# ACCESSION SHEET
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**Description:** **2750 Ann Deiffenbacher-Krall,** interviewed by Adam Lee Cilli, January 22, 2014, in her office in Murray Hall at the University of Maine, Orono. Deiffenbacher-Krall talks about working with other members of the Climate Change Institute, particularly her advisor George Jacobson; conducting research on lake cores in New Zealand; her research methods; the reality of anthropogenic climate change; and the opportunities for interdisciplinary research offered by the CCI.

Text: 7 pp. transcript
Recording: **mfc_na2750_audio001** 36 minutes

**Related Collections & Accessions**

**Restrictions**

**Formats Included** Document: Original= .docx, Master= .odt, Access= .pdf; Sound: Original= .mp3, Master= .wav, Access= .mp3

**Notes**

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**Narrator:** Ann Deiffenbacher-Krall

**Interviewer:** Adam Lee Cilli

**Transcriber:** Adam Lee Cilli

**Date of interview:** January 22, 2014

ABSTRACT: This interview took place in Ann Deiffenbacher-Krall's office in Murray Hall at the University of Maine in Orono. In the first half of the interview, Deiffenbacher-Krall discussed her experiences working with other members of the Institute, including George Jacobson, who advised her thesis and dissertation projects. Later, she reflected on her research extracting lake cores in New Zealand and elsewhere, and spoke at length about the processes behind her lab work. Towards the end of the interview, she shared her views on the so-called climate change debate as well as what she likes most about being affiliated with the Institute (namely, getting to work with researchers from a broad array of fields).

Note: This is the transcriber's best effort to convert audio to text, the audio is the primary material.

Cilli: This is an interview with Ann Deiffenbacher-Krall. Today is January 22, 2014, and this is Adam Cilli doing the interview. I'm wondering if you can tell me how you got interested in studying climate.

Deiffenbacher-Krall: I am a botanist and I was interested in botanical conservation. I came to the Institute through George Jacobson, as my adviser for my masters. I was looking for a project where I could get my hands dirty in botanical conservation, and he came up with a project for the Maine Coast Heritage Trust, for a unique piece of property that they had in Down East Maine. And what we wanted to do was figure out the land use history, and see if we could figure out how it was a grassland, and it's not an area where grasslands are common. So if we could figure out how it became a grassland, and how it has been maintained as a grassland, which required using paleoecological techniques. And then, from there I became involved in other projects for the Institute that took on more of a climate-related direction, but still using the same tools.

Cilli: I see. So, you did further collaborative work with George Jacobson?

Deiffenbacher-Krall: He was my adviser for my masters and my doctorate, and when he retired I basically took over his lab as a research scientist.

Cilli: Around what time was that?

Deiffenbacher-Krall: I finished my doctorate in 1998, so I came on board six years before that, as a student.

Cilli: What kind of research did you do with other faculty members in the Institute?

Deiffenbacher-Krall: I've been involved in reconstructing the late-glacial time period, both climate-wise (using chironomids, which are a type of insect, and plant remains for the time periods right at the end of the Ice Age, when there was a lot of change going on), and trying to refine the time of those changes and the magnitude of the changes. I've done work in Maine with Hal Borns; I've done work in New Zealand with George Denton, who was a

postdoctoral mentor; Marcus Vandergoes, who came from New Zealand and is now back in New Zealand, but was here for several years as a postdoc and still has an affiliation with the Institute. Mostly them, and Brenda Hall somewhat; we've been co-advising a student on a project not too far from here.

Cilli: I'm wondering if you could walk me through the day to day work you did with Hal Borns in northern Maine. What research projects did you work on together, and what parts did he take on and what parts did you do?

Deiffenbacher-Krall: We did a multi-proxy study of conditions around the Arumna [?] Ice Cap, that seems to have readvanced during the Younger Dryas time. And Hal did geologic field work. I went up with him and we hired a backhoe. Dug some holes and took some samples out. I did a lake-level reconstruction from several lakes that surrounded the ice cap. And also had a graduate student who was doing an investigation of chironomid remains, which are a really highly resolved proxy for temperature. You can identify and count the chironomids at any point in time, and using a mathematic formula that's been developed, convert them to temperature.

Cilli: Chrironomids?

Deiffenbacher-Krall: Yeah. Non-flighted midges. They spend most of their life cycle living as larvae in the mud. So, little worms.

Cilli: And they contain traces of….?

Deiffenbacher-Krall: No, it's that different species have different ecological preferences. So, the head capsules on them are made of chitin, which are what beetle shells are made out of. Preserves really, really well. I've found them 20,000 years old, that are in absolutely pristine condition. We can identify them to genus, and occasionally to species. And then, based on modern studies of which bugs live where, those are used to calibrate.

Cilli: Indeed, so your work is yet another piece of evidence to show that climate can be studied from a lot of different angles.

Deiffenbacher-Krall: Yeah, so in that study we combined the bug study with Hal's geological research, and we did a lake-level study which uses changes in the sediment composition as well as seeds of aquatic plants, which have different water depths at which they live. So, we reconstructed the water depths, which is a proxy for precipitation and temperature. And then a student who was an honors student, Chris Fayas, who was working with Jim Fastook, modeled Hal's ice sheet. And so we had this computer model to compare with the physical data that we were coming up with. And we are still working on getting that one published. And then I've worked with Hal, just helping him core lakes for studies of where the ice edge was at different points in time. So we've cored some lakes Down East.

Cilli: So, walk me through that. You take a core from the bottom of a lake? And contained in that core is evidence of where…

Deiffenbacher-Krall: If you can get a basal date (which is the point at which the lake began collecting sediment), that tells you when the ice had retreated back over it. So, when it was able to start collecting organic material.

Cilli: O.K. So, there would be a gap in the core that you would be able to identify, right?

Deiffenbacher-Krall: Well, most of the lakes would have been scraped pretty clean by the glacier. So when they started collecting organic material, that's like a minimum date. The ice had been gone by this day. May have been gone before that, and simply didn't accumulate enough organic material to date. We do occasionally find one where we know we'll get a date that's ridiculously old. And there is a possibility for older carbon being down there as well.

Cilli: Can you talk a little bit about the work you did with George Denton in New Zealand?

Deiffenbacher-Krall: Yeah, George is interested in glacial changes there at the end of the Ice Age, and even before that. It's on the total opposite side of the world from where we are. And if we can figure out the geographic extent of different climate events, then it gives you evidence towards what were the causes of them. For example, something that only affected New England is gonna have a very different cause than something that was a global event. So, we were looking at the end of the Ice Age to figure the timing and magnitude of the changes. George got funding for us through the Comer Science and Education Foundation, which was founded by Gary Comer, who founded the Lands End clothing shops. So, Marcus Vandergoes and I served as postdocs, and we used primarily chironomids and also pollen to reconstruct vegetation and temperature at different sites on the southern mountains [?].

Cilli: I wonder how you felt while doing that. I mean, there you were, doing what may seem to many common Americans, like a pretty exotic location.

Deiffenbacher-Krall: It was really cool. [laughs] If you've ever seen the Lord of the Rings movies and seen the scenery as they fly over the mountains… Well, I did that. We went to lakes at different altitudes on the east and west sides of the mountains, and access to those sites, there wasn't road to a lot of them, so we would hire a helicopter. And we would fly in in the morning, and we would have them drop us off at a lake. And we spend the day hiking the ridge and going down to the side of the various lakes. And we had a little inflatable rubber boat, and we'd just float out to the middle of the lake and take a mud sample, take some chemical and physical measurements, and then pack it all up and go to the next lake. But it was awesome. A lot of times we went to places where you'd wonder had any human ever been there before. And then of course you'd find a broken buckle of a backpack and then you know, "Well, I guess somebody was here." [laughs] But it was really awesome.

Cilli: So, when you're hiking all day long to get to the research site, are you all business during that time or are you enjoying the hike?

Deiffenbacher-Krall: It's fun. You would do it for fun. You feel like you're getting away with something. Here we are having this great time, and we're getting paid for it. The National Science Foundation is supporting us to do it. But two days of fieldwork, if you take a long core from the lake, you could be in the lap for three years. So, that's a small part of it. I'm much more likely to be in the lab, behind my microscope. And I've had a lot of undergraduate students who have worked with me over the years to help with sample preparation, and they'll sit and work for hours at a time on a dissecting microscope, prepping these bug samples for us.

Cilli: Walk me through your day to day lab work.

Deiffenbacher-Krall: It depends on the project. If we're looking at plant macrofossils we'll take mud samples and soak them overnight in a mild base solution, sieve them, and then spend another day on the dissecting microscope, identifying the individual seeds and

counting them. They're very beautiful when you look at them at that scale. When we bring back fresh cores we'll spend any number of days describing them, sampling them, doing loss on ignition (which is burning samples to find out loss on organic content), subsampling them (so, we'll be slicing them up and putting them in little vials for this, that and the other thing). You could spend days just deconstructing the core.

Cilli: I imagine that takes special tools.

Deiffenbacher-Krall: It's more like kitchen work. Cause you're using little spatulas.

Cilli: I'm envisioning you have this core, and you're cutting small slivers of it.

Deiffenbacher-Krall: Well, most of the time we extrude the core in the field, so you've got what looks like a tube of dirt, but it's just the dirt. We've already removed it from the tube. When you push the tube in, it smears material. So you clean off the outside, where you'll have contaminated material. Usually slice it, and work from the inside of it, so you know it's pristine. That nothing has shifted.

Cilli: Oh, you'll cut it in half.

Deiffenbacher-Krall: Exactly. If we can, we'll archive half of it. But generally we want more mud than we've got. We've also started doing some lipid analysis, which looks at cell membranes formed by bacteria. And the long chain molecules in them have a different configuration, depending on what temperature they formed at. So, we're calibrating them as a possible temperature proxy as well. So, between all these types of sampling, we run out of mud routinely. So, when we go to take cores, we'll try to take multiples in the same spot. We have to figure out how to match them up, but for the insect remains it's really time consuming, and except for the microscopes it's really low-tech. Our most important tool is our own eyes. We'll sieve those samples through a small mesh, and actually we took a baby bottle and cut the bottom of it off and threw the nipple away and put a piece of mesh there. So, we'd just sieve through that. I mean, it doesn't get any lower-tech than that. And then sit at a dissecting scope. And this is the part that the undergrads do, because it is mind-numbingly tedious. You pick through the mud. And any little piece of junk, you've got to pick it up and flip it over to see if one of these little bug heads is hiding under it. Because you have to get all of them. If you miss some, you might miss them systematically. Like you might miss all of some size or all of some color. And then your results will be thrown off by that. So, they are trained for weeks. And everything that they do, we check them, until they get to the point where they're not missing any at all. And so they pick up each bug with a tweezer, and then they have to turn to another microscope, because these things are so small. They're like dust size; smaller than flecks of pepper. And they're very pale in color. They're like a light amber. So they're invisible to your naked eye. So, you have to get it onto your glass slide and you have to get it onto your glass slide. You have to look and make sure you actually get it on there. And I'm really bad at it. I mean, I shred them and mangle them. The students are much better than I am. I had one student who would get them all lined up in perfect rows. And it was amazing. I don't know how he did it. Once those are dry, they're sealed and we go to a compound microscope, and look at each one and identify it.

Cilli: What was the most difficult field trip you've been on?

Deiffenbacher-Krall: I don't like coring in winter, in Maine, through the ice. Which, logistically it's easier to set up… [than in the summer] but I'd much prefer that to working in the winter. So we went to Multon Pond, which is in Dedham, just south of here. And it was

one of those winters where it just didn't freeze up until it was really late. So we must have gone down there three times. It wasn't until March when the ice was thick enough. You know, you go down and punch a bunch of holes in the ice and decide whether it's thick enough. It's not simply standing on the ice. You've got a whole bunch of people clustered together around the hole, and sometimes we'll set up a tripod with a winch and we're pulling up the core with the winch, and if it's stuck in the mud it's quite a lot of force. So, you need really good ice. You need, like, pickup-truck-quality ice. Not just walk-across-the-ice ice. And then, that day, it was a nice warm day. It was above freezing. It was a nice day to be out there, except when it's above freezing you get a layer of water on top of the ice. When that layer of water is 32 degrees and you're climbing around and you're basically just wallowing in it. There's no help for you; you're just soaked head to toe. And it's just miserable. And if it's any colder than that, any gear you pull out of the lake just instantly freezes up.

Cilli: But most of your time is actually spent analyzing information?

Deiffenbacher-Krall: Yeah.

Cilli: Who else have you worked with besides Hal and George Jacobson and George Denton?

Deiffenbacher-Krall: Well, Jim Fastook indirectly, though the student who was modeling with him. Any number of dozens of graduate students, especially Brenda Hall's students. Sean Berkal worked with us on the ice sheet modeling as well. I have a project now with Lisa Donor, who is at Plymouth State University in New Hampshire, and she's an alumni of the Institute. And we're doing a project on Iceland. Of course, Ron Davis was on both my masters and doctoral committees. And I've worked with him on these completely outside, like the Bog Boardwalk. I worked with him on the signage for that, the information signs.

Cilli: What did the two of you do for that?

Deiffenbacher-Krall: He did most of the writing, and we did the layout of the signs and then revamped them a few years back when weathered. And while we were reprinting we updated some of the text on them. Andrea Nurse, I've worked a great deal with for years on both professional projects and we've done monitoring for plants for the New England Wildflower Society….

Cilli: When you finished your doctorate in 1998, that was just before Paul Mayewski came and the Institute underwent a rather profound change. How did you view the changes that took place around that time?

Deiffenbacher-Krall: It had a huge impact, in terms of the number of people in the Institute, but also the variety of people and the variety of disciplines that people were working in. So, there's some logistical issues, like things like field trips, and when we had our annual seminars there are so many more people to accommodate. But I think it's cool, because it really broadens the Institute and broadens the scope of the questions that are being addressed moved up to the recent period. Prior to that a lot of the work had focused on the late-glacial time period. What's an example of scientists who are studying more recent periods? Jasmine Saros does decadal scale studies of lake chemistry in the Rocky Mountains. All the folks who are working on ice cores, they can get annual-scale records. When a lot of the work was focused on Maine, we could only go back to the glacier, 'cause the ice scraped us clean. But if you go down into the depths of ice cores, some of them are two miles long. And you can go hundreds of thousands of years.

Cilli: So would you say that the scope of inquiry has broadened at both ends?

Deiffenbacher-Krall: Oh, very much so, and people like Marci Sorg, who joined more recently and was looking at climate and health and impact of climate change on crime scenes. It's moving into more modern issues and is probably a lot more applied.

Cilli: What do you think has been the Institute's greatest contribution to our understanding of climate?

Deiffenbacher-Krall: I wouldn't venture to say just one thing.

Cilli: What is the Institute best known for?

Deiffenbacher-Krall: There's lots and lots. Terry Hughes's work on ice sheet dynamics, and the ice core work, and the more recent stuff. Brenda Hall is dating how long boulders have been exposed to the sun, so she could figure out when they were last rolled over by glacial ice. And it's allowing to pinpoint climate events using geologic methods. Before that you couldn't have gotten as fine detail, chronologically, of when things happened. What's always impressed me the most is looking over even rather short time scales to see how much change there's been… In the past 10,000 years, we've had changes bigger and frequent, which is not to minimize the current global warming issues, but just that change is the norm.

Cilli: It seems to me that outside the scientific community, the human role in climate change is still very much up for debate. And I'm wondering if you can speculate as to why that might be the case.

Deiffenbacher-Krall: I think a lot of people have a hard time understanding the big impacts we can have by what seem like relatively small activities. One thing that really impressed me about working in New Zealand was the fact that people have only been there for a thousand years… Before that, no humans. That's a teeny little fraction of time, and it was a very small population of people, and they completely changed the ecology of the north and south island, devastatingly, over a very short period of time. Or if you look at the extinction of the mega fauna and the debate about did human hunters kill them off or not, you're looking at how a small population of humans moved into the area and how quickly the mammoths, mastodons, and the great short faced bear and the giant ground sloth, disappeared. And these are folks who were hunting with bows and arrows. So, I think people have a hard time accepting that we can make huge impacts with just a few of us. And then you're talking about a change in the global climate. And how could I be doing that just by driving my car here and back again?

Cilli: What do you think is required to address the problem?

Deiffenbacher-Krall: Continued education. I don't know how you combat the radio talk hosts who will just pan any scientific information that comes out, and chose not to believe it, and loudly broadcast that belief to their listeners. Education, starting in the grade schools. It would be great if we had a more scientifically literate society.

Cilli: Well, that's all the questions I have, but before we conclude the interview I do want to give you a chance to add something that I didn't think to ask you about.

Deiffenbacher-Krall: I think for me the coolest thing about working with the Institute is [that interdisciplinary work] is the norm. You work with historians. Or, Dave Sanger in archeology. I did some work with him. And geologists. And what I've observed in other disciplines is that it's really very difficult to pull together an interdisciplinary team. But just

the way that the Institute was originally set up, and the way it's interacted over the years with our annual seminars, and our fall field trips where everyone gets to know each other and gets to know each other's work. It's very, very easy. It's just the norm to do that type of project, and it's very powerful.

Cilli: What do you think are the administrative hurdles to doing interdisciplinary research in other departments? Or are there administrative hurdles?

Deiffenbacher-Krall: I don't know that there are administrative hurdles. It might be cultural. If you work within a certain discipline, and all of your interactions are within that discipline, and you go to conferences and everyone there is working in the same discipline, you're gonna be really well versed in that discipline. But the idea of working with people outside of it, you may not know what… [people in other disciplines] do, and what types of evidence they can come up with that would be relevant to your questions. I think it's more a matter of that we come to understand what the other disciplines can contribute and the methods they use. You know, over in Sawyer and Bryand, people are in and out of each other's labs, and you just see what's going on.

Cilli: Well, thank you once again for participating in this interview.

Deiffenbacher-Krall: Well, good luck with the project.