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Natural Resource Stewardship and Science

National Park Service Paleontology Program

Oral History Interview – Kathleen Springer

Natural Resource Report NPS/PALEONTOLOGY PROGRAM/OHI— 2020/018

ON THE COVER
Kathleen Springer

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The National Park Service, Paleontology Program publishes a range of reports, plans, oral histories and other documents that address a range of paleontological resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The NPS Paleontology Program disseminates comprehensive information and analysis about paleontological resources and related topics concerning lands managed by the National Park Service. Given the sensitive nature of some paleontological resource information, such as the specific location of fossil sites, some publications are intended for specific audiences and are maintained as restricted access. When appropriate, sensitive information is redacted from reports in order to allow greater access to these reports by NPS staff, partners and the public. This work supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission.

This oral history transcript is available in digital format and is maintained within the NPS Paleontology Program Archives and Library through the NPS Geologic Resources Division. If you have any questions regarding this transcript, please email vincent_santucc@nps.gov.

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Background

[Interview with Kathleen Springer from her home in California: This telephone interview was conducted Monday, July 20, 2020. The primary speakers are interviewee Kathleen Springer (KS), who is a research geologist and paleontologist with the USGS and Vincent Santucci, interviewer, (VS), senior paleontologist for the National Park Service, Paleontology Program, at home in Gettysburg, Pennsylvania. Erin Eichenberg (EE), Integrated Resources Program Manager at Tule Springs Fossil Beds National Monument and Jill DeStefano (JD), President and one of the founders of the Protectors of Tule Springs were also on the telephone call.]

The interview was recorded on a digital audio recorder and a mp3 file was created. A written transcription of the interview was produced from the digital audio recording, by TUSK volunteer R. Sky McClain, and this document contains the discussion during the interview. Kathleen Springer signed a release form for the National Park Service for the preservation and use of the interview in the future. Birth date PII has been omitted.

Transcript

[This oral history interview with Kathleen Springer, at home in California, was conducted on Monday, July 20, 2020 by telephone with Vince Santucci from his home in Gettysburg, Pennsylvania. Kathleen is a research geologist for the USGS.]

2:38:10 (length of interview)

[START OF INTERVIEW]

[Short discussion of whether Kathleen's past work with larger land context in and around Tule Springs/Las Vegas Valley that was pre-monument would be discussed, and Vince said they would cover this in detail during the interview.]

VS: Today, is Monday, July 20, 2020. My name is Vincent Santucci. I am the senior paleontologist for the National Park Service, Paleontology Program. Today, I am speaking with Kathleen Springer, geologist and paleontologist with the US Geological Survey. Kathleen has an extensive history working in National Park Service areas, including Channel Islands, Death Valley National Park, Joshua Tree National Park, Tule Springs Fossil Beds National Monument and White Sands National Park. The interview is being conducted by telephone from Kathleen's home in California and I am at my home in Gettysburg, Pennsylvania. We are joined by Erin Eichenberg (EE), Integrated Resources Program Manager at Tule Springs Fossil Beds National Monument and Jill DeStefano (JD), President and founder of the Protectors of Tule Springs.]

VS: So, the first questions is going to be the easiest. They get much more difficult from here. First question: Kathleen, if you are willing to share, when and where were you born? What was it like growing up? And if you could give us some background on your education and interests up until the time you went to college?

KS: Oh wow, gosh, this is like 'This is Your Life.' I grew up here in Southern California. I was born in Santana, but I grew up in Riverside, California. Typical 60's upbringing – I was one of two. I had an older brother who's only 11 months older than me, so we were very close in age. My brother Steve. I went to Catholic school up until I was in high school. I begged my parents to let me go to a regular school. (Laughter) In high school I was one of those kids, always questioning everything. I drove the nuns and priests crazy with all of my questions in the back of the room, "But, what about the dinosaurs?" I would ask. I was kind of that kid a little bit. Very inquisitive about the outside world, very, very much so. I was obsessed with math and weird stuff like that. Back then not very girly, because I wasn't very girly. I was a super good athlete, tomboy kind of person. Just wanting to be outdoors all the time. I went to high school and I didn't have any clue you could do something like geology or anything like that. I was not exposed to anything like that at all. I never went camping when I was a kid. My parents took us places but never exposed to that kind of thing. Even though I had the desire to be exposed to that experience. I was interested in so many things but really when I was young I wanted to be a Forest Ranger. I was obsessed with John Denver [singer]. Don't laugh at me. I wanted to go to Colorado and be a Forest Ranger and work in a park. That's what I wanted to do when I was a teenager.

KS: But I was also a really good athlete and I thought I could be a – I really didn't have a plan, a direction, even though I had people around me telling me, "You're really smart. You need to do things." But, I went to community college originally because I felt like I just needed to find out what I liked. Riverside Community College is here in Riverside and is really good. Very old Community College in California. I met people that were in the geology club. I took a lot of geography classes, again obsessed with math. So, I have a lot of geography background. Took every geography class that was available, but met people who were in the geology, round when it was called the geology club. And I'm like, "What're you guys all about?" They were like, "We go to National Parks and we go camping and we look at rocks." And I'm like, "Oh my God, sign me up." (Laughs) I started hanging out with those people. Those geology club people. The more I got hooked into them I realized what I really enjoyed about geography was the landscape. So, I was originally going to Cal State Fullerton and get a degree in Geography. Which is interesting because my brother-in-law was there at that time getting a degree in Geography. So, I actually would have met my brother-in-law Scott before I actually met my husband Mark at UC Riverside, which is where I finally went. I decided to go to UC Riverside and pursue a degree in Geology. UC Riverside's science department is incredible geology curriculum. It was a very tough geology curriculum and they were well known for being a really, really good school in geology. It's right here in Riverside and so I'm still in Riverside. Went to school in Riverside. That was great and I got to live at home. I wasn't really interested in dorm experience. So, I got to live at home and start taking geology classes. I got a scholarship from the Community College and I really enjoyed it. Really challenging for me because I was used to sort of skating a little bit, doing well. But I really had to up my game when I went to the University of California. I really enjoyed it. I met a lot of professors and a lot of students. You would find it very difficult to believe this now, but I was very unassuming, very quiet. (Laughter) I didn't really talk a lot. Didn't find my voice until much later. I was very afraid, an afraid person of anybody in authority. I didn't really talk to professors very much. I just tried to take it all in and students are kind of funny that way. I did well there. I met my future husband there who was a graduate student. He was taking geology classes deficiency's because his original degree was in biology. So, I met him, even though a graduate student, in my undergrad class. So that was kind of fun.

KS: So, I have a Bachelor of Science in Geological Science and I started working at the San Bernardino County Museum in 1983.

VS: Kathleen.

KS: Yeah.

VS: So, you answered the first question very well. And then you went on to my next seven questions. (laugh) So, I didn't want to go too far. There's a couple of questions I wanted to ask before we get to San Bernardino County Museum.

KS: That's how I was exposed to the Museum was when I was in college. So that was just in context in what I did when I was in college. To make money, I worked. I was introduced to people at the Museum and was there for a couple of years when I was an undergraduate.

VS: So, the first question was up until you went to college. I did have one follow-up question.

KS: I must have misunderstood. I'm sorry.

VS: No problem. The only other question I wanted to ask you was before you went to college did you ever have the occasion to actually see a fossil in the wild?

KS: Before I went to college?

VS: Yes.

KS: No.

VS: Ok, so what was your first occasion when you actually saw a fossil in a geologic context? [Long Pause] If not the first time, then the time that was probably the most interesting for you?

KS: Probably as an undergraduate taking classes in stratigraphy and sedimentology and those types of classes. UC Riverside obviously has a myriad of places they took students on field trips. You had the whole Mojave Desert at your disposal. Going to the Cajon Pass which is a geological literally treasure trove of 70 million years of sedimentary rock. Sort of the in-born of the San Andreas Fault so we went there very early on. You don't really get to go on those cool field trips until you get out of the curriculum of minerology and physical geology, then you got to go on field trips. I also took historical geology with Michael Woodburn, who's a very famous vertebrate paleontologist. He took us to the Barstow Fossil Beds. I immediately was thinking the Cajon Pass with some of the earliest places. We looked at some of these Miocene fossils, horses and [colecatheres?] and really weird, cool stuff from the Miocene deposits in the Cajon Pass and of course the Barstow formation. Namesake in Barstow. Going there with Mike Woodburn early on. That was when I was maybe 21-20 – 21 I was on these fieldtrips. Of course, in the curriculum you always go to the Marble Mountains in the Mojave Desert and look for trilobites. That was my earliest touching a fossil, finding a fossil.

VS: Once you got into your undergraduate studies. Did you know at the beginning you wanted to go into geology and geography or was it more exploratory as an undergraduate?

KS: When I first went in I definitely had the bent of something. I went in with the bent of taking general education but tried to find something – I took an entire year of astronomy for instance. I leaned toward science trying to find something in that world. But the geography classes were super interesting to me and I took every one that was available. They had a really good geographer that was a professor on that campus that taught the theories of all kinds of cultural geography. Not just physical geography but all kinds of cool classes. The geography part is what instilled my spark. But it was something more that I knew that—it really was after meeting people and actually going out and going to Zion and Bryce and going to Death Valley and going to the Grand Canyon with all these people. Who were already committed to going on to becoming geologists. I learned a ton from them. That was the experience – going to these National Parks when I was 19 years old with these people. I had never gone to any of these National Parks before. That was outside the academic realm, the actual experience, that got me – ok, that's it. I'm going to become a geologist. I want to know everything. (Laughter) It's my frame of reference. I want to know everything. It's kind of how I am now. I want to know it all.

VS: So you came to that realization as an undergrad?

KS: Yes, before I went to UC Riverside.

VS: So, you completed your undergraduate degree. Did you do any undergraduate thesis or research project?

KS: I did not. I worked in the lab of Michael Murphy, who is a very, very well-known invertebrate paleontologist and one of the premier biostratigraphers, Paleozoic biostratigraphers in the United States at the time. He's 94 currently. He's a cool dude. He was at NAPC last summer and we had a whole symposium dedicated to him. I worked in his lab a little bit. Working on conodonts and graptolites. I also had the experience of going to Australia with Michael Woodburn for about three months. Working in the outback, digging up Miocene marsupials. I was a very torn person between vertebrate paleontology and invertebrate paleontology. I was a little bit of a schizo. Most people are, 'I'm just interested in X' and they become like a horse expert and that's all they care about. It was part of my personality and I wanted to know everything. Really loved all aspects of paleontology and invertebrate paleontology taught me that you have to work really hard to get some of these really tiny critters out of the rock. And when you do you can study them and measure them and analyze them. Even though they're practically microscopic- a conodont. I learned the patience of paleontology with invertebrate paleontology. Working in a lab, actually preparing the fossils and getting little, tiny fossils out of rock, is not easy. But the satisfaction of doing that and seeing through that process to the point where you can study them was really kind of cool for me. Being exposed to the vertebrate part of it with Mike Woodburn really left me with, "Oh God, what am I going to do? Work on invertebrate fossils? Am I going to become a Volcanologist?" There was a time when it was kind of weird for me. There's too many things that I like. Those two parts of paleontology – being actually exposed to invertebrates was a very seminal teaching thing for me for the future.

VS: So, a little bit more detail about the lab job. Do you remember what year you started that job? How long you worked there? What your responsibilities were? How you were trained and mentored?

18:00

KS: It was the early 80's. I worked at the Museum from '83-'85. But I also worked for Mike Murphy kind of at the same time during those same years. And I continued as a graduate student working for him too. So in those years '84, '85 we are looking for Silurian Devonian conodonts, which are these really teeny, tiny phosphatic animals; pre-pre-pre-vertebrate animal. And they're tiny and they're very important for biostratigraphy and chronostratigraphic in the Paleozoic because the succession of vertebrate animals, these pre-vertebrate animals that – these conodont creatures, they change through time. The rock units in Europe and all over are broken up with these biostratigraphic zones of conodonts and graptolites and it's a way to tell time that is very, very robust. In a lot of places in the world they're sort of these cosmopolitan species that span the globe because of the way the configurations of the continents were and the Silurian and Devonian. So you have these limestone rocks that were at the bottom of the ocean floor and you have to melt—these critters swam around in the ocean—you have to melt the rocks to get the conodonts out of them and in between these conodont horizons – we call them terabyte layers – basically an underwater landslide, essentially. So, you have a deep ocean oozy sediments, like shale and mud and mud and mud and then all of a sudden you will get a more-coarse grained lithology we say, more grains in it. And that's this pulse of stuff coming down off the continental slope and those horizons have the conodonts in them. The muds have the graptolites – so this really wonderful successions. To get the conodonts out you have to use one technique where you

melt the rocks with formic acid and to get the graptolites out you do that in the field. You're just whacking on the rocks, splitting shales, revealing these beautiful little graptolite critters that look like pieces of pencil lead on the shale. The conodonts are very difficult to get out and to study because you have to do all these chemical treatments. You have to use formic acid in water and it takes weeks to melt these rocks. And they're phosphatic so their chemical nature, they just don't dissolve. The fossils don't dissolve in the formic acid so you're continually decanting this water and adding new acid. So, that's a pretty boring job. (Laughter) Taking tubs of water and pouring it down and then putting new acid in. So, I did that a lot. Tubs and tubs and tubs with labels of all these stratigraphic sections from all over Nevada. I think I've had dreams about this. He had a lab at UCR outside on the loading dock. There was a lab in his lab in the geology building where he did some of his work as well. So once you finally ended up with a melted rock, which is basically, picture a handful of sediments. You can look at the shells in there and see all kinds of weird stuff. But then you have to get the conodonts out. So you don't pick them out by hand, you have to actually do another chemical treatment using this really nasty chemical called TDE, which is a heavy liquid. The conodonts sink and the rest of the stuff floats. You do that under a fume hood because it's very nasty stuff. You're not supposed to breathe it in. And then you eventually get these little, teeny, tiny conodonts after more chemical treatments and cleaning them with acetone and more acetone and more acetone. So, a lot of chemicals I used in my early 20's. And then you end up with this teeny, tiny bits of black stuff. And when you look at it under a microscope, there's little critters. And you pick them out and you glue them to these little, teeny, tiny slides that have little tiny squares. Like one, two, three, four, five and then you end up with this permanent record of the conodonts from that section. So, it's very meticulous work.

22:55

KS: You can also get octopods this way. Octopods are also in this part of the record and they get preserved this way. So, you're picking out octopods and you're picking out conodonts. Spent hours and hours and thousands of hours of my life picking out little, tiny things under a microscope. The whole entire process takes a really long time to have that happy moment when you get to pick the things out and look at them, figure out what they are. Basically after that you have to identify them, species, and there's like a million papers on conodonts. So many world experts on this. I am probably one of the few people in paleontology that has a scientific paper, I think two, on conodonts. For my work with Mike Murphy. So, the lab work was really informative and instructional and a little bit dangerous. I was burned with formic acid, 100% formic acid on my right forearm. And I have a very nasty scar still to this day. I was in intensive care at UC Irvine Burn Center for a couple days after that happened. I was pumping out the acid and the pump broke. Even though I had gloves on, all the way up to my elbows, the acid went inside my glove. And filled my glove up. From the time it took for me to pull my glove off instantly I was burned, with third degree burns on my arm. Wasn't very fun.

VS: Sorry to hear that. So, just a clarifying question. Just clarifying and brief. So, when you were an undergraduate you worked both at UC Riverside in the lab and you worked at the San Bernardino Museum? Could you put that chronology together? Because it's unclear.

KS: I'm positive I worked at the Museum from 1983 to 1985. '85 was when I graduated with a degree in geology. There was some overlap. I'll try to remember here. I was burned with acid in 1984, the summer of 1984. I was working for Mike Murphy then. So, there was probably some overlap at some point. I started working at UCR in early '84 and worked there pretty much

continuously from an undergrad and I segued immediately to graduate school, working under Mike Murphy as a grad student. So, probably ’84.

VS: OK. Great. You transition. You graduate as an undergraduate and you begin your graduate career. It sounds like you worked with Murphy. Can you tell us about your graduate education?

KS: I graduated ’85 and I went to Australia that summer with Woodburn to do this vertebrate paleontology thing in the outback, South Australia. That was really fun and really good experience. I was committed to starting a Masters with Mike Murphy. What I was interested in—this is a very funny thing. It wasn’t that I was in love with a certain taxon. So, there are people they’re saying it’s “their thing”, I’m more of a—it’s not the animal that I’m interested in. A colleague of mine is a Pleistocene horse person. Knows pretty much everything about Pleistocene horses and that’s his animal. He knows all the things. I was more interested in bigger questions that the animals could answer. I was interested in evolution, patterns of evolution. I was always interested in patterns and what you could discern from patterns of evolution through time. What these animals were doing with their body plan through time. Some of these animals that are just in multitudes in the ocean, 380 million years ago. When you collect them you can collect gobs of these suckers and you can measure their little bodies by the hundreds. You can get a really good statistical sample. So, I took a lot of statistics in college. I took a lot of biostatistics. I didn’t love calculus (Laughter) which you have to take for a degree in geology. The whole calculus, physics, chemistry – all that route. But, I loved statistics and I took a lot of biostatistics just for biologists. I should backtrack and tell you that in my undergraduate education I have almost a minor in biology cause at UCR you were allowed to have a paleontology option. So, in addition to the regular curriculum for geology, basically I took evolution and functional anatomy of a vertebrate, natural history of the vertebrate, and evolution and genetics and population ecology. I took a ton of biology classes including these biostatistics classes because I was very interested in paleontology, even as an undergraduate. Even though I didn’t know exactly what I wanted to do with that I was just interested and wanted to do something in paleontology. Of course, I had been working at the Museum and exposed to all kinds of fossils there too.

29:17

KS: The biostatistics part really spurred on this idea that I could collect all these critters and I could measure their different apparatuses or whatever they are on their bodies and see if they change because in a stratigraphic section. It was an idea that Dr. Murphy and I came up with that I would go to Nevada and measure these sections in Central Nevada in the Simpson Park Range and I would collect a series of horizons of these graptolites and I would measure them for these different characters. Basically, the title of the thesis is *Patterns of Single Character Evolution in Lower Devonian Group of Graptolites called Monographls hercynicus*. So that’s what I did. It was really interesting. Because I discovered something doing really rigorous, quantifying statistics. Something they had noted qualitatively in Europe, and Poland, and Russia. Because these are cosmopolitan species that occurred all over the world in a snapshot in time in the Lower Devonian. Something they had noticed and published on—actually for the first time we were able to quantify this character change. This evolutionary change through time in these graptolites. That was really kind of cool and gratifying. And we published that as well in the Journal of Paleontology, a couple of years after I finished grad school. I got to do the fieldwork part and then I got to collect all these fossils and measure their little bodies and then do the

statistical analysis of them and come up with this idea you could break these species out with mophrodites and there was a very specific period of time where they abruptly changed to this new morph that is a morph that's seen in Poland. It's also seen in Central Nevada. It's just the coolest thing ever, I thought.

VS: Kathleen, was this research tied to your Master's thesis at all or did you do a Masters?

KS: That was my Master's thesis. Sorry, if I was not clear enough about that.

VS: Excellent. Very good. So, you completed your Master's and you defended. Then where did you go after you graduated?

KS: So, I was one of those people, when I started as an undergrad, oil companies still came to schools and swapped people out and gave them good jobs. But then that started to wain in the '80's at some point. I have to say that in my Master's career I took a break because I got married in 1987. On my birthday in 1987. I went with my husband. He was a visiting graduate student at the University of Wisconsin finishing his PhD and the only machine in the whole country that did this DNA stuff that Mark does was in Wisconsin. So we lived in Wisconsin for not quite two years and I took a leave of absence from my Master's to go there. And then we came back. Coincidentally, he got a Post Doc at Cal Tech. Upon him finishing his PhD. So, it's like, "Yeah, we got to move back home" and I got to finish. I graduated with my Master's in 1989. So, that's why it took so long, from '85 to '89 because I was gone for some of that time. But, getting back to the question, I was not interested in oil industry. I was not interested in geotechnical work. I was not interested in doing anything like that. I wanted to work at a museum. In my head, that was what I was gonna do. That's partly because I worked in the museum and I knew what museums were like and what they did. I just thought, 'That's what I wanted to do.' I wanted to be a curator at a museum. I knew that's not where you start. I was just a little, tiny person at the museum doing whatever Bob Reynolds wanted me to do. [Bob] was the curator there at the time. So, I finished my degree and there was a job advertisement at the San Bernardino County Museum for Field Supervisor for their paleontology program there. I applied and I got that job. I started at the San Bernardino County Museum on September 11, 1989 and I worked there for 26 years doing all kinds of things. I'm sure you'll ask me questions about that.

34:26

VS: When you were hired what was the title of your position again? Was that the position you held throughout your career?

KS: Oh, gosh no. I started in September of 1989. I was hired as a Field Supervisor of the Paleontological Resource Assessments Program. It was like the first of its kind in California. The only example of that today is Tom Deméré program at the Natural History Museum in San Diego, California. Tom runs a similar paleo program where he has tons of people that do field work on construction sites. Doing mitigation type field paleontology. So, I was hired as the Field Supervisor in 1989 and in 1990 I was promoted to Project Manager. I was the Project Manager of that program and that was when Eric Scott was hired. So, I hired Eric Scott. Scott was hired on my recommendation and he was hired as the new Field Supervisor. So, Eric came in at 1991 and that's when he started working at the Museum with me. But I was the Project Manager, managing all these projects. We had lots of people working all over doing all kinds of things.

Some of the places were in Las Vegas. I became in charge of the entire program a couple years later. So Bob Reynolds was in charge of the program. He was the Curator. Also in charge of this program. I think it was about 1992 he was asked just to be the Curator for sciences. And I was promoted to the head of this Paleontology Assessments Program. As it was called PRAP starting in about '92. So, I was solely responsible for everything. All the people. All the projects. Doing everything from that point on. My title was—I don't really—my title eventually changed to Curator. It was a way of saying Vince, and a lot of museums operated this way. A lot of the people early on at the Museum were contract employees. So as a governmental entity, a County entity, some people were actual County employees and some people were contract. So, I actually was a contract employee, even though I negotiated that I was in the County Retirement System early on. Lucky for me. I did that really early on so when I left the Museum I had a lot of years. But, not everybody did that, which is sad. But people were hired in this contract way. In 1997 I actually became a regular County employee and my title from that point on was Senior Curator of Geological Sciences.

VS: Great. Thank you. That's helpful to put it into context. I knew that it evolved over time but I wasn't sure of the various titles and responsibilities.

KS: From 1997 to 2015 my title was Senior Curator. Bob Reynolds actually left the Museum in 1999 and from that point on I was in charge of the entire division. In 1999 to 2015 when I left the Museum, I was the Senior Curator of the museum, so I was the highest Curator. There were lots of other Curators. So, I was the Senior Curator, but I was also the Senior Curator of Geological Sciences from 1999 on.

38:55

VS: Great. Thank you. So, we're gonna shift the focus now to a more specific focus. When was the first time that you ever heard about Tule Springs Fossil Beds? The other part is – When was the first time you ever saw Tule Springs Fossil Beds? So, that's a two-part question.

KS: I'm going to answer it in a – not a direct way. But, I'm going to answer it in what I was saying earlier. That Tule Springs Fossil Beds to me is the Las Vegas Formation. Is that ok?

VS: Oh, absolutely.

KS: The Formation. My first exposure to that Formation was in, I did a huge survey in January of 1999, excuse me January 1990. So, I started working at the Museum only a few months earlier, September of '89 and just four, five months later I went to Las Vegas with a team of guys. There was four of us and we had to survey ,in a very short period of time, 9,000 acres! In the Upper Las Vegas Wash area for a very large BLM [Bureau of Land Management] land transfer. So, in 1990, you have to image what Las Vegas looked like. I mean it was actually shocking. There was nothing north of Craig Road and this land transfer was actually north of Craig Road. 9.000 acres. And the entire surface we walked on, Vince, was the Las Vegas Formation. And there were floosy green sediments, and giant planorbid snails all over the surface. Knowing what I know now I would give anything (Laughter). Knowing what I know now about the geology and all the times I went there early on I wish – because I remember what we walked on and basically documenting fossil sites. But eventually of course, we all know what it looks like north of Craig Road, you know houses. That was my first exposure to this Formation

and there was gorgeous gullies, arroyos, and stuff. You could see the stratigraphy in section. I didn't know much about the geology or anything. I didn't really know much. It was early on and Bob Reynolds would just send us out to places and – he was kind of famous for just 'Oh, just go out there and just put the dots on the map, write up the locality, and tell us if there's any fossils, you know. That was really it. Not an emphasis on context. Let's put it that way. I guess I'll just say it in that way. Not a huge emphasis on Context. I know I was there and nearby there was this Tule Springs area with all the same stuff. So that was 1990 and there was the Kern River pipeline that went north through Utah, Wyoming, Nevada, and California. We got the contract for the Nevada and California portion – It was a huge, huge project and it went right down Centennial Parkway which is just a little south of the Monument and we found a famous Centennial Mammoth. So, just a little south of the actual boundary of the park is the famous Centennial Mammoth right? Which is where that park is that's just a little east of Clayton. I wasn't on that project, but I managed that project because I think I had literally just had a baby. (Laughter) during that period of time. So that was the other big thing we did. In 1991we also did the Clark County Flood Control work that is in the park currently. The weir on Moccasin Road and the Detention Dam at Decatur. We did all that work and found tons of fossil sites. And again, another famous mammoth site was found where that weir is, just south of Moccasin Road. We did all that work. And all those fossils came back. We did a lot of that work with a company that is defunct now. It was called Dames and Moore and Geoff Spaulding was a principal at one point for Dames and Moore. Geoff Spaulding, if you guys don't know, is a pretty well-known paleo-botanist, worked on pack rat middens in the Sheep Range and did some climate studies in the 80's and 90's. Eventually worked for industry on these big, environmental projects. He was an environmental person doing this kind of work. That's where I know Geoff Spaulding. He was a very good scientist as well. He understands very well the importance of Tule Springs so that was nice to work with him when we did all this work and found these cool fossils. So, that was my earliest exposure.

VS: OK. Let's take a break right there. Would you consider these mitigation projects and the San Bernardino County Museum contracted for this work? And did it also contain both documentation of sites and collections of specimens? Are you able to respond to all of those?

45:08

KS: Yes, the San Bernardino County Museum Paleontological Resources Program did mitigation projects exclusively. Usually we were contracted by big environmental companies in the name of BLM. Like, for the BLM or for the Clark County Flood Control or for the Kern River Pipeline Company. So, they were like sub-contracts for some big environmental company. We would be on teams. Like, big environmental companies bid on these gigantic projects and me and Eric – we'd write the proposals and we'd be on these teams essentially. So, yes they're mitigation projects. Yes, it was done. And Eric and I—this was one of the things that sort of set us apart was we were a Museum and we did it by Museum standards and we really didn't waiver even when people pressured us to do other things. We collected the data really scrupulously. The objects were collected. They were all curated. Nothing was sort of these orphaned collections that happened in a lot of instances. So, we did that for a number of years. And it wasn't until I had more control over the division, late 90's early 2000's that I shifted the focus away from doing mitigation per se with more of a research focus. But, I'm getting ahead of myself, I think.

VS: No, that's good. Perfect. So, at the time were all of the collections then curated at the San Bernardino County Museum? Did they ever wind up going to different institutions or did they all remain at San Bernardino County Museum?

KS: That was the way the contracts were written. They all had to be curated at the San Bernardino County Museum. If this was on land that was BLM land at the time then we had BLM permits. We were the daily repository. We were the repository for the State of Nevada. We actually curated other stuff from other projects as well. But, yes, everything we did was curated at the San Bernardino County Museum, was never transferred anywhere. There was really no reason for that. We were the stated repository.

VS: So, this is going to be a hard question. Based on how you can best recall from the time because I am going to ask you the same question at the end. At the time, what was your impression about the significance of the North Las Vegas Wash and these Tule Spring beds? And how did that evolve over time? What was your initial impression? Was there anything significant or geologically interesting that captured your eye early on; that changed over time?

KS: It probably did because of my context and my responsibility had changed with the Museum. That was also a factor here. It's different if you're a person that goes out and walks thousands of acres and puts the dot on the map vs - which is kind of antithetical from the person I am. It was kind of a job. My job sometimes just that. But, as I had more and more responsibility. I mean I knew these were highly fossiliferous sediments. Always, from day one. You walked out there and there was stuff. You know, there's stuff. (Laughs) And in all of these projects, I had a team of people that were documenting vertebrate fossils coming out the 'you know what. 'You know, Mammoths and all kinds of stuff. So, the recognition that these were highly fossiliferous deposits. That was a no brainer. We knew that early on. I knew that early on. Whether I understood the complete significance, which is what I know now. Of course, I didn't. Because, I didn't know the geology. I just knew that walking on the surface of these deposits there are vertebrate fossils, and there's invertebrate fossils, and they 'scream' fossils. So, there's a thing in paleontology. There's like certain sediments—you know this too Vince—even on a drive-by survey you go, "Oh my God. Those are screaming that there's fossils in there." And that's kind of what these deposits look like. And that did evolve because of the ability to get boots on the ground finally in like 2001 and '02. I don't know if you want me to go forward?

VS: Sure. Just a couple more questions. So, doing the work that you were responsible for is very busy and I'm not sure – did it allow you any time to actually do any research and were there any early specimens that were recovered that you think were particularly important discoveries?

50:50

KS: So, mitigation paleontology is not very research forward. It is to mitigate the impacts to the protected resource. So, that's sort of the party line. Because we were a Museum and because we were actually professional geologists and paleontologists in charge of all this. Yes, there is the desire to do research but in a mitigation context there's not money to do that, Vince. From my experience and to just harken to another location. I did this huge project in Southern California for ten straight years where it was the largest mitigation project in the entire United States at the time and probably since. It was a mitigation project but the way we negotiated it as a Museum we profoundly learned and did research on that collection. That was a novel instance. Most

mitigation is not really research forward. You are documenting and you are collecting the objects and you are preserving them in perpetuity in a repository, which is the letter of the, and intent of, the segue, which where we worked in California and then in Nevada the regulations were federal. And I can honestly say the person I worked for didn't emphasize that either early on. But, it changed because I kind of made it change. I guess that's how I'd address it. We kind of made it and we emphasized it. We're going to participate in these kinds of things this is what you have to do.

VS: Can you recall approximately how many projects that you were involved in in the North Las Vegas Wash and Tule Springs as a sub-contractor or direct work through the Bureau of Land Management prior to the Monument's being established?

KS: Do you consider the BLM CTA [Conservation Transfer Area]? The Project prior to the Monument? The CTA project?

VS: Yes, any work you were involved in prior to December of 2014.

KS: Yes, if you go forward in the boundaries of the Monument or very close to the boundaries of the Monument. I would say the Clark County Flood Control Project is in the Monument. That was like '91ish. They built those weirs in the Detention Basin at Decatur. So that was a really large, large project. The Kern River Pipeline was south of the Tule Springs proper. But, not that far south. That was in 1990. The Clark County Shooting Range has full section to the west that I'm not sure why they were given to Clark County. But, it is a very substantial portion of the wash. We surveyed those sections and there is about 36 fossil localities that have never been collected. Now, this is my soapbox moment. They were documented but they've never been collected. I've tried to preach about this to as many people as I can but that was in 2005 we did that. In 2003 to 2004 was the very large survey. That's another project. A very large survey for what was called the Las Vegas Valley Disposal Boundary. 50,000 acres in and around the Las Vegas Valley with the preponderance of the deposits in the North Las Vegas area and the Upper Las Vegas Wash was where we concentrated our surveys. But we actually did survey all over the Las Vegas Valley. The area where we found the 438 fossil sites in 2003 and 04 – a big project that documented and recommendations. That was the very earliest utterances of me speaking to the big environmental company saying, "Why is this in the disposal?" I mean, you asked my recognition of how important early on the significance of this area? When I was first approached by the BLM and PBS&J which is this huge environmental company and said there's 50,000 acres that are going to be disposed of by an Act of Congress. Will you join our team and help us determine the paleontological potential of the area that we're going to sell. I was like, "What, are you nuts?" (Laughter) I think I might have said that to the BLM. "What are you nuts? How did this get put in a disposal boundary? This is one of the most famous localities, the Tule Springs Expedition." Kind of went off on a little minor tangent that there will be vertebrate fossils. There will be vertebrate fossils encountered and we will find them and we'll document them for you. And then I'll be able to say, "I told you so." But people, to my face, were not as confident. Let's put it that way. So, that was a very important moment.

KS: I'm sorry to say I skipped over another mitigation program. Which was the Harry Allen Northwest Transmission Line. Sorry, that was in 2001 and 02. That was a really important project because we were able to get boots on the ground. Although it was only a 200 foot right of way we were allowed to look at. That kind of, you know, the letter of the law. Like here is the

right of way. You may look here. It was very obvious we could learn a lot more if we could at a larger area. Then we discovered lots of fossils on that. We collected those Harry Allen specimens and that allowed us to learn more about these deposits, not a lot more. It was always, just a desire to see a bigger picture, which is what the Las Vegas Valley Disposal Project in 2003 and 04 allowed us to walk it. Get boots on the ground over this huge area and document all of these sites. The BLM actually gave us a little bit of money. I don't know if you know this. In 2005 they gave us a little bit of money to collect all of the specimens south of Grand Teton in what was called Section 15. Which is where the—what do you guys call it? The Doughnut Hole—all of that land there.

EE: The Villages of Tule Springs?

KS: Yes, in surveyors it's Section 15. So we collected all of the sites in Section 15. And in 2005 is when I was brought out to the field with this phalanx of developers and Gayle Marrs-Smith [BLM] and put on the spot about where I would draw any kind of boundaries. Or, almost what I would save. There was a lot of weird questions like that. This was the story I was telling you, Erin, [Eichenberg] when we did that walk along the Tufa Trail, a year ago. When you said, "I've never heard that." But, yeah, anyway, I was brought out to the field in 2005 and asked, "What"—and that was the beginning of this kind of odd-shaped boundary, of what the National Monument boundary became, because of the configuration of the fossil sites and where they were distributed. So, in 2005 we collected – those were the first opportunity to collect the specimens that were found in 2003 and 2004. We didn't have the next opportunity until 2008 when we were awarded the Schedule Assistance Agreement by the BLM.

1:00:33

VS: So, just for the record. Gayle Marrs-Smith works for the BLM.

KS: Eventually she became the Field Manager but at that time she was a botanist who was in charge of this Conservation Transfer Area Project. Yeah, she was a botanist. She did a very good job.

VS: Kathleen, moving forward, what we are going to try to do is to proceed so you can tell us a little more about what happened in 2008. Then we'll have some specific questions up to pre-Monument. Then, I want to take just a quick break and see if Erin or Jill have any questions for you. And then we're going to shift gears a little bit on another topic. What happened in 2008 that was significant?

KS: In between us finding all the fossils in 2003 and 04, I still had my fingers in all of this, of course. And in 2005 we were able to go out there and collect some fossils. I kind of continued to sort of bang the drum if you will. "Hey, we found all these fossils. There's 438 fossil sites out there guys. Hey, when are you going to let a Museum, when are you going to let somebody collect these things?" "They're out there." It was just me doing that bugging the BLM somewhat on a very regular basis. (Laughter) And talking and talking and having meetings with BLM. Talking about - What is needed. What is required. How you would go about it. What needs to be done. Talking with Scott Foss, the Regional Paleontologist. A lot with Scott Foss and Gayle Marrs-Smith. People at the BLM about how you could go about this and what it would look like. On their end they needed to find out how they could do that in terms of money. Where are they

going to get the money? The SNPLMA money or X, Y, or Z. That was their job to figure that part out. But, I was there to tell them how it should be done. Even writing documents – this is the methodologies of what should be done; how it should be done, things you consider, discovery sites. If there's a discovery site, what that would look like. Which was pretty predictive because we ended up finding a very large discovery site. And just off the hook that became the Super Quarry. Eventually it all came together in a document which was the RFP, Request for Proposal, for a federal assistance program. It started out one time and as I recall finally the Scheduled Assistance Agreement was let or posted. There was a deadline. It was a very involved response. A very involved proposal that needed to be put together so we did that. The San Bernardino County Museum was awarded the Scheduled Assistance Agreement and it was all signed, sealed, and delivered by the summer of 2008. Lots of meetings. Lots of things. And eventually we agreed that we would start excavating west of Decatur in the two sections. Sections One and Two because that was considered the highest traffic area and it was also the area where there's the densest concentration of vertebrate localities. So starting in about August or early September 2008, I had two of the best people who have ever worked for me, Craig Mancore and Quentin Lake. They are both amazing museum excavation technicians. They started collecting the fossils and documenting them. And Craig was a very good geologist and Craig started documenting the context in addition to collecting fossils. That was the beginning of doing all this stuff. I should back up and tell you that the way I framed it early on with these early meetings with BLM was that you can't just take things out of the ground. There is a sequence of sediments and a sort of iterative environment through time. You don't just walk up to something and know where you are, the context is really critical here. If you don't understand that then you just have a bunch of pretty rocks that don't mean anything and they're just going to be jumbled together. When you actually have the opportunity here in this long line sequence to understand where these fossils fit in time. And that was the case I made really early on that not just the fossils have to be taken out of the ground. But in concert with that and parallel, you have to understand the stratigraphy. We have to start getting more modern dates and robust dates and create a context for these vertebrate fossils. That was my, to my dying day that was my goal all along. Was that these vertebrate fossils are going to have a context in space and time and it's going to be the best document in Late Pleistocene fossil assemblage anywhere. And it is. (Laughs) Because we did it in this really targeted fashion. But it started in 2008 in two sections. And I guess you all have been out there. You don't just understand or learn this place in one spot. The whole sequence is not in one spot. Obviously it took a lot of walking and a lot of doing to see the big picture. That did take a little while. So, yes, that's when it started Vince. And we just methodically cleared sections. We did it by section in 2008 and 09. As part of the RFP I had partners in there and I had met Jeff Pigati in 2007. And 2008 when I was writing this thing I called him up and had a long conversation with Jeff and I had told him what we were doing. When I met him I actually told him what we were doing. That we'd hoped to do this big project in Las Vegas, and we were sort of in a holding pattern but we were really excited about it. And after I talked to him I told him we're going to do this Las Vegas thing – we're really going to get it. And his response to me was, "Why are you doing Las Vegas? Las Vegas has already been done." Anybody knows me they know those were fighting words then and now. (Laughter) I just said to him, "Jeff, not in the way we're doing it." And he went, "All righty then. I'm in." So, he loves telling that story. If you ever talk to him I'm sure he'll tell you the same story. We wrote him into the proposal because Jeff is an expert geochronologist. He's an expert on radiocarbon dating and all kinds of dating. We wrote him in there to help us do the luminescence dating which extended the chronology of the Las Vegas

Formation beyond what radiocarbon is capable of and in addition to continuing to do the radiocarbon dating with us. He didn't actually have boots on the ground in Tule Springs until 2010 because we were really focused on collecting these two sections and getting up to speed with a little bit of geology under our belts and understanding a little bit better. He had other commitments, so he ended up coming out in the field with us for the first time in 2010 and doing some of this original work with us. That was really the focus, to understand the context in concert with this parallel effort. So, I had field people out there from 2008 until 2013. For five straight years people were collecting these localities and discovering new localities. We ended up with 500 and change localities. Some could not be relocated but some new ones were discovered. So, that happened in parallel to what Craig and I were doing and then eventually Jeff were doing. Also, Craig and I were working with the Nevada Bureau of Mines and Geology starting in 2010. We published the Gass Peak Southwest Geologic maps and the Corn Creek Northwest Geologic map in 2011 and 2012 respectively. There was that kind of work that I was doing, and Craig was doing and then Jeff periodically was doing. Come out and work with us during that period of time.

1:11:00

VS: Just for the record Jeff Pigati works for the US Geologic Survey.

KS: Right. He's a research geologist like me and he is in Denver and he works for the USGS. He was the one that worked on wetland type, paleo wetlands, or these desert wetlands with his mentor which is Jay Quade at the University of Arizona. And of course [Vance] Haynes is at the University of Arizona. Those were his mentors, Jeff's mentors. So, he had a lot of experience with these types of systems. But, he was blown away by the way we were doing it. And how much we understood and how we could recognize specific spring environments and how carefully we were dating them. And then most importantly we were recognizing that the springs and marshes were turning off and on. We were actually able to date and constrain when the springs dried up instantly only to be reinitiated at some later date over and over and over again. Not just that recognition but tying that to the global climate record. That was the first time we ever talked about that result in public was at the SVP Team meeting - Society of Vertebrate Paleontology meeting in 2011. I gave a talk where I reveal this result that these desert wetlands responded temporally in sync with the climate fluctuation that are seen in the Greenland ice core record. And that's a huge, huge result. TUSK [Tule Springs Fossil Beds National Monument] or Tule Springs is the poster child for that. Not just the vertebrate fossils and not just the awesome Las Vegas Formation that's been really well documented by us. But these climate signals that these types of systems display is huge. Those altogether are why Tule Springs is so unbelievably important significance. It is only in this moment in 2020 – I still learn stuff about these systems every day, but we recognized early on how important these things were. It was like 2010 where Craig and I were like, "WHAT! (Laughter) are we seeing? Is this really what we're seeing?" And it is. And we published it in a very, very high-profile prestigious journal. Paleo wetland deposits are a very important climate, paleo-hydrological climate record that can be used in the American Southwest. No one else has ever done at this kind of resolution before. So, again, this is why Tule Springs is just so unbelievably significant. You know, it is.

VS: Thank you. That's what I wanted to hear you say and capture that. So, thank you for sharing that. One more question before I open it up Jill and to Erin. And this is going to be a difficult question. If we're thinking about pre-monument, pre-December 2014 there are three entities as

you have pointed out. There is the North Las Vegas Wash. There are the Tule Springs Fossil Beds. And then there's the boundaries that are delineated for the Monument. And you have obviously worked across those boundaries on all of those. Are you able to estimate, prior to the creation of the Monument, roughly how many localities and how many specimens you collected from Tule Springs? What percentage of those may have been localities and specimens off of what is now the Monument? Does that make sense? I can repeat that if needed.

KS: Everything that is in the collections from the Harry Allen Project which is at the Nevada State Museum and everything from the CTA Projects, which is at the Natural History Museum, are all within the Monument. The Clark County Flood Control fossils – we tried to find those. I don't know whether the Nevada State Museum is supposed to have them, but they haven't been able to find them. I've had conversations with—anyway those came from the Monument. Are you asking me in total? Like other people's collections, where they are?

VS: No, No, No. Through the collective work that you've done throughout your career in the North Las Vegas Wash. Approximately how many localities and how many specimens and what percentage of those might be from the Monument?

KS: Probably 600ish plus localities, 40,000ish [fossils] – I mean I don't know exactly because the CTA work does not—I mean that could be a larger number at some point if somebody actually picks through all the micro fossils that were collected from all of these localities. That number could expand ten-fold. Because the Harry Allen number was so large because we really did a great job sampling for the micro specimens and just the stuff that anybody can trip over. The large vertebrates are represented but also concertedly sampled for the micro stuff and that's where we have a really wonderful snapshot of the full breadth of what's going on out there because we did that. But the CTA work, there was just so much effort put into collecting the megafauna. We collected for the micro stuff and we washed the micro stuff. We had a state-of-the-art washing facility at the Museum. But for us, even though it was a very large process that took a lot of money, there wasn't enough time or people or money. BLM at one point just went, "Well, no more." I mean, that's why the Super Quarry did not get prepped. Super Quarry is one of the most important sites in this Formation and hopefully those are going to get prepped at some point. So that's the reason why I can't answer really specifically because I don't know ultimately how many objects are going to end up in an inventory after everything has been prepared. Practically, the whole enchilada if you will. And that's really a function of people's research interest. I've had conversations with Josh Bonde [UNLV] about this. There are any number of thesis that could be done. I've talked to potential graduate students about a lot of these kinds of things. You can stick some people on here – I have any number of projects [Laughs] that people could do with that collection. I'm going off on a mini tangent, but in summary I would say 600 plus ish localities in the Monument and 40,000ish fossils that have been collected and curated and are on / in some kind of inventory I think. Outside the Monument – I mean the San Bernardino County Museum had over 600 localities in our records. These are from localities that are south of the Monument proper, the Kern River Pipeline localities. We have these localities that are in the Clark County Shooting Range. Again, those never got collected. So that's just stuff that's sitting at the surface all these years.

VS: Perfect. So, Erin I'm going to let you go next if you have any questions? I would say any questions up to when the Monument was established. Except the next line of question, I'm going

to ask have to do with conservation preservation. So, if there's any other questions that don't have to do with the conservation side of the discussion of Tule Springs.

EE: I think my questions can be asked to Kathleen later.

VS: OK. Jill?

JD: No, I'm good. I'm enjoying it.

1:28:08

VS: Ok, thank you. So, Kathleen I just want to focus on pre-Monument history of when you started hearing rumors about the possibility of establishing a National Monument at Tule Springs? Do you recall approximately when that was?

KS: Well if you even back up. I mean just from these early things I did. Even when they built the Beltway, the 215, I never actually did that project as a mitigation project. But, I was involved in talking to people about what I thought the potential was when they blew that highway through there. And talking to people that worked in the area. That was my first hearing of Helen Mortenson. (Laughter) I'm talking mid-90's. Then when we started working on the Harry Allen Northwest Transmission Line. That's when I actually met Helen in 2001 or 2002 when we gave a presentation at NV Energy, at their offices and Helen came with her 'tooth'. So, there was definitely an understanding [that] there was a very enthusiastic and vocal group in the Las Vegas Valley that wanted to preserve and celebrate the history of the Tule Springs Expedition and just to protect. I heard one environmental consultant refer to them as the 'Friends of the Fuzzy Mammoth.' Or something like that. (Laughter) It wasn't disparaging. He just referred to this group as the 'Friends of the Fuzzy Mammoth.' Yeah, they're out there. So, I knew there was a group of people that was a dedication in their life to preserving this area but it wasn't until I was involved with this BLM Project that I became aware there was – groups that would come to the open meetings and ask questions while this CTA Project was going on. This was after the original surveys. I don't remember what year Jill got involved. I remember meeting Jill early on.

JD: Early 2007 I think I met you. We met with Senator Reid in 2008, so sometime in 2007.

KS: Yeah, early 2007 – I knew it was sometime prior to the CTA work or right around when we started doing. Yeah, I knew there was a group of people that lived right there that were very keenly interested in not seeing mansions in that direction. We should protect this. And it was the same sensibility that I had from the very beginning. I literally said these kinds of things to the BLM all the time. Trying to promote this idea from the 'inside.' Again, "Why is this in the disposal area? Why does this EIS [Environmental Impact Statement] not have a No Build option? Isn't there an alternative?" We have to put. I remember meeting and telling the consultants at PBS&J and the BLM, "There needs to be a No Build option. There needs to be an alternative where you protect it some way. Whatever your mechanism is, you guys figure it out." There's ACEC's [Area of Critical Environmental Concern], whatever. I just remember having early conversations and it was always. And I was like "Yes," there's a vocal group of people now on the outside pushing also for this very idea. To me it was just horrific the thought that this was going to be sold and built on. So, I was like "Yeah, I'm so glad". That there was a group that was super excited. And I got to know Jill and I guess there was communications and stuff like that. I did go with them. We presented a power point to Senator Reid with Harry and Helen and

Jill and Eric Scott and I. Harry Reid was very fascinated by the idea that these critters were roaming around. I'll just never forget that little bit of a light bulb moment. "What?" I remember him saying, "Go back. Go back." Because I'm showing him pictures of what these Ice Age animals look like. "Go back. Go back. Show me the animals again." And saying, "I grew up in this area. I never knew that this was here. How can I not know that?" And it was like a rhetorical question, "How can I have not known that?" And I'm going, "I don't know. I don't know how to answer that." (Laughter) But, it was amazing to hear it and see it. OK, I think this is an important thing to maybe get behind. He didn't actually say those words, but you could sort of see the light bulb moment. That was great. And then I met Lynn Davis, about a year later. Right, Jill? Even after meeting Reid the momentum still had not reached a crescendo yet. I was asked by Jill to go meet with this woman, Lynn Davis, NPCA in her office in Summerlin and I did that. That was early in 2009. Like a year later. I gave Lynn a PowerPoint presentation also and enthusiastically told her my take on everything. She bought in also. Then Lynn Davis got involved with you all, as I recall. Right? We got Ted Fremd to come out. Was that the next year?

JD: It was 2009 in the spring.

KS: Yes, in the spring 2009 and again gave Ted Fremd the preamble power point presentation. He used many of those slides in his report. And took him out for a couple days, went to all the places and talked to him about what we knew.

VS: So, just for context for each of these individuals. Lynn Davis worked for National Parks Conservation Association; Ted Fremd was a paleontologist with the National Park Service. Can you just tell briefly us who Helen Mortenson was? And her husband, what his role was?

KS: Ted Fremd was also the scientific advisor for the Pacific Region at that time - Right?

VS: Yes

KS: Helen and Harry [Mortenson] had lived in the Las Vegas Valley for decades. Harry was a state legislator. Helen was a local dynamo active in lots and lots of things, at his side. He was a very active person in the valley as was she. She was always involved in this effort. I don't really know what the organization was called. Helen's organization sort of morphed. Jill, do you know what it was called? [Las Vegas Ice Age Park Foundation] They're movers and shakers in Las Vegas Valley and very active in this effort. And I knew Ted Fremd from attending Paleontology meetings. Attending paleontology meetings, fossils on federal lands, conferences and the like. I knew Ted before he came that time and Eric also.

VS: Did you have the opportunity to review Ted's report before it was submitted?

KS: No

VS: When was the first time you recall hearing the name Protectors of Tule Springs?

KS: Right around after I met Jill. I don't remember when they developed that moniker, when they became a 501 3(c). I don't know exactly the date. That name was out there pretty early on. I don't know when they started calling themselves that.

JD: When I met you in 2007 we were called that.

VS: So, it sounds like the meeting you all had with Senator Harry Reid was a very influential, important moment in terms of the preservation of the Tule Springs area. Would you agree with that?

KS: Yeah, I would. Years later I received feedback from his aide who was there. Shannon Raborn I got personal feedback from her telling me that, "You should be very proud that you were able to excite his interest the way you did." She even used that phrase that was his 'light bulb' moment. And decided to back this idea after that encounter. That was really gratifying to hear because that is what we set out to do. (laughter) To sway his opinion and help make it all happen.

VS: I apologize—Do you remember what year that was? Approximate date?

KS: When I talked to Shannon Raborn?

VS: No, when you presented to Harry Reid.

KS: It was January 9, 2008.

VS: Perfect. Thank you. Do you think things began to change in regard to the discussion of preserving Tule Springs and your conversations with a variety of stakeholders and the BLM? Did that discussion become more pervasive over time?

KS: I think the enthusiasm didn't wane at all. But, I think Lynn Davis joining the group and joining her voice and the NPCA's, their political clout to the effort, really helped propel the momentum. That's from my perspective. It feels like that. And then Ted came, and it continued to grow from there. To build and build.

VS: So as that momentum began to build were there any conversations that you were engaged [in] talking about why preservation was needed? For example, were there any threats to Tule Springs resources that were of a concern that were being vocalized by anyone? Theft or vandalism? Off-road vehicle use? Shooting ranges or development? Are any of those part of the discussion as to why there was a strong need for protect and preserve Tule Springs as a Monument?

KS: I heard all of those arguments from Jill and the Protectors. I heard all of those arguments. I expressed some of those concerns. We were the boots on the ground out there. We were out there when people were shooting. I have been shot at. We were out there in all this. We were exposed to a lot of the stuff. Like people driving over the fossils. People stealing the fossils. It was all part of our relationship with the BLM. It was all reported and investigated by the BLM. All the things. When we were out there all the threats that go with people not respecting that this land is now protected. All those kinds of things went along with – we encountered all kinds of stuff. In the bigger picture, all those groups brought up all of these things all the time. Vandalism, potential protection. Potential loss of scientific information. As this stuff just sits at the surface and it just goes away. Just everything in between. The encroachment of new development. I heard all of these arguments by any number of people because we were there. I'm one of the few people that's walked every square inch of this place. We were there and we saw how things changed on a weekly basis. If you're there one week and the next week now there's a new refrigerator in a ravine that wasn't there the week before. That was pretty discouraging and to get

a handle on that trash was huge effort by specifically POTS to just get a handle on cleaning up that stuff and when it finally became a park. The BLM did some clean-ups and that was great. All of those things continue to be and security of the perimeter of this boundary is really paramount of an issue. To preserve the stuff.

KS: Did I answer your question?

1:38:00

VS: Yes, absolutely. Because you were on the ground as much as anybody and understood the resource and understood the threats. And observed the threats to the resource. I just wanted to hear your thoughts about it. Is there a particular incident where you encountered illegal collecting at Tule Springs that stands out in your mind?

KS: Yes, TUSK was vandalized in the North Unit while we were still doing the CTA work. In one of the localities just north of Moccasin Road. Beautiful tusk – people just – I don't understand the mindset. "Oh, look at this. Let me smash it." They got caught. But, there's that whole thing. To me the bones that are out there in that beautiful site that was part of the original excavation that everybody calls "Tule". That site, we have the photograph of what it looked like when we found it again in 2003 and there's a lot of bones missing. That's one that I know for sure. There are other instances probably that we'll never know. But, that one there's bones missing. And then the other one that is just a heart break is the quarry that we used for the site stewardship program where we taught the stewards the techniques of excavation. This was a historic quarry that was quarried by the Southwest Museum and quarried by Phil Orr from the Santa Barbara Natural History Museum. And people came in there and smashed the darn tusk. That was very soon after it became a National Park Unit. Jon Burpee was the Superintendent then. Those are the ones that stand out for me. I guess I should say that the Tule site is a super important site and I absolutely, one hundred percent endorse the idea of it being used as a vehicle for advocacy the way it was. But, it really suffered a little bit I would say, that site. And I feel bad that we never got to fully excavate it and know what was really there. I mean we know how old it is. Jeff and I dated it. So, we do know how old it is and we understand its context. The loss of the tufa to [me?] is heartbreaking and I know that's not a vertebrate fossil resource. But the tufa is just heartbreaking to me, the loss of that. [Sadness in voice] That's the other one – that is one of the geological resources that we identified during the workshop. It is a very, very, very important resource. And it just makes me sad that a lot of it's going to go away. I'm glad that we mapped it and it can be interpreted. I am very happy for that.

VS: Thank you. One last question before we get to the Monument itself. Prior to the creation of Tule Springs Fossil Beds National Monument as a unit of the National Park Service, do you recall any discussion about a BLM Monument vs. a Park Service Monument? And if so can you share some of your thoughts about that?

KS: Yes, I did and those were ideas that were bantered about by various folks. I guess I should say also that we were the grantees from the BLM. So, we were aligned with the BLM because we were doing this work for them. That put Eric and I in a very uncomfortable predicament more than once. My desire was to see this place protected. That's what needs to happen. However, that transpired, to me, I just want it to happen. The two agencies are going to have to figure that out if that's what it actually came down to – but it came down to the National Park Service had the

desire. And BLM didn't have the desire, I guess. To me it was always a better fit that it goes to the National Park Service. I tried to not – I just tried to do our job and focus on that. It was a little awkward because we were not trying to be advocates. We were trying to be the scientists that informed this effort. And that's what I said probably a thousand times—Jill probably heard me say it at meetings—trying to understand the science, articulate the science to inform the public and I will forever be proud that we did that. I think the science did. The fact that we called attention to this area and how important, significant, it is. Is what really allowed it to be protected, the geological context of the fossils and the fossils. I did hear that many, many times, Vince, but I don't remember who talked about it. I don't remember. It was sort of bantered about kind of thing. It could go this way, it could go that way.

VS: Thank you. Do you recall where you were when you heard Tule Springs Fossil Beds National Monument was established and signed into law? And did you celebrate?

KS: [Short pause as Kathleen replaces batteries in her air pods] Sorry, can you hear me if I'm on speaker?

1:45:46

VS: Yes.

KS: I might have been in the field, I'd have to go back. I might have been in the field with Jeff. I'm trying to remember. But oh, yeah, absolutely celebrated. It was just a 'Woohoo' moment. I wasn't at the museum. That day it was signed, are you asking me the day it was signed in December?

VS: If you, recall where you were when you heard? How did you feel? Did you feel a part of the ownership of that Monument because of your contributions to the discussion? And how did you celebrate?

KS: In the moment, yes. And forever more I feel ownership of the fact that it is a National Park Unit that I think I helped make it happen. By the work we've done by calling attention to resources and why this stuff was so important. That day, yes. And it was like, "Yes, finally!" There was a lot of naysayers—Jill knows that—a lot of naysayers. All the stakeholders, all the people involved all took ownership. It's not a singular thing. It really is this unbelievably beautiful thing and an unusual number of people coming together and saying, "Yeah, this is a good idea. Isn't it?" I was just proud of Las Vegas (Laughter) too. And such an unusual urban National Park Unit. This is an unusual fossil beds National Monument. It just got this hallmark of oddness. Like "WOW! It really happened there." And deservedly. And I've told many, many people this and I say it all the time, "It's my happy place." Looking at it right now on my computer screen and it's just a happy place. I feel in a way that it's transformed my life. I segued from being a curator at a Museum to doing research one hundred percent on these types of systems in the American Southwest. And everything I've learned I learned right there in Tule Springs. And I can take that knowledge anywhere. I could go to Israel. I could go to Egypt. I could go to South America and I could figure out these types of systems based on what I know in the Las Vegas valley. And Jeff and I have done that already. I mean I haven't gone to other countries yet. But we go to lots of places and, "Oh my God, that is the exact same thing as in the Las Vegas Formation." So, I could still just pinch myself. It just makes me so happy that almost

22,000 acres were protected, and anybody can learn it now. Or study the fossils now. People can be educated by the inside experience. Whether it's in a Visitor Center or an outside experience. Whether it's a trail or a kiosk or whatever. So, that's my museum background talking right now because I think of all the things that can be communicated to the public. Obviously the Park Service is very, very good at doing that. That was a long answer. But, yes I'm very proud. I was very proud that day. And I'm still proud of it all.

VS: Did you have any role, or did you participate in any discussions relative to where the boundaries for the proposed Monument were to be placed? And what is your opinion about that?

KS: In as much as I was involved in the EIS that had all these different boundaries originally for the CTA or the future boundaries of something that could be protected. I did not participate in the discussions because that was really political, and a lot of the decisions were part of the [unclear] making it all happen. I understand that. I am a big girl. I understand all that. Some of the boundaries I'm not really thrilled with. They're going to have to have some kind of an easement away from – going right up to these deposits – it's ridiculous. There has to be more of an easement, I think. That's just my two cents. Again, I'm heartbroken about the tufa and everything that's going to be built near that Eglington Fault. Heartbroken about that because I was involved in that. I fought for, I argued, but I was being stared down by about a dozen developers. Because they don't want to hear some paleontology scientist person go, "Save it all." That was kind of silly. I didn't think it was silly of me. If no one wants to hear a person like me say, "This entire Formation, everything you're standing on is fossiliferous regardless of where we found the fossil". People don't like to hear that. Because when you say it's all fossiliferous they still want their piece of the pie. So, that was very difficult, I thought, for me to be put in that situation. And that was in 2005 that I kind of had to go to battle with these guys. I did that in my job at the Museum. I was used to talking to developers and having them be pretty dismissive about the importance of the resource. And blah, blah, blah. But, that is one area of the park that makes me sad, confuses me a little bit. Because I thought everything north of the beltway should just be the park. And—you've got me on a roll—I think that this western part of the Clark County Shooting Range is ridiculous. That buffer is too huge and an important part of the wash. Somebody should have negotiated that to just be part of the park. I just felt like that ball got dropped a little bit. And I don't know what the issues are. It just seems like that boundary is so gigantic that all those sections were given to the county for that park. I don't know if anybody has any feedback on that for me. I always thought it was very weird because it is a substantial part of the active wash that is not part of this park unit. And it's filled with fossils.

VS: Thanks. I am going to check in with Erin. Erin, do you have a question at this point?

EE: No, I don't.

VS: And Jill, do you have a question at this point?

JD: No, I [never] worked on the Shooting Park.

KS: I have the data. I don't know if Erin has that. Do you have?

EE: Kathleen, if you could send that would be great.

VS: Kathleen, we're coming up on an hour and fifty-five minutes of recorded interview. Do you have stamina to go on further? Or would you like to reschedule.

1:54:50

KS: I can go a little way if you want. And then we can do it again. Am I talking too much? The right amount?

VS: Ok. Perfect. Absolutely.

KS: Ok. Good.

VS: Erin and Jill are you ok as well?

EE: I'm ok.

JD: I'm waiting for a phone call, but I'll stay on 'til then.

VS: Ok. Thank you. So, the National Park Service takes over the management of Tule Springs and they're trying to figure out a way to transition smoothly. There's tremendous public and political interest in early 2015. I, Vincent Santucci, was fortunate to be pulled in as the first Acting Superintendent for a 120-day detail and lots of things transpired during that short period of time. Erin Eichenberg was assigned to work closely with me on a whole variety of issues. Kathleen, you and Eric Scott and the San Bernardino County Museum was one of our big targets for discussion because of the large collections that you maintained from Tule Springs. Do you remember the first discussions about the potential to transfer some of the collections to the National Park Service and to the Nevada State Museum?

KS: A lot of the early discussions I didn't get the memo, I don't think. Most of the discussions were with Eric. I left the Museum on May 21st. Even though I still worked for the Museum I was not physically still there. I wasn't part of any of the discussions about that. I think they were mostly with Leonard Fernandez and Eric Scott. I didn't really have any input into how it happened or any of that. Eric would probably be a better person to fill that part in. I met you [Vince] in Las Vegas and you kind of filled me in and that was kind of the first data dump of what was going on. I don't remember exactly when you guys got them. Was that in the spring of 2015 or was that in June?

VS: So, it was during the summer. I believe the big transfer was in June of 2015 and then in July we had that big event, that announcement to the public that you attended.

KS: Yes, that's why I was thinking it was June. I wasn't physically in the museum to mark the end of May. I left the museum on July 4th, 2015. That was my last day. Then I started working at the USGS.

1:58:46

VS: So, good, bad, or indifferent. There was sort of this public perception and some voices that were saying, "Why are Tule Springs fossils in California? Why don't we have them here in Nevada?" Do you recall ever hearing those discussions?

KS: I heard those discussions for ten straight years, Vince. Or longer. Including, "Why are people from California studying fossils in Nevada?" I mean, I'm being completely candid. I heard that from day one of us working out there from various – whether it was a newspaper articles or whatever. I did. I did encounter that attitude. I would go, "We work in a museum. Not every person that works in a museum has the luxury of walking out their backyard and collecting fossils". People at the American Museum study fossils in Montana. That's just a common thing. A very weird misconception about paleontologists and where they work and how they work. So, I just chalk it to sometimes that. But, what I've discovered is that there is sort of a parochialism; that's ours. You can't take our stuff away. Even though museums all over this country have objects in their collections from off [source] locations that aren't anywhere near where the museum is obviously. This skill, that perception, "Why are you taking?" I worked in San Bernardino County and I got that very attitude from Riverside County when we collected 100,000 fossils from Diamond Valley Lake. I was used to the very same thing. One county over people were like, "Why are they taking our fossils?" I was like, "Well, because Riverside County doesn't have a repository first of all." I always knew the answers to the questions but nobody ever asked me, that was writing an article about – or whatever. It's kind of par for the course. Anybody that's worked in a museum has heard that battle cry before. Tried not to take it personally. Obviously, because I continued to work there and continued to do our good work. But, that's not uncommon. What I did not enjoy was the quotes that said things like, "They're in a warehouse". Never, ever did anybody ever describe me, or Eric or our museum as an actual accredited museum that curated things unbelievably, scrupulously—you know what I mean? The characterization is what I always objected to Vince. They just got thrown in a warehouse and not taken care of.

VS: So, for the record Erin and myself can both state that when we arrived at San Bernardino County Museum to look at the collections and develop a game plan to bring them back. I can say you rarely see such a well curated collection. And by virtue of the decades of work that you had put forth in meticulously documenting, collecting, curating, preparing specimens that benefited the work that we had to do on the other end. It made it much easier. Erin, wouldn't you agree?

EE: Yes, definitely.

VS: Yeah. So, we realize it was a very tumultuous time. There was great excitement and momentum about the new monument, and we don't have to go into a lot of detail. But, there was some change in perspectives in the leadership at the San Bernardino County Museum that I think also factored into this as to why – maybe the transfer may have been a good thing. Do you have thoughts about that? Do you want to talk about that at all?

KS: I do have thoughts about that. So, because of the timing those objects—here's the other thing. We were a BLM, basically we had been given the paper waive by the BLM, to hold all objects from Nevada, that was our designation, and California. The fact that the leadership of the Museum changed to the attitude of, "Why are you holding federal fossils when San Bernardino County Museum—the largest county in 48 states—most of this, the Mojave Desert, was their deposits on BLM land". I mean there is just a lot of ignorance to be perfectly blunt as to why museums hold federal collections or non-federal repositories for fossils on federal land. There was just a lot of ignorance about that. But, regardless it was just a mandate. So, getting back to what I think. I think that all of the federal collections that are at the San Bernardino County Museum need to go to an institution that is going to take care of them. In Nevada, we always

said from the very beginning, and Eric will back me up on this, "Eventually these objects should go to Nevada". We are pressing them; we are studying them, and we're going to produce documentation of all this stuff so that – for the people who gave us 1.6 million dollars to do this work. We were dedicated to completing that work. Eventually if there is a museum built or a repository outside, or whatever, fill in the blank, these objects should go there. Just like Joshua Tree, Vince. Those fossils, they were so well taken care of that if they're not going to have people or curators or even an administration that wants these objects in their collection. They need to go someplace that is going to take care of in the proper way. And I really feared that after me and Eric both left that was not going to happen. Now these objects were removed when Eric was still there. It's ultimately good. It's all good. I was concerned, very concerned about putting up that collection to be perfectly frank. I thought that the CTA collection is, in a way, a far more significant collection in that it shouldn't have been split between two institutions. That really ruins continuity of collections when you do that. I understand the politics of it. But, I don't agree with it.

VS: Were you involved at all with the design and development of the two exhibits that were put together? The portable exhibits.

KS: Yes, me and Eric did those all by our little selves.

VS: I knew that. I'm just asking to get it on the recording transcript.

KS: Yeah. We designed those and we built them for the BLM. They were at the Nevada State Museum and at Red Rock Canyon. We installed them at the Nevada State Museum and Red Rock Canyon originally. At Red Rock Canyon, in three months, I think 100,000 people saw that exhibit. They gave me the visitor numbers when it was there. They were really good. They were clever because they could be dismantled and put anywhere. And that's how we designed them. The BLM wanted them to maybe go in the Courthouse or a library or the foray of blah. They could just be moved around.

VS: In your developing a plan, a design for them were there any considerations that you recall as to which specimens you were going to include? And what messages or interpretive stories you were going to try to tell in the exhibit?

KS: Eric and I have a lot of experience designing exhibits. We had helped design all of the exhibits at the Western Science Center. We were in the process of designing exhibits for the [Powell] Geological Wonders which I don't really know how that ended up sadly. But this is a special kind of exhibit, a traveling exhibit. We'd had experience with a traveling exhibit. One time we had gotten a California art grant to do a traveling exhibit for Death Valley a number of years earlier. You just try and hit the Greatest Hits if you will. We had one panel on the history of Tule Springs with the original photographs that Eric meticulously re-photo shopped and cleaned up of the original Tule Springs Expedition. And we had the story of – we always try and show a diversity of animals – not the full breadth but you want to – again – the Greatest Hits. You want to show a mammoth. You want to show a camel and a horse and a bison. They have to take into consideration the size, and what the mount has to be with the weight. We used a tusk and put that on a pedestal. There was a discussion about timing is everything. Context is critical. The story of understanding the geology. Just trying to piece the story together. As the person walked around this thing they would basically come away with a good understanding of what

this is about – Tule Springs. What kinds of work has been done there and what work in the future. There was a panel on climate and a panel on extinction. There was a panel on what we had done for the BLM with site stewardship. That was really important to include because that was a huge part of that grant, part of that grant. Even though the title of the grant was about Public Interpretation of the area. We tried to encapsulate everything we had done into one convenient little package, if you will.

2:11:15

VS: Thank you. So, you're talking to a group of non-geologists, non-paleontologists. And somebody in the audience asks you, "What is tufa? And what is the significance of it?

KS: That's so funny. (Laughter) So, tufa is basically sort of a special kind of limestone. It's calcium carbonate. And calcium carbonate is all over Tule Springs. Tule Springs is lousy with calcium carbonate. The surrounding mountains are limestone - calcium carbonate. They're all limestone from the ocean millions and millions of years ago. So that stuff erodes and the ground water is just charged with this carbon dioxide. And so, this calcium carbonate is carbon and oxygen and it precipitates in the air and hardens. In some cases, you just have these hard rocks that look weird. People go, "Is that tufa?" "No." But, tufa is a special kind of precipitation of calcium carbonate and it's in the medium of – it's very complicated actually. But, what you see in those tufa channels for instance, that are out there, are a special kind of tufa that forms around logs or twigs. Or forms around bryophytes, which are like mosses, things that line edges of streams and the carbonite precipitates. It comes out of the ground. It's ground water that's basically being forced to the surface and it's charged with calcium. And it kind of de-gasses, if you will, and then it has to do something. You can consider it sort of falls onto what the gas is on so it precipitates around whatever thing it precipitates on. What allows it to precipitate? Is that it has this biologic substrate and there is a lot of algae. I always call it algal snot, but it kind of looks like that. When you actually see it in real life as it's happening, just sort of this yucky algae or like mosses. It's actually really cool. It requires a biologic medium to precipitate, to do it's chemistry if you will. So, it's forming around logs and twigs and everything. And the tufa at Tule Springs is really important and significant. These stream channels – because it's the only documentation of a river – a braided stream system of tufa. And this is a phenomena that is documented all over Europe and Australia and places. Tufa is just crazy in all these other countries and people study tufa. It's crazy. But in North America, people when they think of tufa, they think, "Oh, the tufa towers at Mono Lake or the Searles Lake Towers that got knocked over in the Ridgecrest Earthquake or the lake edge tufa that people think of; these giant towers. Well, this is different. This tufa was forming in these streams and it's got even a technical term. It's called riverine tufa or a braided fluvial tufa and you can look at its map extent and you can see these rivers flowing across what was originally the Gilcrease flat and the Stewart flat flowing from the north and west and flowing south and east. And we map these things way far south. I've been in every vacant lot south of the Monument when we mapped the Gass Peak/southwest quad. I've been in every vacant lot. And in a lot of the vacant lots there's still tufa at the surface if it hasn't already been destroyed by some kind of development trash. That original tufa complex, that stream system was huge. And it took place about 10,000 years ago. No [vascular] animals went extinct but there was still water charging up through faults and coming out across the landscape as these streams. And we call them outflow streams. You can go up to the Spring Mountains today and go to Cold Creek and you can see tufa precipitating 7,000 feet higher than

the Las Vegas Valley today. It's the coolest thing ever. We have a study we're writing up right now. Where we have looked at the isotopes of carbon and it's a technique called clumped isotope. It's looking at the stable isotopes of carbon and trying to backtrack the temperature at which the carbonate formed. We're comparing it to modern tufa being formed today in a very similar setting but many, many, many meteors higher than the Las Vegas Valley 10,000 years ago. And guess what? The temperature at which those things formed 10,000 years ago is roughly the temperature that is about 7,000 feet higher today. So, a little bit colder 10,000 years ago. But, warm enough that tufa can precipitate. Tufa won't precipitate during a full-blown Ice Age. When the marshes were there and stuff. There's really not a lot of opportunity for that because tufa really needs a little bit warmer temperature. The carbonate needs to be warmer for it to out gas. So, the tufa there is important because it's a really important climate signal and we're looking at tufa. To us, because we've looked regionally Vince, we are looking at tufa as this last gasp of biggish water all over the desert. So, you can go to Las Vegas Valley and you can go to Death Valley and you can go to all of these places that Jeff and I have gone in the Mojave Desert. And by God if there's not tufa which is kind of the last thing that kind of happens. There's this water. The last gasp of water flowing across the landscape. So, for us it's a climate signal. It's post when the animals went extinct. There is other tufa in the Las Vegas Formation that's older, in a few places. But, this stuff is really cool and because it has never been recognized in North America as this braided fluvial tube system. And that's this paper we are writing up to sort of document this. And reveal the temperatures at which it forms as the topics signature and all that stuff. That was a long winded.

2:19:30

VS: No, that was very good. So, similar question. To a non-geology group, briefly, what do you understand about the Eglington Fault? What is the Eglington Fault?

KS: We just wrote a paper on the Eglington Fault. Basically, this is what I know. From all this work that we've done all these years ago when we first started working out there. I remember, this is before I met Jeff, turning to Craig, and going, "You know what? The way we are drilling in on this formation we are going to absolutely be able to say when the last time this fault broke. I guarantee you. We're going to be able to figure it out." And the tufa kind of drapes over the fault. So we know it had to have happened before the tufa stream started doing their thing. It kind of got lost in the wayside cause we were just doing all this other stuff. Climate stuff and getting this Las Vegas Formation paper finally done. All the stuff we were doing, the mapping. And finally at one point I said, "Jeff, I want to get back to this." So we started reinvestigating the Eglington and what we have discovered. We had a goal. We wanted to understand the timing of the last time the fault broke. And so you guys know this fault is about seven miles long. About 11 kilometers long and it's one of many faults within the Las Vegas Valley. They're called intrabasinal faults. The Eglington is note-worthy because it's the only fault recognized by the USGS National Seismic Hazard Model as having the ability to produce a 6.0 earthquake. They call that, in earthquake science, it's a seismic source. That's really important for the populace of the Las Vegas Valley in terms of hazard and risk. That's a huge sub-field; hazard and risk. That's a huge deal in the USGS, earthquake hazards and all that stuff. But also, regardless it's been around a long time and that its 11 kilometers long and it snakes its way through the Las Vegas Valley. No one had ever really done anything substantive to understand the timing of when this fault broke. The timing of when the last fault broke is very important in earthquake science

because if it broke within the last 10,000 years it's considered a recent fault. So we want to know, 'Did it break a really long time ago? What is the potential that this thing is going to break?' And USGS is saying 'Yes, it does absolutely have potential to contribute to the seismic hazard in the Las Vegas Valley.' So, we built on all this previous research where we found that the climate.

KS: So, it's kind of like this layered story, Vince. Sorry, I'm not doing it very quickly. What we discovered is that this fault last broke somewhere between about twenty-three thousand three hundred years ago and about nineteen and a half thousand years ago. And we based that on the fact that we know – we read the rocks essentially. We read the rocks using this detailed stratigraphy that Jeff and I had done. Married with this unbelievably high resolution chronology that allowed us to basically say, "Because we know exactly when these marshes dried up and we've dated the sediments and we know that this marsh dried up and the cap out there, one of the caps, it broke in this last event when the Eglington was last active." And so we can date that and then we can date the sediments that are inset into this Eglington [scarf?] and we are able to constrain the timing between twenty-three thousand and about nineteen and a half thousand. And we know how much it broke. It displaced this cap about twelve feet, thirteen feet, about 4.2 meters. It displaced these sediments quite a bit. We didn't want to stop there. OK, that's a very good result and we could publish that. But, let's try to hazard a guess as to why this happened. Because we know the structure underneath the valley. We understand a lot about the stratigraphy. We said, "You know what? When that bed broke it's exactly coincident with this abrupt warming event". I've already told you that we've tied all of these deposits to this warming and cooling in the ice core record. We know exactly when these things were happening and they're in sync with the Greenland Ice Core. One of these events is called DO2 and basically within decades we're saying that the ground water in the Las Vegas Valley abruptly dropped and if you do the calculations, which we actually did. The removal of that much ground water. So, you've got to picture the entire Las Vegas Valley was filled with ground water and we know that how? Because there were vast marshes that are preserved in the rock record. We know that there were these big marshes and that means the water level was all the way at the surface. It abruptly dropped and we're hypothesizing it dropped between ten and thirty-three meters abruptly, within decades. And if you do the math you actually can prove that the loss of the vertical load there was enough to unclamp, was enough to release the stress and unclamp a fault. The fault in the subsurface which is the Eglington. So, basically we're showing that it is not a coincidence that this fault broke exactly when there was this climatic event that abruptly dried up all the marshes in the Las Vegas Valley. Because, you guys, there's other studies that absolutely, unequivocally show that in the Ice Age when glaciers melted or when big Ice Age lakes dried up – in Utah, Wyoming, and places in the Great Basin or in this general region of the west, that is kind of a tectonically active area. When you remove the load, the heavy load of either a glacier melting or a lake you can induce seismicity in areas that are already known to have pre-existing faults.

KS: So, basically this is the first time anybody has ever hazarded this idea that's analogous to a pluvial lake or glacier, we're saying removal of ground water in the Las Vegas Valley allowed the Eglington fault to unclamp and warp the deposits of the Las Vegas Formation. So, hopefully that wasn't too long winded, Vince. But it was just recently published in *Geology*, which is a really good journal. It's gotten some notice. They're going to – we were interviewed by someone who's going to put it in the AGU publication called *Eos*. But ultimately it's important for the National Seismic Hazard Model because they have now a really well-documented paper that they

can stick into their seismic hazards model. And determine now, is the populace of Las Vegas, this huge metropolitan area, is their hazard and risk diminished because of this result by Springer and Pigati? That they've shown this fault has not broken in nineteen and a half thousand years. So, there's questions like that that I'm not part of because there's other people that will assess this work and decide if the Eglington is still going to be a seismic source. But, it's still pretty novel. A hydrogeologist in the valley emailed me and told me it was remarkable that we figured this out. I take that as a high compliment because he's a pretty well-known hydrogeologist. So, that was kind of cool. So that's why the Eglington is important. In Tule Springs it is the only segment that is still undeveloped.

2:29:22

VS: Thanks for sharing that. One of the largest boundaries with the Tule Springs Fossil Beds National Monument is with the US Fish and Wildlife Service. The Desert National Wildlife area and the Corn Creek area is particularly interesting in terms of the springs that are there today. Do those springs today provide you any indication or is there any relationship between those springs today and the history of the hydrology at Tule Springs?

KS: Yeah. Those springs and the [copadunes?] that are covering them. Those are old things. Those are analogous to the deposits in the Las Vegas Valley. They are probably analogous to the spring cauldron that are all gone south of the area. I remember back in the day. I still remember seeing a spring cauldron that are all gone. The Gilcrease Ranch is one example of this type of spring. So, those types of springs are all gone basically. They're right there in Corn Creek and they're really important. They're right on a fault. The way these springs appear on the landscape is largely due to the faulting. So, they're right on the fault and all the deposits that are around there are really interesting. Jeff and I have a ton of new dates up in that area. And we were starting a new project at the beginning of the fiscal year to determine the hydroclimate of the American Southwest. One of the things we are going to start doing more, that we have done a little bit in the past but we are going to do more in more places if they give us permission, is drill into these active spring that probably have active springs and sort of older deposits that are internal into them. So, to learn more. The idea is for us active springs are perfect because they bridge the paleo wetland systems with the Holocene and into the recent. Basically, our goal is to create an entire record that is a seamless, unbroken record from way back all the way to the recent of these types of systems and document the hydrology of these things. Even in the Holocene we've drilled in other places Vince, in like the Mojave Preserve and we're finding evidence of life, a little Ice Age in wetland deposits. So, we're taking it from the Pleistocene into the Holocene and then using climate models. Because basically our ultimate goal is to help people, land managers, understand these systems and how to manage them because groundwater and springs are some of the most fragile ecosystems on the planet. There are lots of springs in the Mojave Desert and all over the American Southwest so if we can understand how they responded to climate. What were the duration of their responsiveness? They want to know how long does it take for a spring to go, "I'm done". What is the temperature increase gonna take for a spring to go, "I'm out, I can't do this anymore". So, we're trying to use techniques to get at the temperature at which these ecosystems collapse and stuff like that. So, these modern systems are unbelievably informative and important for the research here.

VS: Thank you very much, Kathleen. Jill, do you have any final questions for Kathleen?

JD: No, I could listen to you talk forever Kathleen. Thank you for everything you've done. And should I sell my house? Will this Eglington Fault going to do this anytime soon? (Laughter)

KS: I don't think so. I mean the ground water will never rise again to the level of when you saw these massive marshes throughout the Las Vegas Valley and everywhere else. That's the really cool thing about what Jeff and I are studying. Again, the Las Vegas Valley is this lynch pin record and we've gone all over. And guess what? We're seeing the exact same thing happening in the exact same time frame as the Las Vegas Valley. So, these systems are responding in sync to one another in this huge, huge area. All over the Mojave Desert the marshes collapsed at exactly the same time as they did in Las Vegas. And they've never come back. It's like an irrevocable loss of ground water. Which isn't to say it's not a fault. I mean there is a fault there. So, it's up to other people who have higher degrees in math than I do to figure out the potential – have seismologists. But, I have this feeling it will be downgraded. They're not going to say it's going to be able to produce a 6. I have a feeling. I would not tell a reporter that or anything. The USGS basically said this link to climate and tectonics is a frontier area of research. It really adds a critical piece of the puzzle to what happened in the Las Vegas Valley. They're definitely going to use it to tell you all.

JD: Thank you.

VS: Erin, do you have a question or two?

EE: No, I don't. (laughter) You've already answered them all Kathleen.

KS: Oh, I did, ok,

VS: So, Kathleen we want to continue this conversation as it relates to other National Parks like Death Valley, Joshua Tree, White Sands, etc. But, speaking for Erin, Jill, and myself, we feel so fortunate to have you as a permanent fixture at Tule Springs. I know the new Superintendent, Derek Carter, already realizes the value of having you as part of his team. On behalf of the National Park Service, you're a good friend to us. And thank you for sharing this information today.

KS: Wow, you're very welcome. And I'm very, very happy and pleased to be part of all of these things. It's pretty darn fun. (laughter) It is. It's great to talk with you guys.

VS: We love your enthusiasm too. You get us all excited.

KS: Oh good. Yeah! That's awesome. Just let me know whatever, whenever, and I'll be here.

VS: Sounds good. Well, thank you again. And thanks Erin and Jill for your time as well.

KS: Thanks you guys. Great talking to you.

VS: Likewise. Everybody have a good day.

(Last minute are of sounds of Vince turning off equipment)

[END OF INTERVIEW]


Paleo
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