sort of a priority.

And for the Native Americans, a lot of the reason that ever happened was the Native Americans joining forces to help that happen. If you hadn't have had seven tribes pushing for that for decades, that they pushed for, I don't think it would have happened. So I think we really do need to consider it relative to the Native American needs. But you know, archeology, I look at that needing a higher level protection. We do now want the people from Blanding come out and pot hunting on weekends, you know? And they're not digging up the dinosaurs on weekends. It's archeologic sites that they're raping and pillaging one after another.

But I would go with you on that one, making at least parts of it. I mean, they took White Canyon out of Bears Ears! You know, the little chunks they kept. And White Canyon's got like half the sites! I mean, White Canyon, there's amazing archeological – I mean, that was a civilization living along in that area. It's like Chaco. It's a huge area of ruins. And it's just, guys, this is an amazing part of our nation's history, our continent's history. And should be preserved, and not as a pot hunting locality. And sadly, they declared Bear's Ears and did nothing for infrastructure. So people put out guides of where archeologic sites were that have no protection whatsoever. They need to be protected, you know. Paleo, most paleo sites, people, except for a few people, aren't even going to notice. (laughs) They won't see them. But when you have walls and things, have a structure there, people notice. And all of a sudden they're in there, digging away. "I'm going to find something. Put my initials in here."

1:29:35

Santucci: So did you ever have any interactions with Lin Ottinger out of Moab?

Kirkland: Oh, a lot, yeah. I gave him an award for being very helpful. Lin was your wily bandit. But he wasn't like an evil guy. Not like the Shumways were evil. Lin appreciates this stuff. I

mean, he'd report vandalism to us. You know, he does not like people ripping apart sites. And he's reported sites, he still has dug up sites. You know, he's in his nineties, so he's like an old story. But Lin, he'll tell you about, "I found an Indian preserved in copper under the Navajo." (laughs) These old stories. But in a lot of ways, he's not that different than Fran Barnes was. You know, I mean, when Rebecca Hunt first got her job there at Moab, Lin took her and showed her dozens and dozens and dozens of different sites. I mean, she'd have to say, "Lin, I've got other parts of my job I've got to do." (Santucci laughs) Because that's all he wanted to do was take Rebecca out to show the sites that should be taken care of. And Lin's a character and a half. He really is. But not evil incarnate, as people have made him out to be.

Same town, the Shumway family. Those folks are evil. Those are libertarian, they don't care. We're going to mine gypsum out of a national park and then leave all the mining equipment there for them to pick up. They just don't care. A real problem to deal with them. Raiding archeologic sites, paleo sites, whatever. You know? They just break the laws.

Lin actually, you know, leading towards, Lin actually had an appreciation for this stuff. Not the evil incarnate some people make him out to be. He's just famous, because so many people got to know him. Gregarious guy. It's those people you've never seen, like the Shumways, except we've heard about in police reports. (laughs)

Santucci: Right.

Kirkland: They're the ones that I do not want them to come around a corner and see them illegally digging something. I can see them just shoot me. That's a group I would not trust.

Santucci: Yeah. You bring up Rebecca Hunt Foster. So she's the new paleontologist at Dinosaur National Monument. I think, any comments about Rebecca in that role?

Kirkland: Smart move, guys. Smart move.

Santucci: Thanks.

Kirkland: She's going to be great. She is. I told you what she told me when she called me up to tell me that you offered her the job. "You're not going to yell at me, Jim." Because she was a great asset in Moab, too. But Rebecca, yeah, she's great. And she'll create really important programs at Dinosaur. But she doesn't want to be in Washington doing what you'd do. She'd be good at it because she's very forward-thinking. But, you know, she definitely wants to be a paleontologist and be able to do some things. And of course, so good.

1:33:25

Santucci: She brings a whole new future of collaborative thinking to Dinosaur with Rebecca there.

Kirkland: Oh, yeah. No, she'll be great for you guys. And she'll be around for a lot of years. And I do not see any reason in any way I can dream of it that you wouldn't be as happy with her in thirty years as you are now.

Santucci: Yeah.

Kirkland: I mean, she was a great hire for that position. [unclear] oh, she should have been a PhD. For that kind of job, it's like Dalton Wells. Having a PhD, if we do this Utahraptor State Park, may not be the smartest move. You want someone that can run the quarry, and can do all the jobs that need to be done. But you want to have someone that is collaborative, that can work with outside researchers and run shotgun on them in ways that aren't intimidating for people. Develop programs. She's going to be so good excited.

Santucci: Yeah. I'm very excited about this young generation of paleontologists in the Park Service. With Rebecca Hunt Foster, with Adam Marsh at Petrified Forest.

Kirkland: Oh, yeah, Adam—

Santucci: Nick Famoso. Nick Famoso at John Day.

Kirkland: Yeah, I don't know him. Those mammals. (laughs) Adam's got a vision I'm coming up when we work that Dome Plateau stuff to the east of Arches. In fact, I'm almost tempted to say well why don't we do it under your permit? I mean, I don't care what the repository is. We can have the repository with BU or whatever. Or at Dinosaur. I mean, or at PEFO. But being early Jurassic, I can see him wanting to just put it up with Randy up at UMNH. But I'll tell you, he knows that Kayenta fauna well. And my point in my career, I just want to play with it. He's the guy that's going to end up doing the science. So I'm really excited. And Andrew's going to come up, too, for that project. It's good to see how well they get along. You know, Andrew Milner got laid off.

Santucci: Short-term, right?

Kirkland: Understand, yeah, I mean, they'll want him back. But it's tough. And he's in the field right now doing stuff on his own dime. Just because it's what he does. (laughs) Doing paleontology isn't a job; it's what he is, you know?

Santucci: Right.

Kirkland: And the job is just to give him a framework for it. But no, Andrew's good. Marsh, he's a great guy. He's going to be excellent there at the park. So how's Bill liking his job? He's farther up the food chain.

Santucci: Yeah. I think he's somewhat happy. He's got a broader responsibility. He's earning a better income. I think he's waiting for opportunities. He might want to follow me when I retire. He's been looking for some other opportunities. But Bill did a great job in laying a foundation for a really excellent program at Petrified Forest.

Kirkland: Oh, yeah.

Santucci: So I'm glad to see him provide opportunities for Adam and others. He's brought on a number of young individuals. Phil [Verila?], Diana Boudreaux, that are providing assistance for curation and preparation and things like that. So it's a very strong program.

Kirkland: Yeah. I mean, in my mind, if you're ever to get the Chinle Ecosystem Project going, you'd want to base it out of PEFO.

Santucci: Yes.

1:37:37

Kirkland: Even though, I mean, there may be collections that would go to different parks, depending on parks' interests and whatnot. But just for that central organization, it would make a lot of sense. I've told Bill Park that for years. You guys, I'm just, I truly I think it's the way it should be done. And you guys, the most reasonable decision would be that.

Santucci: Yes.

Kirkland: It may be that something else would actually work better.

Santucci: Yeah.

Kirkland: I think there's a lot of opportunity there. And who knows? The biggest thing is trying to make it look shovel ready. Because after this next election, and after this virus has got a vaccine, things start getting back to normal, they are going to be trying to do some like Great Depression projects. And you know, a project like that where you can really market it as we're trying to create a framework for developing new interpretive stuff, create the next generation of park employees. You know, you frame it the right way, I think there's some real opportunities there. But everything's going to be shovel-ready and you want to have things figured out. We got NEPA done.

Santucci: Yes.

Kirkland: We've got the shovel ready, we're ready to go. Just give us the money and bring on the people we need to do the project. Because that's what they want is things that people can be occupied in. I think there's some real opportunities there. I'm hoping there is. Not for me, necessarily, but for this next generation. This next election, most important one in our lives.

Santucci: Absolutely. Oh my gosh. But probably not worth talking about during an interview that's being recorded. (laughs) So, my final question, Jim. I'm anxious to hear this one. So in your own words, what is it about the state of Utah, and its fossil record, particularly for dinosaurs, that puts it on the map globally?

Kirkland: Well, there's a couple of things. We have one of the best early Paleozoic records on the planet. We have four Lagerstätten shale levels. Four. Not sites; stratigraphic levels with distinct biots, four. No special designations or permits [management] or nothing. We have an amazing Paleozoic record.

And you go into the Mesozoic. Why we're so good is you started out with the Ancestral Rockies. Late Paleozoic, you put up this mountain range in Colorado. Shedding sediment toward the Pacific. Along that coastline, you see the pre-dinosaurs and the first dinosaurs come into existence and preserved on those floodplain sediments. You get up to the end of the Jurassic,

things quiesce for a while. So you end up developing this big pediment plain of Jurassic Morrison. You know, all the way across to Oklahoma, and not that different in thickness. But then you develop into the early Cretaceous. Another mountain range comes up, severe thrust belt all the way up into Canada, shedding sediment to the east, toward the western [tier?] seaway, ocean. On that floodplain, through the remainder of the Mesozoic, you develop all these environments you can observe dinosaurs. We're basically right in the middle of the seesaw for these two major mountain-building deposition intervals. It's unique. It really is. And political boundaries are just by accident happening. Some of it's in northern Arizona. Some of it's in westernmost Colorado. But a lot of it's in Utah. (laughs) The Colorado Plateau is a remarkable sequence of sediments.

If we ever could expand, I'd love to see Arches expand to the Yellow Cat Runway. I mean, have you spent much time around Moab in the last few years?

1:42:17

Santucci: Well, I've spent a lot of time in Moab, but not probably within the last seven or eight years.

Kirkland: You should see it. You know that whole strip is now, is just recreation. There are ATV trails, motorcycle trails, bike trails, everywhere. I mean, they've got a bike trail that starts right on a bone bed that I've been wanting to dig for twenty years. And they wouldn't let me dig it because they claimed there's nearby archeological stuff. And then they put a mountain bike trail right across the top of it. You know? It's like, "Oh, it fell through the crack, Jim. Sorry." But you look all the way around there is just so, particularly north, that west side of Arches, there's such intent of development for recreation. We've got to plan this better.

That's why I'm trying to get this Utahraptors State Park in. And you know, Martin's what, Moab Giants, I've been talking to Martin a fair bit. They're probably going to have a fire sale, because the Polish investors are wanting out of it bad, because they're not making their money. They put twenty-something million up, figuring they were going to make a profit. Ha, ha. (laughs) Museums are not the way to invest for making a profit. But it's like, can I figure out a way to get that museum into public hands and redo it, for the good of that region. And I've got hopes that maybe we can pull it off. And then across the street, have Utahraptors State Park. But have that as the repository facility for the region. It's incredible. The turnoff at Dead Horse Point. Great location. Just that you could do so much better than what they've got there now. And a boondoggle since they built it, they definitely want to unload it. It's tough. And poor Martin. He got in a car wreck a few weeks ago.

Santucci: Martin Lockley?

1:44:30

Kirkland: Yeah, he got rear-ended on the interstate.

Santucci: Is he okay?

Kirkland: Yeah. His car rolled twice.

Santucci: Wow.

Kirkland: He got rear-ended. You know, came up to a traffic jam, pull up, someone came up behind him and hit him doing almost a hundred.

Santucci: Oh, geez.

Kirkland: His vehicle rolled twice after being rear-ended.

Santucci: Wow.

Kirkland: Yeah. And he didn't break anything. I mean, you know, he certainly bruised, I think cracked ribs. He got hurt bad. But it could have been so much worse.

Santucci: Yeah. Sorry to hear that.

Kirkland: He lucked out. Yeah. Yeah. I feel bad for the guy. But he calls me because he knows I might be of help in finding someone to take that off their hands. He's an investor in it, too. You know, he goes, "Yeah, you've got to be prepared for the fire sale." And as far as I'm concerned, they're the worst thing that ever happened in Moab to paleo. (laughs) Because everyone in Moab thinks, oh, that's our museum. No, it isn't. (laughs)

Santucci: So I guess I wanted to just conclude by first thanking you for all the years and years of support that you provided to the National Park Service. You have been extremely generous, enthusiastic, positive, collaborative and willing to go the extra mile on any project you've been involved in. And I think you've got the reputation that when you're going to invest yourself in a project, you give it more than 110 %. And we've seen that in every project that you've been involved in. We're very fortunate because you're a pretty smart guy and you know the resource very, very well. And we've benefited from your work over and over again. So I'm personally indebted. I'm honored and—

Kirkland: Well, you guys have given me a lot of opportunity. I do realize that. I mean, I complain and you know—(laughs)

Santucci: Yeah, but it's been fun. I'm honored and proud to have worked with you on these projects. And I think that we've built a really good foundation that we wouldn't have otherwise without your help.

01:46:42

Kirkland: And I think we have joint thing. My big thing is legacy. We want this stuff to be here in a hundred years.

Santucci: Yes.

Kirkland: It may not be here in a hundred years exactly the way it is now. But we want these resources to be a viable asset to our citizens in perpetuity. And not just the fossils, but the landscapes. I look at what's going on today. I'm on more soapbox talking to you about

outhouses. (laughs) Human waste. You know, we're loving this state to death right now. Park Service, you guys are so far ahead of other groups. The BLM is just now starting to say, we've got to put some restrictions on dispersed camping. It's starting to look like places in China. You know, human waste piled up behind every bush. And it's really sad, but we do, we need to work together on this stuff. Me griping about it to myself, we all work together, then we can solve some of these things. I just think real big on legacy. I have kids and grandkids. There will be generations to come that I hope will think as much of this country as I do.

Santucci: Yeah. So, you know, once again, on behalf of the Park Service and our team, we want to extend thanks to you and to Don DeBlieux and to Scott Madsen and to Martha Hayden and to Grant Willis for all the great stuff you've done for us. And I appreciate your time today to spend a few hours to chat about it.

Kirkland: No, no problem. I've been surviving right now. A day not working on my allosaur thing. I can get away with it. I need focus but you're a good excuse. You're a better excuse than others.

Santucci: (laughs) Well, I appreciate that. When I get the transcript together, I'll send it to you. It will probably be voluminous, given how many hours we've talked today. But thanks again.

Kirkland: Are you just trying to put together just some verbal histories of some people?

Santucci: Yes. I've done twenty-three oral history interviews in the past two months. I'll list some of the names because you probably know them. Gorden Bell, George Billingsley, let's see, Will Elder, Dave Elliott, you mention many of these names. John Hoganson for his work at Theodore Roosevelt. Let's see. Jim Kirkland. Lloyd Logan, Gary Morgan. Dave Parris. I even interviewed Harry Reed, Senator Harry Reed, about Tule Springs.

Kirkland: Ah, okay.

Santucci: And Christine Turner. You mentioned several of these people over the course of today's discussion.

Kirkland: Oh, sure. If we were talking about St. George, I would have brought up Harry Reed. He held that back for several years until we just finally convinced him. Clark County kids benefit from the track site. And once he realized how many schools went up there, we were able to get the rest of the money.

Santucci: Very good.

Kirkland: Yeah, he's not a fan of Utah, you know. He may be Mormon, but those Mormons don't like me. (laughter)

Santucci: Well, I'm going to let you go and I'm going to run and grab dinner. And I'll look forward to chatting you again.

Kirkland: All right. Take care.

Santucci: Thanks a lot, Jim.

Kirkland: All right. Bye.

Santucci: Bye.

1:50:54

[END OF RECORDING 2]

[END OF INTERVIEW]

Total time = 270 minutes = 4 hours, 10 minutes