

Name: David Klein
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Location of Interview: Home of David Klein in Fairbanks, Alaska
Interviewer: Karen Brewster

Brief Summary of Interview: In this interview, Mr. Klein talks about his 1985, 2005, and 2012 trips to St. Matthew Island, in which his daughter and son-in-law were on one of those trips, and talks about their camp. He also talks about the different studies that took place during at least one of the trips including lichens, bird populations, the fox/fox relationship, the fox/bird relationship, insects, plants, archaeology, and geology. He also talks about the fur seals and how they determined their population was going down by looking at the lichens and he discusses his interest in Paleo History and why he got involved with geology, and eventually doing some peat coring to help determine the age of the island.

KAREN BREWSTER: Okay. Today is April 10. I believe it's April 10, 2014.

DAVID KLEIN: It is April 10.

KAREN BREWSTER: April 10, 2014. And this is Karen Brewster and Dave Klein, once again talking about Dave's life. And last time we were talking about St. Matthew Island. And we're going to continue to talk about St. Matthew Island since Dave you spent so much time there and have done such interesting research out there. So why don't we talk about -- you said, 1985 -- So last time you talked about the 1966 and your rescue. And then the next time that you went out there was '85, or was there a trip in between?

DAVID KLEIN: No, there was a long gap. And it was -- My interest in going out again was tied somewhat to wondering how the vegetation was recovering after the reindeer had crashed and died off, and then I'd written that up. And so then -- but I was -- I was, you know, trying to think how to organize it and I didn't have -- I was Wildlife Unit Leader, and I didn't have a big budget to work with. I was mainly raising money to support my own graduate students and didn't have a surplus to pay for expensive trips to St. Matthew Island. But then the Alaska Maritime Refuge wanted to do some bird work there and one of their biologists who I knew well, Art SOWLS, he hadn't been there but he had done some follow-up work on St. Matthew after the die off. He hadn't been in those groups that went in the '60's and the earliest group, as well. And plus, I had a former grad student who was working for the Refuge as well, and he hadn't been to St. Matthew, but he was working mainly in the Aleutians, Vernon Byrd. And he liked the idea of getting me out in the Aleutians to some of those areas where I'd had past experience with reindeer on Atka for example, and Umnak Islands.

KAREN BREWSTER: I didn't realize there'd been reindeer down there.

DAVID KLEIN: Yeah, and then there were -- caribou had been introduced to Adak. And then, they were -- with the idea that they'd be hunted by the Navy, which they were. But the Navy had to put a lot of logistics support into getting the hunters out there because it's such tough weather and there're no roads, and it's foggy. That's about the only way you could get around is in a boat. And so they would usually have a small tug boat they could usually bring hunters out. They built some cabins. And then they wanted me to take -- check on these caribou that were increasing, and stories of there being super big caribou. And so then a combination of going to -- that was in 19 -- that was probably in, I don't know whether that was in 1996. 1966 or 1985. But -- any rate.

KAREN BREWSTER: When you went to the Aleutians?

DAVID KLEIN: Yeah.

KAREN BREWSTER: Okay.

DAVID KLEIN: But any rate, the --

KAREN BREWSTER: So the 1985 trip --

DAVID KLEIN: -- was primarily they wanted me to go to St. Matthew and have a chance to look at the vegetation plots to see how much recovery was occurring, and especially in the lichens. Because vascular plants, many of those that were responding by 1966 even, which was only a couple of years after the die off, like sedges and willow. But 1985 you could see more. There were a lot of these flowering plants, which produced -- the floral parts were favored food in the springtime by the reindeer. Therefore, they weren't overgrazing these plants, but they were above-ground annuals, or I mean perennials, that had above-ground growth and then a root system that could overwinter and then it'd come up again. And so things like the lousewort, the woolly lousewort. These were just high-quality food for both caribou -- or and reindeer.

KAREN BREWSTER: So the fact that the caribou were no longer there, I mean the reindeer, excuse me, were no longer there, it allowed these flowering plants to now grow and produce and become more dominant?

DAVID KLEIN: It allowed them to -- Well , there so much bare ground as a result of the removal of the lichens that it meant places for plants to seed in as well as move in from the surrounding vegetation. So the moving in from the surrounding vegetation is a much slower process than if they could be seeded. Well, here was fresh soil ready to be seeded, but they hadn't produced seeds while the reindeer were there because they were being eaten. The floral parts were being eaten.

KAREN BREWSTER: Oh, okay.

DAVID KLEIN: So there were always a few places where they were present. Rocky places, where they continued to exist so it wasn't eliminating them from the island. But

then in the absence of reindeer, the seeds got dispersed by wind and sometimes by birds sticking to their feet or what. And some of them were probably capable of going through the guts of birds and still being viable. And the voles tend to cache seeds and move them around before they cache them and forget about them. And so it was surprising in 1985, there were some less stands of woolly lousewort, for example. And I'd never seen anything like that when I was there in '57.

KAREN BREWSTER: So in '85 there were more woolly louseworts or a few more -- ?

DAVID KLEIN: Yeah, they'd come back in.

KAREN BREWSTER: They'd come back in.

DAVID KLEIN: Along with several other species. A legume species, an *Oxytropis* species. And in '85 there were problems with logistics of getting there, because the Alaska Maritime Refuge didn't have the *Tiglax* boat, so they'd have to charter boats from Kodiak or other places. Fishing boats. So they did -- they chartered a crab fishing boat because the crab season was shut down for a period. And so we, again, flew out to the Pribilofs and a crab boat that they had chartered.

KAREN BREWSTER: Oh, from the Pribilofs, not from Dutch Harbor.

DAVID KLEIN: Yeah, right. And they then flew us -- or had the crab boat -- it stayed around the islands while we were ashore. And so I was able to -- they dropped me off with one other person down by the plots, the major plots and the exclosures on the southern part of the island. And they proceeded with some of the bird people to go around and do their bird counts from the ship, where some of them could be done best, especially for the cliff nesting birds, from the water. And some could be done from the land like Auklet colonies they could do it from the land. So they could put them ashore and then go on and come back and pick people up, so we didn't rely so much on base camps. However, there was a group from the university. Some grad students under a project by Ed Murphy that he had a contract to do some studies with heavy focus on the auklet colonies, which were mostly at the north end and on Hall Island.

KAREN BREWSTER: Hall Island is the next island over?

DAVID KLEIN: Hall Island was just a little over three miles north of St. Matthew. But there was also one big colony of seabirds including an auklet colony at the southernmost mountain, Cape Upright. In between of -- north of that is a lot of lowlands without any seabirds nesting for quite a ways. And so they had three camps, I think. They had the one on Hall Island, one on the north end of St. Matthew at Bull Seal Point, and one at Cape Upright. And they had a couple of students there and they had pretty good weather-resistant -- like plywood floor and sort of like a small Quonsets --

KAREN BREWSTER: Like the Jamesway kind of things?

DAVID KLEIN: Yeah, something like that. They were designed for being very portable and you could cable them down so they would be wind-resistant. And they had small oil stoves in them for heating. And it turned out that my daughter and future son-in-law were part of this team that were -- they had flown out, which was a novelty, in a Widgeon. A chartered twin engine, amphibious plane and landed in the lakes to get established, which they did. And then I think they had a deal with the crab boat to pick them up, too, when they were finished. Any rate, they had the biggest camp on the northern St. Matthew, and I did my work in the south. They dropped me off -- that in 1985 by myself, and then came back and picked me up at the end of the day, the crab boat. And took me about mid-way where there's another big lake where we had camped in 1966 and I wanted to see what that area looked like. That's where we saw a lot of skeletons in '66. So they dropped me off there and then I said I would walk from there up to the camp where my daughter and son-in-law were. And then they could pick me up there after a day or two. After I'd arrived, I would be staying there for a couple of days. And so I worked out that I was quite unexpected. I was able to hike in often foggy weather and come out of the fog and onto their camp. And in the family tradition, my son-in-law to be and daughter had organized the team to build a sauna down on the beach with driftwood and a little bit of plastic Visqueen that they had. Using an old oil barrel, knocked an end out of it, and it was pretty functional. And so after this long hike there -- and there was a little stream, fresh water stream which was where they got their water but it was there just before it broke out onto the beach -- the stream broke out onto the beach, there was a place where you could sit down in it and it would be sort of waste deep and after you were in the sauna and it was like you sit down for a short time.

KAREN BREWSTER: To cool.

DAVID KLEIN: Splash water over you. And it was nice clean water.

KAREN BREWSTER: Your cool off spot.

DAVID KLEIN: Or you could, if you wanted, you could go from the sauna directly into the sea, which was quite a bit colder than the stream, but then you'd want to rinse off the salt water in the stream anyway. So it was quite a luxurious kind of situation for a sauna. And plenty of driftwood. And so, yeah, they would do this sauna and bathe there several times a week. And since the weather was particularly rainy and foggy, and they -- this heater they had in this Jamesway was insufficient to raise the heat up there for all these people in there with their wet clothing and sleeping and cooking. It wasn't the greatest. And the sauna was sort of a salvation for them, because they could at least get warm there and didn't have to wear long johns and heavy clothing inside their deal all the time. And so that was a great experience to be able to join up with my daughter and son-in-law. Both of whom I was very close to and they were part of the winter field trips that I used to make from campus, on skis, and camping out. And so it was just wonderful to see them up there enjoying the experience.

KAREN BREWSTER: And so that daughter pursued biology and fieldwork? At that point in her life, she was interested in doing that?

DAVID KLEIN: Yeah, she was in --finally, she had taken awhile to focus on -- she was -- had started in environmental -- she took one semester at Evergreen College in Washington. But she had given several tries on languages and she also had spent a year with a family in Norway and learned some Norwegian and then went back in her junior year of high school and went to a Norwegian high school that focused on languages. And she became quite fluent in Norwegian and German, and had a little bit of French, too. And so she then got back and UAF was the logical place where tuition was low because she was part of my family and didn't have to pay tuition, 'cause I was a faculty member. And she tried art and ceramics and philosophy, and eventually, oh, and pre-med, and eventually settled for biology. And then she ultimately -- well, she and her husband, were biologists. She was still an undergraduate student at that time, he was a grad student.

KAREN BREWSTER: So what was that -- that must have been kind of neat to be out in the field with your daughter?

DAVID KLEIN: It was terrific, yeah. And especially a place that she knew -- had heard a lot about St. Matthew and here she was experiencing it herself. And she -- she and her husband-to-be definitely fell in love with St. Matthew and the seabirds and the sea, which she had grown up in interior Alaska and thought -- she loved interior Alaska, loved the winters and the cross-country skiing. But after that experience, the two of them were pretty firm on spending their life together and they decided to --they wanted to look over Alaska as where they wanted to settle. But they had already got hooked on the sea, and so they visited southeast Alaska where she was born, but she didn't understand it very much because she was pretty young. And they visited communities in the coast of Alaska and Cordova, Valdez, and then they took the boat out to -- the ferry out to Dutch Harbor and got off at varying places, and of course it was the sea and it was beautiful and they loved it, but they concluded they wanted a compromise, and so they settled for Homer. And in retrospect, they're very happy with that. They still get some skiing, and they can always walk down onto the beach in the worst kind of weather, and this is great.

KAREN BREWSTER: Now in 1985, you mentioned that the Maritime Refuge was kind of your connection to get back out there. Is St. Matthew Island part of the Alaska Maritime Refuge?

DAVID KLEIN: Yeah. The Alaska Maritime Refuge sort of came into being through the National Interest Conservation Act.

KAREN BREWSTER: ANILCA.

DAVID KLEIN: ANILCA. And then there was an Aleutian Islands Refuge, and it came into being -- they realized that, yeah, that was a major issue and the Aleutian Islands are so strung out. But then there are all these other marine --small seabird and marine mammal rookeries and breeding places scattered from southernmost Alaska -- Forrester Island which is off of the southern -- close to Ketchikan but on the west coast, a few miles off the bigger islands of Dall and Prince of Wales Island. And it's a forested island, but a small island. It has a lot seabirds and marine mammals and no predators.

And then coming up the coast, there's many rocky coastal seabird areas and some of them with marine mammals, sea lions predominantly. But then all the way up to -- and then scattered along the coast to Prince William Sound, some outer islands there, and the southern outlying rocks between the Barren Islands between Kenai Peninsula and Kodiak. And then these varying places on outlying rocks all the way out to the outer Aleutians. And then in the Bering Sea, again isolated bird colonies along the coast and including portions of the Pribilof were important bird cliffs, and as well as St. Matthew then. And then all the way up through Bering Strait to, I think, Point Lay is the northernmost. So they're spread out in these tremendously great distances, and obviously they can't get to these every year. And they have this boat, but the boat is working mainly in the Aleutians where the greatest numbers of sea birds and sea mammals are. And so then they do periodic trips, like the Pribilofs and St. Matthew are usually done the same time. Although the Pribilofs have the advantage, you can fly there, biologists can fly there on scheduled flights and do the work from the land and they don't have to organize a ship. Although some of the kind of work they do, they'll do it the same time they're out there with the ship and can do the -- where they need to do the observations from the sea, and they can do the St. Matthew at the same time. And so the standard is they try to get to St. Matthew about once every five years, but in recent decades they were unable to squeeze it into the -- in 2010 which would have been after the 2005 because the ship was so tied up in the Aleutians because they had unexpected things like the Kasatochi volcanic eruption and then scientists needed to be brought out there to see what animals -- how fast before animals came back, the nesting birds, marine mammals, and insects and plants became established, etc., etc., etc. Plus other Aleutian Island studies that included rat removal on the Rat Islands and introduced foxes, Arctic foxes. So the Maritime Refuge is just amazing. There's nothing like it in the rest of the United States or in the world for that matter. And it's just a vast area and they're fortunate to have this very well designed ship and crew, but it's a fairly expensive operation. But it's critical to carrying this out.

KAREN BREWSTER: So in 1985, there were no more reindeer on the island. In 1966, when you were there, I can't remember, had they all died off by that point?

DAVID KLEIN: No, I don't think so.

KAREN BREWSTER: There was a small group in the south, as I recall you saying.

DAVID KLEIN: I forget; there was small group of only females.

KAREN BREWSTER: Right, right, right.

DAVID KLEIN: Thirty-two animals, I think.

KAREN BREWSTER: That was in the southern part.

DAVID KLEIN: That was in 1966. Well, then they lingered on and the numbers decreased, but, of course, people weren't getting out there on an annual basis. And so

they -- there was some situation went out there to do the bird work and they were able to say, "Well, there's still a handful of reindeer." And then the last one that lived longer, about a couple years after all the rest had gone, was a lame female. And there was a picture of that taken by Art Sows and then the next year it had died out.

KAREN BREWSTER: So what year was it where they saw that last one? Do you remember?

DAVID KLEIN: I'll have to look. I don't remember.

KAREN BREWSTER: But it was somewhere between '66 and '85.

DAVID KLEIN: Yeah, it had lived an estimated 21 years based on the age of the animals that -- all of the animals, females that survived. That it would be a minimal of 21 years and probably 29 years, which was a record for reindeer in captivity lifespan. But then all this time she didn't have to produce any young, she didn't have to conceive.

KAREN BREWSTER: So that would give her a longer life expectancy?

DAVID KLEIN: Yeah, because she wouldn't have the stress of feeding her young and in good condition going into the winter and no competition for foraging, which you wouldn't need when the population was so high. I mean there were no places to go to get away from competitors for the food that you're feeding on.

KAREN BREWSTER: Yeah, the problem of being stuck on an island, I guess.

DAVID KLEIN: Yeah, stuck on an island. Caribou, you know, there's an advantage in being in groups for predator avoidance, but you've got to move around a lot. You can't stay in one place too long or you eat out food that's available. And you keep moving around a lot and that works well for caribou, but not on islands where the reindeer were put. And part of the problem was that the reindeer that were brought there from Nunivak, and they'd only been at Nunivak for a short time. Well, a few decades, but they originally had come from the Chukotka Peninsula (also known as Chukchi Peninsula) where they were noted for being very non -- they had been herded for a long time and selectively removed, those animals that tend to wander away and hard to -- so that they were -- they tended to stay where they were released in the southern part of the island, which happened to be where there were a lot of lichens. But there were areas to the north that had not very many lichens, but the reindeer didn't get up there in mass to feed heavily on those remaining lichens in the north because they were little small patches here and there. When the population was so high, it just stayed -- it didn't move out. If it had been herded now, that's the way the reindeer get moved by humans into new ranges so that they don't overgraze in any one area. And caribou, on the other hand, they are more mobile and don't have to be herded.

KAREN BREWSTER: Yeah, so these reindeer, they weren't going to pick up and move someplace else unless they were herded and kind of told to move.

DAVID KLEIN: Yeah, and then they couldn't. And so it was amazing that they didn't either swim across to Hall Island, or walk across the sea ice in the winter. One would have to assume that it would be discouraged -- it would discourage them from doing that by the fact that there's a narrow strait there. It's only about three miles wide, and it's not a good place for boating because there's usually strong currents when the tidal movements are moving water back and forth and the wind creates big waves. So that would be the -- frequently, the case. However, when it's less windy is in the summer when there's plenty of food for the animals.

KAREN BREWSTER: So then they wouldn't --

DAVID KLEIN: So they wouldn't be likely to do that. In the wintertime, if you had sea ice moving through, that's dangerous for animals to try to swim, especially if there's strong winds and the ice is moving rapidly and squeezing, opening and closing. So it would be discouraging to them.

KAREN BREWSTER: So does it ever freeze up there all the way that it's solid ice and they could just walk across it?

DAVID KLEIN: Well, we've never been up there in the most extreme conditions of winter. But if you have -- there's often a polyna on the south of St. Matthew because the north winds push the ice down around it and then there's a somewhat open area to the south. But, of course, that's not the case up north where Hall is. And there's a polyna in the south side St. Lawrence Island to the north, a much bigger island. And this is where there would be some marine mammals might be hauling out and a few seabirds would be hanging around there, like eiders for example, in the wintertime. But otherwise there would be no incentive for the reindeer to go out on the sea ice. And in the wintertime, they're very energy conservative and it's just too great a risk.

KAREN BREWSTER: So what did you find in 1985 when you got there?

DAVID KLEIN: Well, I kind of already had an idea of what I'd find in terms of which plant groups would be showing the greatest response to the heavy grazing. The removal of the lichens made it more favorable for sedges. And sedges didn't do well in lichens partly because the lichens insulate the soil and so the soil is cold and not good. And lichens are not rooted. They're dependent upon sunlight and they can photosynthesize in temperatures just even below zero a few degrees. But they dry out so rapidly, and once they dry out they just become dormant. So in sunny days they couldn't grow. And so what appeared to be the case in '85 was that, yeah, the lichens were not as advanced as when they were grazed so heavily. The main reason why they were slow to come back was there was not significant living lichen material left, so lichens had to start from scratch with pioneering forms. Or others that could move in after the pioneering forms came in and get established. The pioneering forms were usually darker brown-colored and not as palatable to reindeer if they were there, or caribou where caribou range gets overgrazed. And then they're followed by others. So in that situation, it was pretty much

accepted in my mind, and generally people that were familiar with caribou and reindeer range, that it would take at least fifty years for recovery of the lichens and probably longer. And I was the one that suggested probably longer, partly because we didn't know very much about growth rates of lichens there at that time in contrast to other areas. And we had a little bit of knowledge from this, since some of my students working on the Seward Peninsula provided growth rates, but they were the kinds that the caribou were eating. And the ones that were coming back on St. Matthew were not the types that caribou were eating, and we didn't know -- have knowledge of their growth rates. There was Russian literature's complex on this and helpful, but still they didn't have a similar situation. It was a very unique situation.

KAREN BREWSTER: Well, I find it interesting that the reindeer -- there were so many reindeer there originally in an isolation, they over-grazed the lichen, which then prevented these other --

DAVID KLEIN: Which had --

KAREN BREWSTER: No, no, that because they over-grazed the lichen it allowed these other plants to take hold.

DAVID KLEIN: Yeah, and recover.

KAREN BREWSTER: And recover first. But it still took the lichen fifty years to recover?

DAVID KLEIN: Pardon?

KAREN BREWSTER: Did it still take the lichen a longer time to recover than the other plants?

DAVID KLEIN: Yeah, they haven't recovered.

KAREN BREWSTER: They still haven't recovered?

DAVID KLEIN: No. There's some recovery going on, but it's a long ways from -- And so this led to the 2005 work. So then there was like forty some years since the die off.

KAREN BREWSTER: So '85 to 2005, you didn't go in between?

DAVID KLEIN: No.

KAREN BREWSTER: Okay.

DAVID KLEIN: You're talking about the time from '57? What?

KAREN BREWSTER: So in 2005, you were there and what did you see?

DAVID KLEIN: Oh, let's say they died off in 1964. That's when they had the major impact on the lichens, by that time. In 1964, that would be -- in 2005—that would be what forty some years? 44 or something.

KAREN BREWSTER: Forty-one.

DAVID KLEIN: Pardon?

KAREN BREWSTER: '64 to 2004 would be forty, right?

DAVID KLEIN: Yeah. Forty-one years. Yeah, so forty-one years. So that -- I expected to see more recovery of lichens than was there. But I saw pronounced -- the willows, one species of prostrate willow, Arctic willow, hadn't been -- it's tough. It suffered some from grazing of the current annual growth in the wintertime. And these were on little hummocks surrounded by lichens. So when the lichens were gone, they recovered somewhat. Fairly rapidly because they had the root system and the older stems. The sedges, obviously, mostly seeded in from places. There were a lot of sedges in sedge meadows where there never had been lichens. And on drier sites, there were different sedge species that had been there and there was some places between rocks and stuff that hadn't been hammered too badly. But they would -- if there was something to keep the wind -- Wind caused some loss of soils after the over grazing of lichens, the high winds. And that left sort of a substrate that was heavily small gravel or scree. And so lichens can get started in that, and some of them had, but it's a slow process. A very slow process. At first lichens are these -- they look like a fungus growing on the rock surfaces and then gradually other species come in and it would take a long time. And I maintained that it would take maybe many hundreds of years to recover after this severe situation there on St. Matthew. But then by 2005, it became apparent that the weather had changed. Well, we knew that, but we didn't know how it changed there. But lakes -- some of the lakes were drying up, or at least much lower lake (water) levels. And the assumption was that the longer summer, without a significant change in precipitation, meant more evaporative loss from these lakes. Some of the lakes had no outlet to the sea. And so there was an evaporative loss and a longer summer season, plus wind is always common there, so evaporation would be particularly high when there's no ice covering the lakes. So that -- And then we saw, in some places, the Arctic willow in sheltered valleys, the growth form was much more vigorous, which suggested warmer summer growth conditions. And so longer, warmer summers with less fog also meant that lichens were dry a lot in the summer, and would dry out rapidly in sunny days because the sun dries but then the breeze would just speed up the drying. And then they can't grow. They just sit there. And it doesn't kill them, but they don't grow. And so it was fitting that pattern, and that's -- we published with Martha Shulski, who did the weather summary and extrapolated from the Pribilof Islands. And that paper was published in *AMBIO*.

KAREN BREWSTER: Yeah, you mentioned that last time, right?

DAVID KLEIN: But in 2005, then when we were at that base camp -- although we visited the plots again in 2005, we had to get there from the north end. We'd been dropped off by the *Tiglax* at Bull Seal Point camp and we had to go by zodiac. So there were one, two, four of us went there with everything in waterproof bags and we had to use jumpsuits to get the --

KAREN BREWSTER: The survival suits.

DAVID KLEIN: Yeah, to get to -- to launch the zodiac. And particularly to come back, because we didn't know what the weather would be like down there and we could only spend a limited time because we didn't take a huge amount of food.

KAREN BREWSTER: So would you go out there to the enclosure area for a day trip -- ?

DAVID KLEIN: No.

KAREN BREWSTER: -- from the camp, or you went for -- ?

DAVID KLEIN: We camped. We went down for about four days. And set up tents, not far from the big lake where we had access to water and were only about a mile from the plots. And so we were able to -- though I had a field assistant who was a Native from St. George Island who had an interest in reindeer. Max Malikovski [sp?], I think it is. And so he came out and he worked with me on the vegetation work. And part of it was getting him experience, because he hoped sometime in the future he would have responsibility for more management of the reindeer on St. George Island. But then a study was started then on -- it was known that red foxes had gotten to the big island, St. Matthew Island, in, I think it was 1999. And were breeding. And that was some bird people that were out there and limited to working, I think, with the Auklet colonies and didn't get around much. But, yeah, they were breeding, and still Arctic foxes there. And so then in 2005, we got there and, wow, you know, we had a red fox den right next to our camp with eight young. And we found another one on the north end, another den of red foxes, also with eight young. And the young were all uniform size and good condition. Well, normally, with a litter that size, there's one or two that aren't as aggressive and if food is limited they don't get much food when mom and dad come back with food. And so they lose out and frequently don't make it. But these were all doing fine. And we were able to see mom and dad going out on their daily run. They took turns. And they would go out, and if they went inland, they would come back with voles. The vole population was high and they would come back with about eight or ten voles hanging out from their mouth and bring those to their young. And the other one, or one or the other, would go to the auklet colony and it was the same. They'd all have the smallest auklets and have about six or eight of those hanging from the side of your mouth. And it's easy for both Arctic's and red's to capture auklets.

KAREN BREWSTER: They could carry that many?

DAVID KLEIN: Yeah, but it wasn't very far to the den close to ours to the closest auklet colony. The other one was close to the big auklet colony that we weren't able to observe continuously. But this one close, it was only a little over a mile.

KAREN BREWSTER: Well, it's amazing that they can catch auklets.

DAVID KLEIN: Catch what?

KAREN BREWSTER: That they could catch the auklets.

DAVID KLEIN: They catch the adult auklets when the adults are coming out. See these auklet colonies are a massive number of birds compared to other seabirds. The average colony would be somewhere between ten and thirty thousand. Ten thousand and thirty thousand. And the strategy is they are crevice nesters, so they nest underneath big boulders and stuff that foxes -- where there's slump, and past coastal erosion causes these volcanic rocks to break up in some areas where the underlying rocks are softer from the explosive volcanic explosions, the ash and stuff. That stuff can be really fine and even kind of clay that is like a lubricant if it's wet and facilitates coastal erosion. And some of it is generated by the sea, but some of it is just the types of rocks that would cause this slumpage and it does over long periods of coastal erosion. Short periods of coastal erosion are different. And, of course, the harder rocks from lava flows, the basalt, especially columnar basalt, is so tough it doesn't have any cracks in it and the sea doesn't have much effect on it. We were able to see this from rocks -- from photos I've taken in 1957 of some of these specific areas where they're just loaded with seabirds. Little offshore rocks that the foxes couldn't get to, and still haven't changed. Those rocks haven't changed significantly. Whereas others areas have changed a lot. So where the coastal erosion results in these big boulder fields of broken lava in rocks that were part of the softer rocks, there's big rocks that the foxes can't dig under. And so the auklets, they're little birds -- and very small birds the smallest ones, and the adults dig underneath the rock and have their nest there. And so the foxes can't get the young ones, but the adults have to come out a couple times a day from under these rocks to go to the sea and feed. And they do it in mass. And their colony, also the strategy is in mass so that they're literally swamping the predators. So the predator fox there gets all it can handle, but if it comes back, it's a time when they're either all out to sea or they're under the rocks. So they have to be there just as they're coming out. And because when they come back they go into the rocks right away. When they're coming out, they perch up on the rocks and call and they sort of stimulate one another until everybody's out. Then they take off in this big black cloud of auklets of eight or ten thousand at one time. They go to the sea, and as far we know they stay aggregated and feed in the winter column at sea. And they're feeding on, of course, very small plankton because they're such small birds. And then they're not competing with the bigger birds and the seals and fish mostly, smaller fish they would be competing. But presumably they also stay in mass while they're feeding, again its predator swamping. If there are big fish or sea lions or seals, there would be so many of them. And if you're in a group it confuses predators that try to come into the group and don't target individuals that most of -- a lot of seabirds target -- bigger seabirds, for example, that hunt separately, they'll target a species and then they speed

up. Of course, they're flying, in the water like they're using their wings, short wings like fins and they can go extremely fast.

KAREN BREWSTER: Like penguins.

DAVID KLEIN: Yeah, like little, tiny penguins, right. Which means that they have to fly very fast in order to stay airborne. And they usually have a hard time in flat, calm sea in getting airborne, because if there's waves they can bounce on tops of waves and catch a wind and get off of the water. But, of course, they can always dive better.

KAREN BREWSTER: Right. That's what they're designed for.

DAVID KLEIN: Yeah.

KAREN BREWSTER: So that gets us to 2005.

DAVID KLEIN: Yeah, oh, I mentioned the foxes. So one of the things in 2005 is we were starting to collect information on how many Arctic's were left on the island. Were they denning? And were there other -- What other red fox dens could we find in areas that we could cover? And obviously, we couldn't -- with the limited number of people, and they had other things to do, we couldn't thoroughly cover the island, but we could cover a lot of areas especially close to these bird colonies. And so in the meantime, the red foxes had -- in 2005, there was one red fox seen on Hall Island but no sign of more than one. And still lots of Arctic's, and Arctic's were doing fine in denning. And then when we went back in 2012, there were no red foxes still on Hall. None were seen, and Arctic's were doing fine. But in 2005, the number of Arctic's left on Hall Island, I mean on St. Matthew, were very few. We saw Arctic's, but it was like we couldn't find any dens where they were producing young. And these Arctic's were very shy of us. And prior to the red fox's arrival, Arctic's would come around our camps and try to get food and that didn't happen in 2005. And close to the red fox dens, we found their behavior was quite different than Arctic's. They never came and investigated for food in our camp. They were pretty self-sufficient. And just their behavior was -- they got used to us and so just sort of ignored us. And we saw a few Arctic foxes and if they came into the area, into the huge valleys leading down into our base camp, we wouldn't see them except maybe on the edge and then they were very wary if they came in. One time we saw one sneak in along the beach, hunkered down very low, at low tide so that it couldn't be seen by the fox dens at their den. And it just was trying to move as rapidly as possible to get by there. But it probably had gone up to the auklet colony to get some food. And probably the reds wouldn't bother it if they were up there catching auklet, but they would probably bother their dens if they had young. And so the general assumption is that in the literatures from other areas like the Alaska North Slope and Northern Scandinavia where Arctic foxes decline when lemming populations get high, because the red foxes tend to move down in the coastal areas if there's a lot of small mammals available. And so the Arctic's decline, and then in the winter it's hard for them to breed when the red foxes are around. And in the winter time, the Arctic's are more adapted to going out on the sea ice, whereas the reds will stay, as long as there's small mammals, they can hunt through the

snow where there's small mammals and do fine. And reds, subsequently, we've learned from the literature and other people that have more experience that the reds much prefer hunting small mammals than they do birds, even though the birds may be abundant in some areas. So now I'm writing up the 2012 --

KAREN BREWSTER: So you went back out in 2012?

DAVID KLEIN: Went back out in 2012. And then, by that time, Art Sowls, who had sort of started the fox work had retired. And so I said I would take over the -- because all the other people were bird biologists and so I'd take over the fox part. And so the two major projects for me for 2012 were the bird/fox relationship, and, of course, the fox/fox relationship. The red versus the Arctic. And those were tied together. And then what was the net impact on the birds having red foxes there and not Arctics. And we had this sort of control on Hall Island. And then coastal erosion. And coastal erosion affects seabirds differently. So it tends to create new habitat for the small auklets. So there were some places that more recent slumpage was occurring and they weren't occupied by auklets at all and when they have to exist in a mass, you can see it's hard to get a big colony started probably. Although, there was one place where we had -- on comparing satellite imagery, which we got some first ones associated with our being there. And they weren't perfect because they didn't give total coverage of St. Matthew. They did for Hall. But on Hall, there was one slump that we could see from the satellite images compared to 1948, I think it is, Navy stereo black and white photographs, aerial photographs. We could see that this slump existed in two thousand and -- when the Navy did theirs in the '40's, the photos. But by 2012, the satellite imagery showed that it was pushing further out into the sea, so it was continuing to slump down. And the people working with the auklets on the island, they checked the whole island and they said there were a few auklets starting to nest in that one place. But in other, somewhat similar places, we didn't see any evidence that the auklets were moving in. So what we can say -- and this is on-going erosion there, , you know, the islands are getting smaller if we're thinking in geological times, fairly rapidly, but in the shorter term you can say that the coastal erosion is certainly probably benefitting the auklets. And then the harder rocks, where solid lava created these big cliffs, the vertical cliffs direct from the sea, you know, there's virtually no significant coastal erosion occurring because the rocks are so hard, the sea just rises up on the cliff face and there's no beach there because there's not significant erosion going on. Well, this is okay for the birds that nest there because they're ledge nesters mostly. So that would be the murrelets and the kittiwakes and fulmars. And there's a few puffins, but the puffins are -- they're kind of crevice nesters, or if there's no foxes, they will dig a hole in the top of the cliff on the soil, but if there's foxes around, they won't do that. So in the Aleutians, if there's no foxes and no rats, the puffins choose to nest on top of the cliffs in the soil where they can walk to the edge of the cliff and leap off to go and fish. And in a cliff face, where there's a ledge sticking out, it's frequently cracked there and cracks that are big enough that the puffins can go in there and have a nest. And it's more secure because there's predators on the cliff nesting birds. The foxes can't get to them very well, but there's the big gulls and ravens that will go after the eggs primarily and the very young ones. And so if you're in a crevice, they can't get in there. And if they were

to land and try to go in they have to face the sharp bill of a puffin standing guard over the young.

KAREN BREWSTER: So how did you end up getting out there in 2012? What was the group, and what was your purpose? I mean you were there --

DAVID KLEIN: The group was a fairly large group because it included some of the refuge people, including the refuge manager, had never been out to there and wanted to get out because they were charged with management. Plus some of the bird biologists from the refuge, who had been there before, a couple of them. And then there were volunteers from the refuge -- who people volunteered to go out. They didn't have a big budget, and the biggest component to the budget, of course, was the boat and the feed and the camp sites for all of us. And they didn't pay our transportation out to the Pribilofs, where we were picked up, 'cause they didn't have any money. They wanted to, but they didn't have any money.

KAREN BREWSTER: So you paid your own airfare to the Pribilofs?

DAVID KLEIN: Yeah. And so I went to Anchorage and then there was a flight direct, usually one flight a day direct to St. Paul Island. And it would also try to get to St. George, but the airstrip at St. George is not as well lighted and so it doesn't have instruments for instrument landing. So it has to have pretty good weather. So the St. George, frequently, that flight is often canceled.

KAREN BREWSTER: So tell me about the boat that you went on.

DAVID KLEIN: The *Tiglax*, I should remember the footage of it, but it -- it's probably in here, but I don't remember what it is. It's a large boat, a crew of about six including the Skipper and First Mate and other crew and a cook. And then it has extra bunks for people being transported in addition to the crew. It's a very well equipped ship for that kind of operation. Very sea worthy. And it has -- And they can put big zodiacs up on the deck and tie them down and lower them with booms to get people ashore. So they're big zodiacs with the big high-powered engine, outboard engine, so it's relatively easy to off load those. I think they may have at times built a helicopter platform on the back deck, but only for certain areas when they were doing and needing to have --

KAREN BREWSTER: And so is that a Fish and Wildlife Service boat?

DAVID KLEIN: It's a Fish and Wildlife Service boat.

KAREN BREWSTER: It's like in the old days they had airplanes, and now in this refuge they have a boat?

DAVID KLEIN: Yeah. I don't think they have any airplanes, the Alaska Maritime Refuge. They have this boat, the *Tiglax*, and it's based in Homer.

KAREN BREWSTER: Okay.

DAVID KLEIN: And that's where their main office is, in Homer.

KAREN BREWSTER: Right.

DAVID KLEIN: And, so, of course, there's a lot of maintenance work has to be done on the boat, and has to go for checks occasionally to Seattle and go through the checks and everything. But it's very well maintained, and the crew are just amazingly good. The Skipper and others, and they have good instruments and so they can travel safely and handle all these operations. They're particularly good at handling biologists, and other scientists and others that don't have much experience, but to do it in a safe -- there's a certain amount of training you have to go through to wear survival suits whenever you go out, going ashore, and they have to go through all these drills and safety on the ship, etc., etc. It's a great ship, and traveling on it is good because you can get up either in the pilot house or, it depends on where the wind is coming from, find places where it's not blowing too hard but when it's pretty stormy. And it's just exciting because you get all these fulmars and occasional albatross and kittiwakes. And watching these birds that are so adaptable to living at sea and feeding and taking advantage of the winds and these big waves and to be right over the water and you can watch them. And it's just really exciting. You can learn a heck of a lot when you realize these -- most of these seabirds spend their -- the only time they're not at sea is when they're nesting. And so, you think of birds, they can't live in the water, they can dive some of them in the water. The gulls can't dive very far. And they can survive year round at sea, traveling great distances. Like albatross, they can go so far and of course they mostly are using the wind, taking advantage of the wind, and not using a lot of wing action. But then like the puffins and things, they're spending most of their time in the water when they're at sea. Whereas a lot of them like the albatross and the kittiwakes are mostly in the air feeding in those surface waters.

KAREN BREWSTER: Oh, I see.

DAVID KLEIN: And some of them are often in groups. And you see when you get up in the Bering Sea close to some of these islands, well, then the whales are starting to feed and there's schooling small fish or shrimp. And where the whales are feeding, that's where the fish are and the birds will be aggregated there in great numbers. So you see this big flock of birds from a distance and frequently you see that before you realize there's whales there, too.

KAREN BREWSTER: So how many of you were on that 2012 expedition?

DAVID KLEIN: There were --

KAREN BREWSTER: You said there were six crew and then how many scientists, or science-related people?

DAVID KLEIN: Well, the rest of the people -- the refuge people that were going to be with us as well as other scientists. So it included Derek Sikes and his grad student doing an insect survey. And the grad student's master's project was focusing on a special kind of beetle that lives just above the splash zone on the coast. So they spent some time on the Pribilofs, too, as well as St. Matthew. And there was one grad student, a botanist, he worked out of the museum under the curator -- the botanical curator there as his advisor. And he was pretty much free to collect plants, and he was familiar with the collections that had been made previously and so he was trying to fill gaps and collecting plants. And then there was one archaeologist from -- a senior archaeologist from Oregon who works for the Oregon Archaeology Department, I think, in the state government.

KAREN BREWSTER: Oh, okay.

DAVID KLEIN: So he got leave to go up there, but it was sort of a cooperative deal. And so he was investigating known foundation sites from a couple of Russian -- old Russian buildings and one Inupiat, or Inuit foundation site where some presumably big whale hunters got stuck there, had to overwinter, or spend -- wait for conditions to sail back to probably St. Lawrence Island where they had come from.

KAREN BREWSTER: Well, you indicated, I think was it in your first trip, where you dug the quick trench, test trench?

DAVID KLEIN: What was that again?

KAREN BREWSTER: Didn't you dig a test trench --

DAVID KLEIN: Yeah.

KAREN BREWSTER: -- someplace on the island?

DAVID KLEIN: That was, that was the Eskimo.

KAREN BREWSTER: And so they were following up on that?

DAVID KLEIN: He was following up. He did a more complete dig. I did a test and then that was the first one. That was in sixty --

KAREN BREWSTER: Was that '66?

DAVID KLEIN: '63.

KAREN BREWSTER: Oh, '63, okay.

DAVID KLEIN: And then there was a group of archaeologists that went there and they were looking for more evidence of early humans. And a team from, I think it was the University of Wisconsin, did another test, a more thorough test, but it was still just a test

at that house site. And they found the other half of the seal oil lamp, pottery lamp that I had found the first part from. They found some in a midden out in front, bones of marine birds and some marine mammals like seals. And they found wood that was used in the construction. And they were able to radio carbon date the house site at about 1600 calendar years.

KAREN BREWSTER: And when did; when was that team there? That was --

DAVID KLEIN: That team was there, I think, in the 1990's.

KAREN BREWSTER: Okay.

DAVID KLEIN: I think. I'd have to check.

KAREN BREWSTER: Well, approximate. That's good, approximately.

DAVID KLEIN: Yeah.

KAREN BREWSTER: So then --

DAVID KLEIN: So then --

KAREN BREWSTER: So besides -- so you did insects, plants, archaeology in 2012?

DAVID KLEIN: Okay, then there were the bird people who were mainly -- well, they had permanent plots in the auklet colonies and they used those to assess the extent of the colony and the approximate population. But they can also do that when they're aggregating to go to the sea. So, it's like they can estimate a breeding period, and I think the average young is -- number of young is -- that has actually fledged, is one or two in the auklets.

KAREN BREWSTER: Oh. That seems like not very many.

DAVID KLEIN: Yeah, but when you realize how big a population there is and the replacement. And the young are much more -- less likely to be clobbered by foxes than say the young of other birds on a cliff face because you've got the eggs and then the young birds. Big gulls, big Glaucous Gulls and there's ravens there, too. They can come and they're good at grabbing -- when the female murre or the male murre, when they will stand there and try to harass the --

KAREN BREWSTER: Fox?

DAVID KLEIN: The ravens and big gulls are just --

KAREN BREWSTER: Oh.

DAVID KLEIN: -- maintaining themselves right up there and they'll grab the wing or something because they try to protect the eggs or the young. And they'll grab them and then back off and just let -- fall down and that bird has to free fall and gain flight before it can come back. And then it can't come back, because the gulls are right there.

KAREN BREWSTER: So the --

DAVID KLEIN: So then they can take the young.

KAREN BREWSTER: So the ravens or the gulls are hovering, they're flying and hovering, and they pretty much like fling the adult auklet off?

DAVID KLEIN: Yeah.

KAREN BREWSTER: To try to get in there to get the young.

DAVID KLEIN: Yeah.

KAREN BREWSTER: I see.

DAVID KLEIN: And they do the same if the young are not flying but they're good size, they'll just pull them off and let them fall and then they go down there and pick them up off the beach.

KAREN BREWSTER: Aw.

DAVID KLEIN: But at that time they're dead.

KAREN BREWSTER: Right. And those poor little adult auklets, they don't have a chance against a big raven beak coming in.

DAVID KLEIN: No, but they're under the rock.

KAREN BREWSTER: Yeah, but when they come out, I mean.

DAVID KLEIN: Yeah, but they don't come out until they're almost ready to fly.

KAREN BREWSTER: No, the adult ones protecting them.

DAVID KLEIN: Yeah, that's true. But even them, they're good flyers. And they can take off. And they're up there, and it's usually windy, and they're up on a rock so if they see a fox, they just take to the air. And there's hundreds of them going around.

KAREN BREWSTER: Right, but I was thinking the ravens or the gulls coming in from the air and plucking these adult auklets off the rocks. Those adult auklets are so small they don't really have a chance against those big ravens or gulls.

DAVID KLEIN: Well, but they have a better chance to get airborne than --

KAREN BREWSTER: Than the young ones.

DAVID KLEIN: And then they're not protecting their young, because the young are under the rocks. Whereas the murre are so vulnerable. You know, they've got sharp beaks, but they can't step off that ledge or they're fall down.

KAREN BREWSTER: They don't fly off?

DAVID KLEIN: Well, they can fly off, but if they want -- and they will if they don't have a nest, but if they're protecting the eggs and the eggs are just sitting there --

KAREN BREWSTER: Oh, yeah.

DAVID KLEIN: -- on the rock.

KAREN BREWSTER: 'Cause the eggs aren't under rocks?

DAVID KLEIN: Right.

KAREN BREWSTER: Oh, I see.

DAVID KLEIN: Yeah, the eggs are just sitting -- The eggs are really shaped like -- really pointed at one end.

KAREN BREWSTER: They're the ones that don't roll?

DAVID KLEIN: They go in a circle, right. They're right there on the edge --

KAREN BREWSTER: Yeah, so if that --

DAVID KLEIN: And of course the adults, if it gets a little close, they can move it back.

KAREN BREWSTER: But you're right, if the adult has to leave the nest, those eggs are really exposed.

DAVID KLEIN: Yeah. And so this is one of the problems with the big tour boats going and blowing the whistle and seeing all the [inaudible@1:19:42], if birds leave in a hurry, a lot of eggs get knocked off.

KAREN BREWSTER: Yeah.

DAVID KLEIN: Because they're just so frightened by this huge ship and the whistle and everything and they're not used to that.

KAREN BREWSTER: Interesting.

DAVID KLEIN: Yeah.

KAREN BREWSTER: So, on your 2012 trip, you've got insects, plants, archaeology, birds.

DAVID KLEIN: Okay, then there's a couple other projects. One was one that -- my field assistant was my son-in-law and that was important because he knew those auklet colonies and had been -- was familiar with the area. He's an ornithologist by training and very top-notch, so he did a lot of extra work for the refuge on bird identification, recording birds. One of the things they wanted was some bird calls like the endemic Snow Bunting that's there. McKay's Bunting. They had a big recording device, equipment on Hall but they never were able to get good recording, partly because sometimes the best conditions were too windy and you had all this wind noise.

KAREN BREWSTER: Right.

DAVID KLEIN: While Rich had just a real nice camera that he could record sounds with, too. And he was taking a picture of a male Snow Bunting on the rock and sounding off and he got a recording. And so when they got back on the ship, and we picked up the guys from Hall and they said, no, they hadn't got the -- it was the Ornithological Laboratory in Cornell University that has all these bird recordings.

KAREN BREWSTER: Right.

DAVID KLEIN: And it was really disappointing. They hadn't gotten any. And Rich had his camera with him at the moment on the ship, and we were in the dining area. And he said, "Well, I might have one." And he turned it on and they said, "Oh man, that's fabulous!" We couldn't -- So he says, "I'll just download that. You can have that one."

KAREN BREWSTER: But, so what exactly were you and Rich studying then? What was your purpose of going back out?

DAVID KLEIN: We were studying the geology from the standpoint of coastal erosion. And how do you explain this differences that I've explained so far about the auklets versus the others. And what is their geological history. So we did -- we weren't familiar with how much -- We knew there was a little geological work had been done, but we weren't familiar with the literature and we should have been, but we didn't have that. And there was an excellent -- back in 1975, an excellent geological map done by some top-notch geologist working along the coast, which is where the birds are, too. And rock exposures were. We collected some rock samples from different types to get an idea of relative hardness and vulnerability. We took a lot of photographs ourselves where we saw erosion occurring, and sometimes the basalt, the lava, when it's cooling it fractures and you just get these slaty blocks. And those -- the rain and wet can go down in them

and the frost, and so they're very vulnerable to erosion by wave action at their base. And so there'd be big piles of rocks coming down from wave action. And then, of course, the increased coastal erosion is a product of the fact that when there's sea ice around the island, there's not much erosion going on because you don't get wave action. And yet early winters, when you don't have sea ice and you -- for a longer period, now it's open than was previously, and that's when you have the big storms that create the big waves. And so these big waves are eating away some of these kind of cliffs, but they're usually not where the big seabird aggregations are on the cliff crevice of the ledge nesting birds are. And as the auklets have already swamped a combination from earlier coastal erosion and some of that is continuing but is -- So there's active slumps and older slumps and the big colonies are usually in the older portions of the slumps. But that doesn't tell us much about -- it may be that -- and probably one of the factors is some of the more active slumps still have soupy clay on the bottom. And they would not be suitable for nesting underneath. But a lot that we don't know yet.

KAREN BREWSTER: Right, you're still working on analyzing all this information?

DAVID KLEIN: Yeah, but it's turning out -- I was able to take the rocks collected, that we brought back, into the geomorphology lab in the Geology Department here at UAF. And had help from a Ph.D. student in identifying the types of rocks and their relative hardness. Which then I could relate them to this wonderful geological map that was published previously, which defines rock types and specific locations and the relative hardness of these rocks that we had samples from. And there's examples over here.

KAREN BREWSTER: On your table over there.

DAVID KLEIN: I learned a lot of geology in the process of working with them. They were very helpful. But a lot of it was from studying this -- there'd been another follow up team that went from here in the 1980's, I think it was. And they do some new methods for assessing rock density from -- on the rock themselves along there. And that one's a good one, and so we have that one, as well. And a lot of -- some of that -- both of them together helps to explain a little bit about the interesting volcanic history that was going on there about 60 to 79 million years ago when there was very active volcanics. Since there were actually volcanic craters on the north end, shallow relative, they weren't big tall volcanoes, but they were craters about three to four miles across from edge to edge. And they would rise up -- on the rim of them would raise up above the surrounding landscape about 1500 feet in the highest, but mostly they were much less than that. And you can't get a feeling for this unless you're up on top of one of these ridges and it's not foggy. And so that's never happened, and we weren't able to get up there. From a distance, by accident, we have a couple of shots from ground level, but then these satellite images are so wonderful. And then you can see these craters, and in the northern end was where it was extremely active and less active in the southernmost. And then there's some areas -- it's complicated by the fact that the land apparently went down after sea levels had risen at the end of the Pleistocene Period to create the [inaudible@1:28:31] Islands because they were part of the Beringian shelf, coastal shelf. The sea levels had risen. Apparently, there was some uplift and some submersion on different parts of the

island, but it all stayed like fairly level for 60 plus million years, whereas in this one island, Pinnacle Island, which is these steep cliffs rising right from the sea that rises about as high as any of the other points on the island. And geologically, it's tilted. Instead of being flat, it's tilted on edge.

KAREN BREWSTER: Oh, right.

DAVID KLEIN: And so it's very resistant and it's virtually all hard, hardest basalt that has occurred. The hardness occurred because it was in the sea – or at least in the sea for millions of years or maybe even the Earth's crust and pushed back up again so overridden earlier. But the age seemed to fall within that several 10 million years. Well, yeah, more than -- almost 20 million years.

KAREN BREWSTER: Well, it's interesting, I mean, you started out as reindeer and then you went into plants and now you're doing geology. Why did you – why this last trip in 2012, were you doing geology all of a sudden?

DAVID KLEIN: Well one --

KAREN BREWSTER: 'Cause you're not a geologist, is why.

DAVID KLEIN: Yeah, there's one more -- before I answer that question, there's one more thing that was important. I've gotten more involved in Paleo history. And some of that relates to -- always have been interested in Paleo history. Trying to understand the history of that area when it was during the middle Holocene and the early Holocene, and so some of that relates to the lichen growth. So I published one paper about the lichens on the Bering Sea Islands. And that was mainly based on the Pribilofs that they probably were -- the less growth of lichens there, were probably relics from the past because they hadn't -- Before reindeer were introduced, they didn't have any animals that were consuming the lichens. And it was tundra-like vegetation, but lush with lichens and then the early fur sealers and they described all those islands as being -- they couldn't find them for a long time. The Russians, it took a long time. They knew the fur seals were somewhere and they were so valuable, the skins were so valuable, they made several expeditions from the Aleutians. They knew that they were north of the Aleutians. And they came so close to finding them, but they were in sailing ships, so they had to be careful, they didn't know what the bottom was like. When they get close, they could hear the birds sometimes in the thick fog, but they didn't dare try to go ashore especially if there's nothing but a steep cliff there.

KAREN BREWSTER: It's not very appealing.

DAVID KLEIN: So, they finally, when they found them, they were so amazed that they had missed them. And here were these, literally a million or more fur seals hauling out there, and a lot of birds. But on the land, there were a lot of lichens. And they're associated with trying to figure out whether the fur seals were increasing or decreasing because their haul out areas -- they had come out onto the rocks and soil above the

beaches. And when they did that, they'd wipe off any lichens growing on the rocks or the land. So during the dispute between the United States and Great Britain over the number of fur seals, which related to mostly Canadians who were sealing, pelagically sealing for fur seals. And whereas the Americans had bought, from Russia, the islands and so they took over the island operation of the fur sealing. And the Russians had some fur seals on the Bering Islands. Not Bering, the Komandorski Islands, which were an extension of the Aleut Arc. But there, there weren't as many as fur seals hauling out there, but there were a lot of them. And so there was an international agreement between Russia, United States, and Great Britain representing Canada, because the fur seals spent a lot of time in Canadian waters when they're migrating up from southern California along the coast of Vancouver Island. Native people had been hunting them traditionally because these were mainly females and young making their way north. And then they came a little bit -- they started going across the Gulf of Alaska, so they missed a lot of southeast Alaska, most of them. And then they went through the Aleutians and they arrived in the Pribilofs. And the U.S. was charged with managing them properly and harvesting them and then splitting up the value between Russia and Canada, or Great Britain and the United States. But Great Britain wanted to go on hunting pelagically. They were killing females. The population was declining on the Pribilofs and Americans were saying they were declining and the British said, "No, no, it couldn't be declining. How are you counting them?" And stuff. According to the treaty, they could work together and so the British sent a botanist who was trained on lichens in Great Britain from a Canadian University. I think it was the University of Toronto. And he sailed -- came in a sailing ship, a British ship. Dropped him off there on St. Paul and he worked with the American teams. They were trying to determine how long the haul out area had been abandoned. And he was a lichen specialist, and he was -- he didn't find out what the British wanted him to find out. What he found out is lichens grow faster there than any place he'd seen. He'd been trained in England and he said the south coast of the British Isles was the most propitious lichen place because it was so foggy and just ideal. But this place was so much more favorable because of the moist atmosphere when lichens can grow all summer long. And even when it's into the early winter when you get storms, it's temperatures above freezing, they can still grow. So this to answer your question, I've been fascinated in the whole Paleo history of distribution of animals. For example, on the Aleutians, the red foxes made it all the way out to Umnak Island. And that lowered sea levels, that would have all been part of the mainland. Beyond that they didn't get. But there's also small mammals that got out there and ground squirrels. Whereas further out the Aleutians they weren't there. So anything -- any mammals getting out to these other Aleutians that were not marine mammals, like rats and introduced foxes, were clobbering the seabirds. So going back to the fur seals, this botanist was able to show that, yeah, the lichens grow faster there than any place else in the world. And therefore these are not that old, that the high population is going down. Well, he didn't make that, but that was the conclusions. He submitted a good report to the British and they decided not to use that as primary evidence. So at any rate, I got fascinated by the lichens and then had been to the Pribilofs several times through -- relative to the reindeer there, and so was able to write this paper showing that the lichens will never recover there as long as there's reindeer there because even though the reindeer are able to go on living at a lower level -- then they peaked once right after they were released, now they're mostly dependent upon vascular plants. And

it's further enough south and the winter's so much shorter than St. Matthew, that they don't have big die offs. They have some when you get a lot of snow and icing conditions. But they're eating mostly green vegetation, sedges and very few -- Any lichens, they eat them and they don't grow again to replace what's been eaten.

KAREN BREWSTER: So the times you were in St. Matthew was '57, I just want to review it, '57, '63, '66, '85, 2005, and 2012?

DAVID KLEIN: Yeah.

KAREN BREWSTER: Okay. I just wanted to make sure I didn't miss something between '85 and 2005. Go ahead.

DAVID KLEIN: So then the 2012, the third project, which was specifically I insisted on, was trying to reconstruct the Paleo environment in the past. Because the Pribilofs are fascinating, because we know there were mammoths there that lived until about 5000 years ago, 5500 years ago. And what was the environment like if mammoths were able to live there? And there were also polar bears, they found in some pit fall caves in lava tubes on St. Paul Island where they found the mammoths. They found polar bear bones that had fallen in probably -- maybe going in after the mammoths, but couldn't get out and it included young polar bears. So that meant polar bears were probably resident there in the summer like they were on St. Matthew. So no big Pleistocene mammal bones have been found on St. Matthew, but St. Matthew doesn't have as good of a -- with all this volcanic stuff, it's not as good as sedimentation for preserving bones. There's some sites, and we'd always looked if we were in those sites but we didn't spend a great effort. So one of the things that was missing -- we have good -- we have some pollen profiles from sediment cores in lakes from St. Paul Island and also from St. Lawrence Island, and also up the coast further around St. Michael and the coast and Norton Sound. And so there was a keen interest in getting a sediment core from St. Matthew, but the problem with getting a lake sediment core is you should do it in the winter time because then you can go out on the ice and drill a hole and you've got a solid platform to work from. To do it from an inflated raft is not easy. And you've got to have a lot of equipment and cables and trying to keep the thing in the same place as you pull up each core from the same hole. So it would be -- if you wanted to do it -- and there aren't many lakes that would be appropriate because you don't want to do a lake that's connected directly to the sea because it won't reflect -- it'd have sea coming in, big waves and stuff at times. And so in the meantime, we had this woman here on campus who was given a post-doc award to come here and she was -- had done a lot of peat coring as part of her PhD from the Lower 48. And she did work up in -- as part of her post-doc work, she -- on the Seward Peninsula. Miriam Jones.

KAREN BREWSTER: Oh, I thought Nancy Bigelow.

DAVID KLEIN: She worked some with Nancy Bigelow and Mary Edwards, but she was also doing other coring work. Some of it was Park Service funded and tied to what Nancy Bigelow was doing.

KAREN BREWSTER: So she came with you to St. Matthew and did that coring?

DAVID KLEIN: That was the plan. She was -- but she did peat coring. She was a specialist in peat coring whereas --

KAREN BREWSTER: Not the lakebed?

DAVID KLEIN: Not the lakebed. The advantage of peat coring in summer you don't have to go out in a boat to do this, and you don't have to go in the winter when there's ice on there and you just find a marshy area. So the plan was that she would come out as a field assistant for me. I would assist her, her field assistant on the coring, peat coring work. And there was -- looked like the most desirable place from the aerial photos we had was the northern end of the island. This marshy areas there. And so we did that, but the problem was that she got a job. She had been offered a position here after her post-doc ran out as a research professor. Well, she wanted to stay here if she could, but she was applying. She wasn't -- A research professor gets three month's salary and you have to bring all the -- so a new person to do something like that, it's very difficult to get enough funding to pay for your living conditions for a full year. So she was applying to get a faculty position somewhere. She finally got a position that was ideal for her It wasn't a faculty position, it was with the U.S. Geological Survey based in Reston, Virginia, where they were doing a lot of coring along the eastern coast from Maine to Florida. And the west coast is done out of, including Alaska, is done out of Boulder, Colorado.

KAREN BREWSTER: Oh, not Menlo Park?

DAVID KLEIN: No. But the position was in the east. So, she thought that was -- and it was a good salary and she would be doing peat coring and her family lived in Virginia. So she decided to take that, but she said she thought she'd be able -- had got a commitment from the person who would supervise her that she would be able to take time off to come out. Well, it turned out that when she got there they had built their field season to include her and it was a busy time. She just -- They just couldn't --

KAREN BREWSTER: So she couldn't get away.

DAVID KLEIN: And they said if she wasn't brand new, they might have worked something out but she was so brand new they had to do this. But then she tried to line up a grad student that had worked with her here to go out and was familiar with the peat coring. And the -- sort of the almost the last minute, about a month and a half before we were to go out there he got full funding for his PhD work in the North Slope, so he couldn't go out. So then I was left with, you know, I was going to help her do this, but she was the expert. And so what to do? So I considered varying options. I checked with a couple others like Dan Mann, but he was fully funded for work on the North Slope. He would have loved to go out there, but he couldn't do it. Couldn't get away. And others like Nancy and others had contracts.

KAREN BREWSTER: Had already committed to projects.

DAVID KLEIN: Yeah. So then I thought, the only person I could think of was, I would have to learn how to do a peat coring. And there were only one or two peat corers in the state at that time. And I thought they'd be available, but they weren't because they were - - Ed Berg down on the Kenai was using one and he was going to retire and I think he was going to put it up for sale, and Dan Mann, I think, bought it through the government contract or something. And he hadn't -- Dan hadn't received it yet. So then I talked to my son-in-law and, oh, he'd love to go back out there again. And I said, "But we're going to have to learn how to use the peat corer." And finally had to realize I had to buy one, so can we get one in time. So we got one from a company that was supposedly reliable in, I forget where it was, Wisconsin, and sold to U.S.G.S. for their coring work. And it's called a Russian peat corer, because it was originally designed for use in the Ukraine, I think, by Russian scientists. And then it's been -- the design was modified a little bit. So it was quite usable and you could -- even with extension rods get down quite a ways if it was suitable, but we had already been cautioned by Merriam Jones that it's tricky when you get too deep. But she said just getting a meter of sediment would be so much information she could get out as a first time try for this island where we had nothing. And so we ordered it, and had it sent to Homer because it would have to go out on the ship, because it was hard to get baggage out there with assurance on the airlines. And that meant that my son-in-law had to learn how to use it. And so he got together with Ed Berg, who he knew, who had experience, and they went out and tried it out, and they got it stuck and had to dig it out just when they were only down about this far. And Ed thought it would be a good place, but it broke the top off of it when they were trying to pull it out. And so it obviously was not designed very well. So my son-in-law, who's really a pretty good engineer among other things, as well as a biologist. And he then figured the problem was there were only two screws holding this top plate on, and he said there should have been more than two. And so he was able to redesign it a little bit and put in additional screws, but then he took the thing down to the machine shop. Well, he contacted the company, too, which I suggested. And talked to their people and told them that this problem existed. And they said, well, they would try to work on it, but they -- and would hope to try to get one -- modified one and be able to send it. Just the cap that could be screwed on, so it wasn't too big a deal. And then he went ahead and also went to the machine shop in Homer, which makes all kinds of things for fishing including -- and they know how to use stainless steel and all this kind of stuff. And, yeah, it was a challenge, they said, "We'll give it a try." But, anyway, it cost us another few hundred bucks, and we ended up with three deals. He tried these after and they all were fine. And Ed Berg said you should have a hydrologic auto jack, a small one, to jack this thing out.

KAREN BREWSTER: In case it gets stuck again?

DAVID KLEIN: Because you can't just pull it out by itself. It had a bar, you know, with two people pulling up, and so you couldn't get it out. So we had all this stuff together and tried it and we were able to -- it was a pretty heavy pack he had. He was carrying this heavy load of that stuff. And we were able to get -- by accident we got dropped off on

the north end of the island just for half a day when we were waiting for the wave action on the side that was exposed to the wind, where our camp was going to be based. So the ship said, "Well, we can put you guys ashore and you can just scout around." And it was close to, also, this archaeological site that had to be dug. So the archaeologist took his screens and shovels and stuff and went ashore, and Rich and I went ashore with the coring stuff. And we could hike, then it was about a mile and a half to hike to where we had tentatively figured. And we were able to get out there and probe. We had a probe. And found a place. First, we couldn't get through the annual frost because it was late spring. Well, we finally found a place where there's enough water seeping down through that it was thawed. And so we left the coring equipment there in place already and we went back to the boat and moved around and camped on the other side. And then it was three miles to hike from the camp, so we didn't have to carry that stuff to the coring site.

KAREN BREWSTER: That's good. You didn't carry it six miles every day.

DAVID KLEIN: Well, there only was one time to do this.

KAREN BREWSTER: Oh, I see.

DAVID KLEIN: So then the next -- a couple days after we set up camp, Rich and I hiked over there and Ned Rozell went with us. And he helped by helping take notes, and then he interviewed us while we were there. And we were able to get this core out and got a successful core down for about a little over a meter before we hit a little mud and gravel. So the gravel was discouraging, because that meant this place was washed by the sea at some point to get that gravel in there. And likely washed by the sea. So we were up above sea level about 50 feet or so, so it's quite likely that there would have been a tidal wave or something. But we got a couple of cores. And we had the plastic tubes to put them in, and had all these instructions from Miriam and we did everything and kept them horizontal to carry them back and on to the ship, and then we put them in the freezer. Then it was okay. Then you could tip them or something. We didn't want the water to drain through and carry anything from one level to the other. And so then we shipped those back to Miriam by FedEx. And kept them frozen. And she put them in the freezer and she's been working on them. She got back -- they did get a date from the bottom and it was like 4,500 years or something. So it didn't go back to the beginning of time. We'd hoped it would go back to the -- for the full Holocene, which would have been about 12,000 years. But if we'd been at a higher elevation and could have found a suitable marsh area, we might have been able to do that but we don't really know. But any rate, Miriam was happy to get this, and it's sort of her project and so she's now responsible for --

KAREN BREWSTER: Right, she's doing the data part.

DAVID KLEIN: She's doing the analysis. And the last I heard, she hopes by the spring would have a pretty good reconstruction from the pollen, as well as the plant parts. And she's an expert at doing this, and she should give us that. And then she's already -- she's still got connections here, and if there's another expedition in the future I'm sure she'll be

able to get away from her position if she knows well ahead of time. And then could go back out there and do some more work. And she -- you can do a lot of work around -- we did a little for her. But at the edges of this slump areas, where there was exposed soil. And of that -- I don't think she's worked on that yet, but if she got funding to get some dating on that, 'cause they only went down to about this far.

KAREN BREWSTER: It's like three feet.

DAVID KLEIN: But it's different colored because of volcanic ash. Well, I'm not sure that's going to tell us a hell of a lot because it'll tell us -- may go back in time to the volcanic era. And the soil is so thin there that the sediment is in marshy areas where we have to find other places, and we can probably find those.

KAREN BREWSTER: Well, that's a lot of science you guys did there in 2012.

DAVID KLEIN: Yeah.

KAREN BREWSTER: I'm thinking maybe, is that a good place to stop for tonight?

DAVID KLEIN: That's probably just as well.

KAREN BREWSTER: As good a place as any, I guess.

DAVID KLEIN: We're already back from St. Matthew now.

KAREN BREWSTER: All right, well thanks, that's a great overview of what all's been done and what it all means. Or so far what it means.

DAVID KLEIN: Right.

KAREN BREWSTER: There'll be more, more to come.

DAVID KLEIN: Yeah, we'll finish up that 2012 the next time.

KAREN BREWSTER: Okay.

DAVID KLEIN: Because that -- we did get -- one of the places I wanted to get to was Pinnacle Island.

KAREN BREWSTER: Okay.

DAVID KLEIN: Which nobody -- The geologists hadn't been to it and they were just speculating from what it looked like from the ship because there were no beaches relatively speaking. And the Skipper was so -- he knew I wanted to get there in a bad way, and it was so great. And it was done at the very end of the trip, which was -- it was pretty damn foggy all the time in 2012. And so he picked us up and he said, "Oh, we'll

try to get to Pinnacle. And then we're going to leave direct from there to St. Paul." And then the next day we had a scheduled airline flight.

KAREN BREWSTER: Wow.

DAVID KLEIN: To come back.

KAREN BREWSTER: You didn't have much leeway.

DAVID KLEIN: Didn't have a lot of latitude. So it was late in the day, because they had dropped us off in the southern end of the island and we spent, you know, much of the day down there. Oh, there was a fish collection too as part of --

KAREN BREWSTER: Well, I think we should keep your Pinnacle Island for the next time.

DAVID KLEIN: Okay.

KAREN BREWSTER: It will keep us in suspense to hear what happens, 'cause it sounds like that's going to be another good --

DAVID KLEIN: Yeah, that last day, which was culmination of the fish collecting down there, too, down there on the southern end. And then Pinnacle, that was a fabulous experience.

KAREN BREWSTER: It was the Pinnacle of the trip.

DAVID KLEIN: And a good point -- Yeah, it was. And we got rocks but it was dark by the time we got --

KAREN BREWSTER: It sounds like a good story that we should --

DAVID KLEIN: It was a good one.

KAREN BREWSTER: That we'll keep it for next time. Okay, great, thanks.

End of interview