

GENEVIEVE ATWOOD AND DON MABEY

Salt Lake City, Utah

An Interview by

Greg Smoak

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GOOD MORNING. IT IS VALENTINE'S DAY, FEBRUARY 14, 2014. I HAVE THE PLEASURE TO BE BACK WITH GENEVIEVE ATWOOD AT HER HOME IN SALT LAKE CITY, UTAH, TO CONTINUE OUR INTERVIEW FOR THE GREAT SALT LAKE ORAL HISTORY PROJECT. THIS IS TAPE NUMBER U-3245.

GS: When we spoke last we had just finished talking about the high water years, the options of bringing the Lake down, the pumps and so on. And then the last thing that we talked about was you were talking about the east-west division of the Lake being more meaningful than the way a lot of people today consider a north arm-south arm, that kind of thing. And I wanted to follow up with that just briefly and ask you about the railroad causeway. I think one of the reasons why people think north-south so much is because of the causeway and because of its effect on Gunnison Bay, that northwest arm of the Lake. And during your time with UGS, what were the relationships like with the railroad, and what was the perception of the causeway and its effect on the ecology?

GA: I think it was fascinating. And so I think someone like Wally Gwynn was just as interested. And as an organization, Utah Geological Survey is evidence-driven. And so we were the entity that was collecting information about the salts. And we worked somewhat closely with the Wildlife folks, but not to the extent that it is now. The state had a Tech Team, and still has, and it varies in terms of its effectiveness of bringing people together and talking about technical issues. There were two people: Paul Stern was the data collector, chemist; and Wally Gwynn. And they were just very interested in what was happening, collecting information. They would go out and float around and try to replicate data points—we had towers that were meant to stay in place. And of course the towers would get eradicated by the water and the ice, ice push in the winter.

With respect to the railroad, the railroad's a big deal. I mean, you can't say it's global, but it's really continental, and it sure is national. And Governor Matheson came from a railroad background as a corporate attorney. And, I think we always saw the railroad as kind of a gorilla, just a really big deal. Put differently, we didn't have much relationship with the railroad. Now, *individuals* would get relationships with the railroad. So someone like Don Currey, who was at the University of Utah, Mr. Lake Bonneville, he would get a good relationship with the railroad and then be able to get some of their cores. I think our earth scientists, the hazards people, were really interested in seeing the stability, so the run-out. So as you pile material on the top of that causeway, if everything isn't right you end up with the causeway sliding outwards, because there are some zones there that are incompetent. And so just the idea, I mean, geologists love ground failure, incompetence. So we would work person to person on that kind of thing with the railroad, but I would say—I'm trying to think. I didn't have much relationship with the railroad. They were never hostile to us. We always had access. It just wasn't our issue. But the fascination with, what is the causeway doing? How wide is it? How open is it?

Oh, this is helpful. I sometimes think about what the Utah Geological Survey was doing. But remember we were working right with the United States Geological Survey. And the United States Geological Survey were really the monitor of the whole Basin. My hunch is that the railroad was probably working more closely, just on an individual basis of access, probably more closely with the individuals such as Wally Gwynn, but particularly Ted Arnow, the head of the office of the USGS. So it was more a fascination for us. It'd be like watching some enormous python that was forty feet—

GS: Was the Army Corps also an office the railroad would have to work with?

GA: Yes. And I admired—I wish I could remember the person’s name, who basically saw the importance of the wetlands and the idea that the health of the Lake depends on fluctuations. And this idea of controlling the Lake was not in the Lake’s best interest and frankly not in anybody’s best interests. Although everybody thought they had a favorite level where they would thrive. But you just don’t hit that most of the time.

The Corps of Engineers had brave people, who got transferred [laughs] is my impression. So bottom line was you ended up with an antagonistic relationship between the Corps of Engineers, who were protecting, and those who needed, they felt, to have it their way. And the Corps—yeah, brave people got transferred. That would be the easiest way to say it. I don’t know the name of the person, but I think he ended up doing fine, but was not protected.

GS: So to finish up with your years at Utah Geological Survey, what are some of the other issues that you dealt with with the Lake beyond those high water years?

GA: Come and join us Don.

One of the things that, we liked working with Governor Matheson, but it continued after that, was to have a sense of why the Lake went up and why it went down, and how often it would go up and how often it would go down, and this focus from Lake Bonneville to Great Salt Lake. So I think many academics and other people look at Great Salt Lake and just consider it a remnant of Lake Bonneville. I’d never call it a remnant of Lake Bonneville. There isn’t a drop of Lake Bonneville that was there. And frankly it’d be like saying I was a remnant of my grandmother; I mean, I’m me. Now the Great Salt Lake, I think, took on a UGS focus of how does the Lake work, how do these fluctuations affect it as a system? It was a time in just our knowledge of earth systems when we were

starting to understand that the ice ages weren't just two or three events that had happened kind of sort of at the same time once, and you had to do all this work then. We suddenly were realizing that we have perhaps four million years of glacial, interglacial, glacial, interglacial. And even our map, I think it's Map 73 or 83, doesn't really mention repeated glaciations. I mean, you could tell that that was the changing time, internationally, when we realized that this global glacial, global interglacial, global glacial, global interglacial was affecting the Lake, and that Great Salt Lake *and* Lake Bonneville were *the* best historian of climate change of western North America. And so, it was exciting to suddenly see that Great Salt Lake was telling us about the dry times. And that figuring out, how do you correlate the sediments that are underneath the Lake with the shorelines? Oh, it'd be so easy. [laughs] We're still figuring it out.

I mean, we can go out into the basins and we can see these layers and we can say, "Dry, dry, drier, wetter, drier, drier, drier, wet, wet, wet, really wet, wet, wet, drier, drier." And you can go down through there. And then you think you can go to the edges and say, "Well, this one, this shoreline evidence should correlate with that in the record." And that became an exciting field, for a couple reasons with the Utah Geological Survey. Geologists in general like bedrock. They like oil that comes out of bedrock. They like gold that comes out of bedrock. Frankly, they like limestone because it does good things for processes. So most geologists are bedrock types. But the Utah Geological Survey, under my leadership, focused on mapping, that the best thing we could do would be—and we shifted a couple people into the program, and then we hired some fresh faces. And we said, "Many people will create two maps: one for the bedrock and one for the sediment. But all our maps will have both." And we hired an extraordinarily good young geologist,

one of Don Currey's students, Jack Oviatt, who became fascinated with the Quaternary deposits—meaning those that are young—of Great Salt Lake and Lake Bonneville. And so we started to be a part of the national scene of climate change, Great Salt Lake as a record, Lake Bonneville as a record. And I think that that mapping program somewhat shifted the interest, and certainly the—so I would say—and this is good talking about it 'cause I haven't really thought it through—I think the focus of the Lake from the Utah Geological Survey's perspective when I arrived, let's say 1980, 1981, would've been its mineral content. And that is our job; the Utah Geological and Mineral Survey is what we were called. And so our team was looking at the salt content, the processes, that you might have different contents coming out at different times. We were interested in severe dry lake as well. We were looking—the same people would've been looking at the Paradox Basin and some of the salts that come out of the bedrock there. That was really the emphasis of Great Salt Lake. I would've thought that Utah State University would've had the territory of the fascination with the Lake in terms of its processes of sequestering some of the biota, what's happening to the sewage, can we be figuring out Great Salt Lake as a way to be an energy producer? They were doing some interesting things that were innovative of, how does Great Salt Lake—how can we harness it other than its minerals?

And then of course the '80s come along, not that we hadn't had the '70s—not that we hadn't had the 1860s, '70s—and the Lake had suddenly taken on this role of being a hazard. And I would say by the time we really hit our stride in 1986 or '87 when the Lake was really peaking at its top, I think it was a system that was being looked at in terms of history, in terms of weather, in terms of global climate, in terms of everyone should be

interested in this lake. So instead of having one or two people going off in a boat and collecting samples and sitting in the lab and working this through, I think it was something that we would've been thinking about Lake Bonneville and Great Salt Lake. And maybe it was my own evolution, because when I got to the Utah Survey I wasn't hooked—I was hooked on surficial processes, but frankly I'd have looked at a shoreline as a datum to see how much it had changed since fourteen, fifteen thousand years ago, rather than saying what was it like as a lake back then. I was interested in its destruction rather than its creation. By the time I left the Survey I was totally with the program, that this is a precious archives of earth systems history, of the geosphere, hydrosphere, atmosphere, biosphere, anthrosphere, all working together. Would you agree with that Don?

DM: Sure.

[all laugh]

GA: That is not a sufficient answer.

GS: Well maybe I'll get an answer this way: Talk a little bit about the map that you mentioned, which I have, a lot of people have, which is the historical levels of Lake Bonneville. And you and Don Currey did that. Maybe that's also a bridge to talk about Don Currey.

GA: I'm so ashamed because I said I'll do it again [update it] and we should do it again [update it]. We've learned so much. You look at that map and you see the value of mappers, because it [Map 83] was mapped at a time when we didn't even use the terms "global glacial" and "global interglacial." And the one on one side is global glacial, and the one on the other side is global interglacial. It just shows the good, solid, intelligent

Don Currey mapping. Don Currey was not a finisher. And you may know the stories of Don Currey.

GS: I mean, he's known, unfortunately, for bristle cone pine Prometheus.

GA: Oh, a major, major error. And he never got through it. And frankly, from my perspective, he didn't wanna be a particular finisher. Don Mabey was able, and I was able, to say, "Let's get your map out. We're going to the legislature, we've gotta explain this stuff." So I did the charts, Don Currey did some of the writing, Don Mabey did the writing. Don Currey did the two maps. And we blasted that thing out. It was a wonderful triumvirate working relationship. It's dominantly Don Currey, but it's also beautifully written, Don Mabey. Both of them are good, beautiful writers. And then I was nipping at heels and making charts that I thought a legislator or manager could understand. So we knocked that out fast. And it's continued to be a valuable resource. It's also a wonderful resource just to see how much more we know now. And although we'd tinker with the story ... Tinker's the wrong word. We'd advance science with the details of the story.

But what Don Currey—and I think Don and his students have really tried to piece together the timing of the rise and fall of Lake Bonneville, which people are fascinated with. I think that we are still working on the processes, the interplay of the tectonics of the basin.

So what does it take to have a lake? 'Cause all lakes are born to die, every student in geology learns that. Lakes are found—any time you see a lake you should say to yourself, "How can this continue to contain water?" 'Cause you have to have a basin and you have to have water. And the basin tends to get filled with sediments. And so a lake is often telling you about the interplay of what's creating it and sustaining it. And we're still

working on that. And Don Mabey and I, when we drive up to Idaho, we always try to continue a conversation of the faulting and its effects on the basin configuration, how there's some real ironies of where the outlets are in terms of their elevations.

So the Lake Bonneville-Great Salt Lake story has progressed, but that little map has been extraordinarily useful.

GS: It's had a long life then.

GA: It's had a long life. And one of the reasons it's had a long life is that five years ago, it might have even been seven years ago, I promised to update it. And it's updateable. There are two reasons not to update it, in case you're interested.

GS: Yeah. The thing about this map is it's all over the place. It's so commonly used. So many people have it. Terry Tempest Williams of course credits it for a greater understanding of the Lake at the beginning of *Refuge*.

GA: Don Mabey gets a lot of the credit of just how it's the same scale so you can see it; it's on one page so you can see it. We would do some things differently. Don Mabey knows that that which controls the Lake is the surface area, therefore, the map shows the hydrograph controlled by the surface area. People don't care about the surface area, Greg, they care about the elevation. So if we were to do it again, the hydrograph would have elevation showing the surface area over here. But that which really controls evaporation is that, so we'd do that differently. We did reprint it with colors that were better. It was hard getting the snippets of Nevada and Idaho to be the same map base. They did well and now of course you can use just everything. I mean, the country has bases, it works better.

Don Currey's work, he had gone out and really field checked. So what he did with his students is in the springtime he would just go out and he would teach science by having us check those areas that were a little bit more solid. So it was a product that he'd worked on for years. If Don Mabey and I hadn't told him he had to get this thing out it would've sat on a shelf for a long, long time. And eventually they did lose the original topographic maps that he put all the data on. And they even lost—one student digitized 'em all and that file's been lost. I mean, it's been endangered in its own way. But it has been a useful product.

And one of my concerns, getting back to why don't I finish this, 'cause whatever I'm working on is the most important thing. But one of the reasons I worry about finishing this is it may be the last version of the wrong map. Because the levels are telling us about how much water's coming in, but the lake basin itself is changed by tectonics. So Denver, Chicago, Florida are moving west with respect to Hawaii, but the western margin of the US is moving west faster.

GS: So Reno's always getting farther away from Salt Lake?

GA: Well, Reno, let's even get a little bit—you have to be over there in the Sierras. You have to make it to Tahoe. Yeah, and indeed, Reno as well. But as you're spreading you get basin, range, basin, range, and you get the dropping of the basins. And once you get past being in love—this is sort of the story of people who fall in love with Lake Bonneville. First of all they fall in love with Lake Bonneville as being really cool. And then they fall in love with the idea of the glacial outpourings of the ice and the water and the sediments in the deltas and they are really interested in that relationship. And then they get really interested in sort of Provo level versus Bonneville, getting really

sophisticated. And there are multiple levels and everybody's getting interested in this.

And then finally, it seems to me, everyone falls in love with the Stansbury level. You don't fall in love with the Stansbury level, it's like noticing that there's this child you've never seen, that actually is kind of a bad actor but might have some hope. And people get stuck on the Stansbury level.

GS: Could you explain just briefly what the Stansbury level is?

GA: You bet. So about thirty thousand years ago, climate changed globally. And if you go into the ocean sediments you'll see different levels of oxygen isotopes. And this is how we know whether the oceans were colder, warmer, colder, warmer, colder, warmer. So we're number one. No surprise. Two, four, six, eight, who do we appreciate? Global glacial, global glacial. So looking at it with what we know now, we're in global interglacial times. Lake Bonneville was global glacial number two. Going back farther, number six was big. And we can actually see these sediments in the Bonneville basin when we take the cores out. But we don't always know where we are, 'cause sometimes we're able to date something and sometimes we're able to observe something, always putting a date with what you observe. So, working backwards, we go into global glacial number two, about thirty thousand years ago. The Lake goes up, sort of following what North America kind of sort of was doing. But it happens that—and what's gonna control the Lake is in part its surface area, and whether it eventually gets an outlet. So it's like my sink: It goes from one area to the other area of the kitchen sink, and eventually it goes out into the kitchen. So it's gonna be rising. So the way that the Lake rises, in general, is more precipitation, less evaporation. So it goes up, and it sort of reaches a place where it hangs out for a while, and that was about twenty-two thousand years ago and it's called

the Stansbury sort of time. The Canadians do it right. They give the levels a different name than the time. But we assume the levels and the time are the same, which may be a false assumption. It goes all the way up and sort of hangs out at that level. And then it continues on up. And the Lake gets to the level at which it spills over the lowest place on the basin, which is near Red Rock Pass, it's called Zenda. And at that point it can't get any higher. Now there are two ways to lower a lake. One is, change climate; and the other is, dam failure. And Lake Bonneville did both. First it dropped by the failure that took it to Red Rock Pass, dropped three hundred feet, big distance. And then it hung out there for a while. And then climate changed and it went back down. And it may or may not have had some bumps on its way down, or on its way up when it reoccupied the Stansbury level.

So I'll say it again. Climate controls the Lake. The Stansbury level fascinates people, 'cause we see it on Stansbury Island and Antelope Island. If it was on the way up it would be buried by what had come out later. We find that. And Don Currey found that. And other great geologists have seen it on the way down. My sense is it probably happened both. I mean, I sort of have the politician still in me, and if I can see that there's not—there's every reason to think it would've come down both. But, why is it there? What's its level? I fear that we're not thinking tectonics when we see lake levels. And the more I stall on this particular project to redo it, the more I say to myself, the secret is Cutler Narrows and Cache Valley, and the idea that that valley is extraordinarily close, but not perfectly, to the Stansbury Level. And I actually think that probably we just haven't combined our issues of tectonics and the dropping of the Wasatch Fault. So Cache Valley's on the Rocky Mountain side of things, and I think if someone—we often

hope and are amazed that people are interested in our questions. I mean, Don really thinks that there should've been major progress in that which he made major progress. And frankly, so do I. I keep telling people. And they're interested in what they're interested in, rather than what I want them to be interested in.

GS: [laughs] Imagine that!

GA: [laughs] Imagine that. But I think it's important to update the map. I think there's new information that really says where the levels should be if you take out the isostasy. Meaning, if you put—much of Earth's crust floats like an iceberg, and sometimes it flows like a huge ice sheet, other places it floats more like a log. And so, if you put a mass across a region of a continent, you actually have the material underneath that displaces and moves outward, and then when that weight is gone it moves back in. So some people think it's like squishing a sponge. It isn't like squishing a sponge. Material of the crust actually moves out, then moves back in. And that has been one of the main things that the shorelines of Great Salt Lake have been looked for, is what is the strength of Earth's crust? So Don Currey, for example, used some of his work to study shoreline rebound. Because you see if the shorelines are built when the Lake is isostatically depressed, then it comes back up and you end up with a bull's eye of these lake levels. And it's a big number. So let's say the Lake had been 1,000 feet deep and the lakebed had gone down 250 feet. Plus, tectonics may have displaced the shorelines 125 feet. I mean, it's a very big number. And it's saying that we have a weak crust. Don't take it personally. And whereas you can go to Canada and you can see their big lakes don't do so much. And then Don Currey went down to Bolivia and looked at their lake. So there's lots of reasons to assume that everything is going up and down and these adjustments are due to isostasy.

But I don't think we've really thought through, do the mountains go up, do the valleys go down when we have major earthquakes? And the shorelines can tell us that. But I haven't done the work, and nobody else has done the work. And I just oughta get out a really updated Map 83 with what we do know, and then suck it up if I'm wrong, 'cause it deserves being updated.

And I think what people wanna know now about the Lake is, where can you go see this? So when I think about redoing the map, to clean up things that Don Currey would've liked, a couple areas that have flooded on the map that weren't flooded at the time. I mean, we knocked that map out fast. And it really was exciting to get it out. Don't you think Don?

DM: Sure.

GA: Sure. So to clean up the errors, to make the edges look better, to do what Don Currey would've wanted to do, which is to put in the isostasy. He has some students that are there. And then I wanna make it useful to teachers, which is to say, for each of these levels where can you go? When was the Bonneville level? What kind of biota—'cause you see it was fresh—was in the Lake? Where can you go see it? What does it tell us? That would be the back part of the map. So I'm forty, sixty percent of the way to it.

GS: All right. I'm glad I asked about the map. So back to UGS, what year did you leave? And then I wanna move into asking you about your engagement with the Lake since then.

GA: So I left in '89. And I left with good reasons, and I wish I hadn't in retrospect. But I was a "more political animal" than some of the people who'd been there earlier. It happens the person who followed me was pressured politically. He's turned out to learn

more and more with time. And I admire him, 'cause he's been state geologist a couple different places. But when he came to Utah he was a little bit more naïve. I was actually far less political, but I was worried about the politics. So I came on board and I saw other state geologists stay too long. So I said to myself, "Stay more than five years but less than ten." Because I watched state geologists grow their surveys, make enemies, and then lose their surveys, particularly in Colorado, but there were other ones as well. And so, the state survey almost doubled in size in spite of it being bad economic times. I'm very proud about what happened. And it really was the mapping program really doing what we do best, which is to collect evidence and data, and to not get involved in politics. We were involved in the nuclear waste repository. We could've been the lead agency, but they wanted us to say things that we didn't wanna say. And we actually did a terrific job, we actually showed that those units in the Paradox Basin were moving now, although it's not a good idea to put nuclear waste in a national park. I mean, hello. There were geologic reasons as well. But I left the Survey because it seemed to be the right thing to do. I wish I had stayed another five years, 'cause a couple things that I thought were solid weren't solid. And I just didn't realize that when you think you've made a difference, it's sort of like putting your finger in a glass of water and pulling it out: it doesn't make the difference that you should.

But one of the things that I really appreciated about being at the Utah Survey is that it's science driven. And Don Mabey in particular, but others, didn't want me to be turned into your plain old bureaucrat. So they found just a really straightforward scientific question for me to do while I was being state geologist. And it was a lovely one. And it was with Don Currey and Don Mabey. And I looked at the shorelines of

Great Salt Lake, how many times the Lake had left evidence that it had been higher than in the 1980s. So it's like counting noses—so you go out there, see a high level, and then you see another level, and then you see another level, and you know that it had gone up at least that many times. And so, I became interested in counting those noses. And as I was working on it I just became more interested in process. So I've been a process geomorphologist, all this career, ya know, stabilizing the waste piles and all the rest, but here was this gift the staff really gave me of saying don't just be great on budgets, stick with scientific research.

And so it was a transition for me to be able to leave the Survey. So I left the Survey and ran for Congress. Don't do that [laughs].

GS: It's not on my list of to dos right now.

GA: It's not on your list. And it is a whole other world and I think it's even now another world for the legislature. So my campaigns have cost two thousand dollars a campaign, that would be a campaign if it was a primary it would be two thousand, and the general would be two thousand. This is manageable, even in former dollars. So I ran for Congress 'cause I really thought it'd be awesome to be a Congressperson from Utah. I thought I could make a difference. I really love money. I really love money. And I've been brought up with that sort of with my dad's eastern—they were considered nouveau money of their own, but it still was old money, and this idea your capital can take care of it; it can take care of you, it can't take care of yourself; you don't invade—all this old-fashioned, and being really worried about where our country was going. So I'm Republican based on money, not based on the social stuff, 'cause the social stuff I'm there. I mean, after all, if you stand for crime, pornography, abortion, ERA, and

evolution, according to your opponent that'd be relatively liberal on some of these things. I am. So I ran and I ran against Wayne Owens, and it was really a dreadful experience. And even five years later Wayne Owens' wife wrote me and said how sorry she was that they really trashed me. People vote four ways: they vote for a candidate, against a candidate, for a candidate, against a candidate. And most people vote against. So trash your opponent. It explains everything. And I won't go into approval voting or that kind of thing, but we've gotta change this in our country.

So, by that point I had really accomplished enough at the Utah Survey, one of the things I had not accomplished was to get an outreach program similar to Utah State's outreach program. They do water. I wanted us to do geology. And they could do it for a variety of reasons. But, all politics is local, well, all geology and hazards is also local. And it just seemed to me that we, Don Mabey and I, were seeing teachers without resources to teach. Well, we went to Grandparent's Day. We went to Grandparent's Day at Sunrise Elementary, and we looked at the wall, and were thrilled to see that they were studying earthquakes. We see all this earthquake stuff up there, and it's all about the San Andreas Fault.

GS: Oh. You said, "We're not in California"?

GA: That's right. And we realized that this was a school that had a spectacular view of the Wasatch Fault. They were doing it right. They had earthquake drills. They were with the program. They wanted to study it and they didn't have the information. And we tried to do this at the Utah Survey. The legislature had not let us start a program of basically reaching out to the public and the teachers. And we decided that we would start to do this, and so we did.

But this same life pattern of science and service continued. Greg, you're very good about having me look back and see that even when I was in the legislature and worked for Ford, Bacon & Davis, I always took one class at the U, even if I didn't do the homework I should've, and I did the legislature. I always had the three splits. So we started this group called Earth Science Education, which I still run—it's a fifteen thousand dollars a year operation—and we teach teachers. But I also wanted to stay with the science, and the science was Great Salt Lake. And my niche is shoreline processes. So I started up at the U under a PhD program with Don Currey, and started to look at what are the shoreline processes telling us, and questioning one particular assumption, which is they start out perfectly horizontal. Now they're really close to horizontal, but it turns out they aren't horizontal. And that non-horizontality is important, 'cause if you start out assuming something's horizontal, it isn't, even if it's just a matter of three or five feet. If you've explained that by tectonics or isostasy, there's a problem. So that's what I studied. And I started teaching up at the U. And I still was active with issues of Great Salt Lake.

Eventually I got on the board of the Division of Forestry, Fire, and State Lands [DFFSL]. They're the group—I know it doesn't sound reasonable to have the fire department doing this—but they had been Forestry, Fire, and State Lands, including SITLA [School and Institutional Trust Lands Administration] and the various state trust lands of the four sections per township. And then those [SITLA] had been split off from DFFSL, 'cause educators were really grumpy about this policy. But there's a little bunch of lands called sovereign lands within DFFSL—we may have mentioned this—where the sovereign really guaranteed access by navigability across lands that are flooded, and, you [the state] can't give them away. So I was on that particular board; I served on the Tech

Team. And I've just stayed fascinated by Great Salt Lake and teach it. And so I shifted from being somebody who's really managing others to actually contributing a bit to science, learning a tremendous amount about geographic information systems, their ability to portray information to be able to see things. To me geographic information systems, GIS, is just j-o-b, it's just made jobs for geographers, and Google Earth, all this has come to fruition. And I've really become a teacher, and noticed how Great Salt Lake really has taught me, but in retrospect I now teach Great Salt Lake.

And the focus now with global climate change of what happens when things get warmer is frightfully important, and Utah is in this wonderful position of getting three different regimes. Sometimes we get these blasts that come out of Canada.

GS: Like last winter [laughs].

GA: Last winter, absolutely. But most of the time we've got this regime of monsoons from the south, we've got these low pressure systems from the north, and so we're really where regimes meet. Great Salt Lake is a historian of this shift of the summer monsoons, or do we have the northern systems coming in and making things wetter. And I know it's much more complex than that—now we really understand that there's a lot more energy in the system. But everybody agrees that Earth is getting warmer and that probably the continents are gonna get even warmer because they're very reactive in some respects, although the oceans certainly are surprising us with how much warmer. And then, so what's gonna happen with the water regimes? And it looks as if the northern part of the state may get more water because of energy systems that are fascinating. But certainly by the time you get to Arizona and New Mexico things are gonna be drier.

So here we are with a major lake in a perfect place to tell us about this balance. Here we are with science telling us about it. And here we are with a society trying to figure out how much—what's natural, what's unnatural, and a lake that's saying, "I'll tell you." So folks like Jack Oviatt, CG something-or-other but he goes as Jack Oviatt, working there at UGS, working on it, collecting information. I'm not one of the lead people in that regard, 'cause I think so much of the time they wanna know when versus why—it's like a batter [hands on a bat]. I'm not denigrating it, it's just not my interest. I'm interested in the process more than when it happened. But think about a batter, then you put your hands up on the bat and then whoever gets to bat first. That's sort of what they're figuring out, is what goes up, what goes down, how high did it go up, and when it happened last. And Great Salt Lake can tell us some of those things. I'm a little worried about the tectonics, about whether we've really got tectonic displacements included—'cause we're looking at minor changes now and even smaller displacements will matter.

In terms of policy, I think when you go onto a board you should do it with awareness of how you feel about the agency. So I serve on water boards; I'm a water buffalo. I've been on Central Utah Project, Salt Lake Public Utilities, Metropolitan Water District of Salt Lake and Sandy. Provo River Water Users Association is the one I'm on now. So these are big boards. Water conservation would be sort of our issues, if indeed—so it's a big feeder system, so I see Great Salt Lake from that perspective. But when you get on a board I think it's wise to know who you're representing, and I represent Salt Lake on those boards. And right or wrong, we're rich in water and I don't wanna lose it. It's sort of my Republican bit of New England background: if you're rich, stay rich, is my sense. Don't give away water if you don't have to.

I got on the Division of Forestry, Fire, and State Lands board and found I was out of step, because I thought the role was to manage and protect Great Salt Lake. And if you have an agency where there is one and perhaps two people in an agency of fifty to a hundred people, and there is no way for those people to bureaucratically advance, they are not going to be powerful. And the head of the Division of Forestry, Fire, and State Lands is a forester called the State Forester. These folks fight fires. And I assure you, with climate change, they may come in and say we do or don't believe in climate change, but they will say fires have changed. And by the end of hearing some of these folks talk about the nature of how Utah's fires changed, you realize they're an important agency, and that they spend lots of money fighting fires. We also care about forestry; it's a resource. Foresters love this stuff. I'm happy for them. But Great Salt Lake is a stepchild. And they are in an agency which does a lot of land deals that are legitimate, but they do them with a purpose that does not include sovereign land's basic premise, which is you can never give these lands away. And so I watched them do things that may have been in the best interests of this state, but they, from my perspective were unconstitutional. And I complained, and I bailed.

So where should Great Salt Lake management be? It failed when it was the Great Salt Lake Advisory Committee or whatever it was, under Governor Rampton. Governor Rampton, as I said, loved Great Salt Lake, thought we'd manage it, thought we'd be crazy if we didn't do this kind of stuff. He liked science, he liked water, he liked railroads, he liked everybody I guess. But I think he saw that Great Salt Lake was something special, and that it could be embraced by the state, and the state would value it. And he made this agency [Great Salt Lake Commission] that failed. It was too small. I

served on their advisory board. They had a friendly staff person that had money, 'cause you see Great Salt Lake generates money. I mean, this is an orphan with a trust fund. This should be something that almost any group—I mean, Division of Forestry, Fire, and State Lands likes having it—it could pay for the nursery down at the state prison that since has failed as well. But that money came from Great Salt Lake. Great Salt Lake generates money. And I'm not saying all the money that's generated by Great Salt Lake should go back to Great Salt Lake, but it seems to me enough to be studying it [Great Salt Lake], enough to be managing it, enough to be protecting it.

And so I think it probably—the agency that should manage Great Salt Lake is the Governor's Office of Planning. Watching Governor Walker, Olene Walker—she followed me in the legislature—and her idea of watersheds, connecting that back to John Wesley Powell, and recognizing that there really is potential in our state to manage by watersheds, even if we don't redraw all the counties, which would be a very foolish thing to do. But if everything goes somewhere, and if you have this idea that we've got to get a handle on what we're putting into these drainage systems, we've gotta be managing water in a whole new way. I think almost everybody thinks that water law is strange. That maybe this idea of having in the State Office of Budget and Planning entities that are looking at the state as watersheds and having Great Salt Lake be there, and a funding source for them, would be a very intelligent thing for everyone, including the state. So you'd still have the Utah Geological Mineral Survey doing the salt. You'd still have the Wildlife folks that have really taken over a lot of the lead for environment—doing the ecosystems. You'd still have Utah State looking at, how does this lake's sediments work?

Can we do the things that we want to with it? You could still have that, and you could have it be in a strong enough place that it could be protected.

I think the idea of the Great Salt Lake Advisory Committee is a good one. I think some of the people on it really are important. I know you can't interview a lot of people, but Leland Meyers looks like dumb like a fox. I mean, he is so wildly intelligent. To give you a clue of what he used to do in life, he used to be the person who, on building nuclear power plants, would say when you need what in the stream [meaning along the critical path]. I mean, he's a perfect planner as an engineer. And he runs the South Davis Sewer District. And he's been sort of the leader, in many respects, of the Great Salt Lake Advisory Committee now. He's amusing. I think he's brilliant. And he happens to want to live in Utah for personal reasons, and therefore this intelligence of understanding the system is on Great Salt Lake. Are you gonna be interviewing him?

GS: I was gonna ask you for more names, and so he will be on there.

GA: Anyway, he's certainly one of them. Bonnie Baxter is fabulous.

GS: I've already interviewed Bonnie.

GA: And she is looking at this in some of this new idea of genetics. I mean, you notice how science evolves and how we're able to just understand a whole other aspect of Great Salt Lake, and that is going to continue.

GS: So what would you like to see happen to protect the Lake—and I guess I don't wanna make this, again, projecting, make it more historically viable—but the failings or the limitations you saw of this advisory committee, what were they and how might they be addressed? To get back to this idea of where should the management of Great Salt Lake be in terms of state government? Should it be a separate agency?

GA: I would put it in Planning, and I would make the whole area of the Governor's Planning and Budget Office be watershed management, be it the Colorado River, be it the different basins. With respect to water, if you're on a submarine you still have water; you're able to drink it, flush it, do all the things that you have to do; and you're not worried that you're gonna find a shark in your soup or whatever. Water is not like trees, that are gone. And we have a wacko water system. And I'm part of it. I understand paper water and wet water, and I can give a good lecture on why things are the way they are, and I'm protective of Salt Lake. But most of the time you're hearing, "We've gotta conserve. We've gotta conserve. We've gotta conserve. We've gotta conserve." Well frankly, if you conserve in Salt Lake County you're just building another house in West Jordan. That water isn't getting to Great Salt Lake. We're allowing companies, ones that I value. US Magnesium may save us globally from being under the pressures of China for magnesium. I understand that there are organizations that are beneficial that do bad things to Great Salt Lake. I worry about them. They're there. So I think this idea of managing water in a whole other way is going to be a part of the future of our state, particularly if we don't do anything about population. I mean, we say we want people to come here, we wanna have large families, whether we believe it or not we bring in lots of immigrants, either for the low paying jobs that we don't want or the refuge communities that add diversity to our state. We are hell bent on having lots of people in this state. And if we continue that way we've got to address the water issues. And I hope we'll address them in a way that's beneficial to Great Salt Lake. And I think it takes a total change. I think we have to look at it as though we're a submarine, and not say it's beneficial that you consume it.

So this is heretical, but we're coming into climate change, and I think the tragedy of the commons will prevail. I think one of the best things that this new group, the Governor's Advisory Commission, and I haven't followed them a lot (Don will tell you, I'm busy all the time, I'd be busy in a box, but I try to get to meetings). But I'm now fringe in terms of policy of Great Salt Lake, though not fringe with respect to water. So I'm much more up on water policy, I think, than I am on Great Salt Lake policy. But I thought the idea of actually saying what are the benefits that the Lake gives us, trying to quantify, just, do we care about our ski industry? Does it matter that we have the greatest snow on earth in part because of lake effect? And we've documented lake effect now from Lake Bonneville times. Something like forty to sixty percent of that which sustained Lake Bonneville was lake effect. This is a very big deal. Can you imagine Mark Eubank in his white coat the day after a Pleistocene snowstorm?

GS: Imagine the powder days that occurred back then.

GA: Absolutely. And I think some of the work that the University of Utah's doing in meteorology, Jim Steenburgh, who's looking at lake effect. A lot of things are happening. So, getting back, I think the Great Salt Lake Tech Team is an excellent thing for the state, and it's important that it stay low-key, under the radar, and it's a way for government entities to talk to each other, plus a few stray folks. And they swap information, and they talk to each other about, oh, every two or three months. And that's really, really good, for technical people to be talking to technical people. So that's awesome. In terms of management in the organization I think the Governor's Planning and Budget is a vulnerable place for any entity because governors change, and when they change so do their planning and budgets. And so to say that an organization should be in the

Governor's Planning and Budget Office is a hazardous place to put them, particularly if they're gonna have a center of mass. I mean, I think they have to have ten or twelve people—like, Energy Office was plopped down in the Department of Natural Resources. It had enough people in it that it could do some of the solar, that it could look at the economic pressures of where do you put coal mines. It could be in Natural Resources but with enough heft to not get eaten. I think there's an organization that Kathleen Clark heads that is somewhere—it might be in the Governor's Planning and Budget Office—that basically says we want our federal lands to be managed in a gubernatorial sense, which means, we want them and we don't want the feds to have them. So this entity is an entity that would be, to me, a classic one to put in Governor's Planning and Budget Office. You don't want it in the Department of Natural Resources because it politicizes resource extraction. Not that there are political things going on there, but it's not a department that protects, it extracts.

GS: But science should guide.

GA: Yeah, and regulation should guide. And somehow Natural Resources, depending on who its leader is and what the legislature's doing, it can be highly political. But it has a continuing mass that's good. And that would be nice if the Great Salt Lake could be there, but it's fatal being there [DFFSL] 'cause it just doesn't have heft—that's one of the reasons, Greg, it probably doesn't do well there [DNR] is that everybody wants their entity to be the lead. So you're competitive within it. That's interesting and I hadn't thought that through. I've worried about it but I haven't figured out what department to put Great Salt Lake into. It doesn't belong in Economic Development, and it doesn't belong in education, 'cause it would take away from education. So as I've thought about

this and was into the grumps of I've gotta leave Forestry, Fire, and State Lands, because at that point I'm being counterproductive. I think you can serve on a board wanting to change that entity, but at some point, if you're not helping them, and you are doing harm, it's time to leave. I felt I was almost doing harm to that entity, 'cause I was really saying, "What you're doing is unconstitutional. You shouldn't be doing this." People weren't listening, so I bailed. And I didn't feel it was constitutional.

And you say what sorts of things were they doing? Utah Lake needed its boundaries done. So what they would do is, you have private landowners, 'cause Utah Lake's west side has a few powerful landowners—and you really had to establish a boundary. So is that boundary something that you could either vote on, or is it something that you could just decide with your attorney, their attorney, their land and your attorney. Four people stand out there and put a stake in the ground. Or is there an actual place that was flooded on February 4, 1896, that has meaning? And you know where I was. "If it was sovereign lands you can't trade it, you can't buy it, you can't swap it. And just 'cause you wanna road that goes from A to B to the shore, doesn't mean you're gonna give that landowner that much of the beach in order to get the road." Now of course it's much more complex than that, 'cause in 1896 it was not a free-flowing lake. So it was already being controlled by an outlet structure. I understand many of those complexities. But at the same time I also know that we were going out there and cutting deals that we thought were in the best interest of the Lake. But that isn't the issue. The issue is sovereign lands are sovereign lands that you can't swap, you can't give, you identify, you protect. And that was my big gripe. Can you tell?

GS: [laughs] I can tell. I can tell that it's still an issue.

GA: This is an issue. So, put differently, going back to what we said before, I think if this [Great Salt Lake] had been a national park or monument, we would've been treated as a national park or monument and protected in a system that does that kind of thing.

GS: Let's talk about that.

GA: The state's management, the state's gaining possession of it, put it into a system where we don't have many of those. You could say—I mean, what's our biggest park? Antelope Island?

GS: State park?

GA: State park.

GS: In acreage? Probably. I cannot think of one that's bigger.

GA: In the 1970s we looked at Deseret Land and Livestock Ranch. There was a huge parcel of land and the state decided to not accept it because it was too big to manage. So Greg maybe what I'm really saying is I think this [Great Salt Lake] is certainly a continental treasure, if not global. You might argue that it's a global heritage site, but I don't think so. And therefore it doesn't quite fit under the umbrella of a state park.

GS: Well, now, I have a student who's working on the Wilderness Act in Utah, and one of the things that he'd mentioned to me recently was—he studies Senator Frank Moss's papers. And Moss and others did consider this idea of a Great Salt Lake National Park. And I was wondering what your recollections of those debates might've been. It's something I've brought up with a number of people, and the way in which national parks have changed in the last couple of decades and incorporated different management strategies, different designations, a national park, a preserve and so on. It makes it more

viable. And laying aside the whole political argument over federal lands in Utah, which remains a hot button issue, what do you remember about those talks?

GA: Well first of all, I don't. And I actually got to work with Senator Moss's office 'cause when I was back in Washington I was working on surface mining legislation, and Mary Jane Dew was a wonderful assistant to work with. But I never really worked directly with Senator Moss, but certainly with her.

Think about what Great Salt Lake looked like in the 1960s. Yuck. I don't think we were as enamored by birds, having sort of had the Audubon folks that would've been labeled as interesting. You had expanses of just white. I mean, the Lake was low. It's almost that low now, it is. So it [the national park idea] probably, to some extent, didn't have legs, because it wasn't as attractive. I don't think people thought about the Lake. So Don, were you ever a part of Death Valley becoming a national park? When did Death Valley become a national park?

DM: It was a national park before I was there.

GS: Yeah, it goes back a ways.

GA: I'm just trying to think. And we've gotten Great Basin National Park.

GS: And that was '86.

GA: And that was largely Don Currey.

GS: Yeah. Which, Lehman Caves National Monument was there for many years before, but then, it's been absorbed by the park.

GA: So, I actually hadn't realized that Senator Moss would've been thinking about it. And maybe that's one of the reasons why the state claimed it. That would be interesting in terms of a causal relationship:

Did Governor Rampton think that because the feds weren't heading towards a park, the state should protect it? I think Governor Rampton really wanted to protect Great Salt Lake. I think he was very aware of the water issues. And he wanted to change the definition of beneficial use. And he thought he could get that through the legislature. And it's one of the votes I most regret, 'cause I didn't understand the issue. I was still so young. I was very much a freshman. And he came up at the end of the session. He'd been drinking, not that you could really tell, but you could tell by his voice. I mean, you didn't smell anything or anything like that. And the legislature had shut down, and he came up and he stood there and just gave us hell, it was like getting a grade, a bad grade. And his idea with the legislature was you turn 'em loose. And he wouldn't veto things. He thought if it was idiotic he'd just let it go through. But if it was unconstitutional he'd veto it. And he sort of gave us grief. And he looked at everyone, I just thought he was looking at me. And I was thinking we'd done ok. And what we'd done was we'd defeated a good change to water law, an essential change, of beneficial use. Because you see Great Salt Lake has no in-lake water rights per se. And these ones that we've let go in the last five to ten years are 300,000 acre feet at a pop. Central Utah Project, for example, is 100,000 acre feet, just to give you a rough idea of how big these things are [allocation of in-lake water rights]. I bet in the last five years Great Salt Lake Minerals, US Magnesium, each have gotten on the order of three to 500,000 acre feet of in-lake water, of being able to take it out of the Lake once it's there. I mean, that's just brutal. An inch on Great Salt Lake when it is at forty-two hundred feet is about a hundred thousand acres. And I might be off by a bit and maybe it's at two thousand. But it's a big lake, there's an inch—but you start adding three inches, five inches, twelve inches, and that which controls lake

level (and I may have mentioned before) that which really controls the lowest level of the Lake is how low do you let the canal feeding the ponds go. So if you let these ponds be constructed—and they talk about it at 4198, and they say that’s the level of the Lake—that really isn’t as low as the Lake will go. Lake level will go lower than that if the feed canal into the ponds is lower. In other words, if the feed comes in at 4185, the Lake can go down to 4185 as they pump it out. Grrrrh, I get so grumpy, thinking about how organizations, many of whom I admire, whose business is the Lake, are on it every day. And who are those of us who meet in a meeting, and try to advise on Great Salt Lake? There’s, within the Division of Forestry, Fire, and State Lands, two people who really work hard. I happen to admire both of them. And they’re really good. So you got these two folks who are constrained by law, and you’ve got on the outside, twenty folks whose entire focus is not that of conservation but extraction, are we in the best interest of this lake? And it just seems as if the teams are uneven.

So no, I don’t know about the—

GS: I just thought I’d bring it up. I had not heard that Moss had been involved in that at all before, or really the depth of that. And it’s something I wanna personally follow up on.

GA: So the person who would know is an attorney, I think his last name is Dallin Jensen. I might have to look it up. I think he loved working on water law—he’s a big cheese attorney, just brilliant, and such a joy to have with the state. He probably (and I’m making this up) came on board with Rampton, and was probably a buddy—Rampton was an attorney, Matheson was an attorney. It’s probably kind of cool to be a state attorney if you’re not too particularly worried about income. You’re not the attorney general. You’re

working on issues with a governor who you care about. You're doing water issues against really formidable opponents of environmental statutes. I mean, sort of two water gurus—Joe Novak and Ed Clyde. So you've gotta have someone on the state team. And I think his name was Dallin Jensen. I may have to look that up. And I think he still exists. And he would know everything. He would know the railroad. He would know access. He would know all this stuff. He probably was the lead attorney for getting it to be state managed, owned. In other words, he probably argued the cases. I don't know whether it went to the Supreme Court or where it went. But he'd be the person. He'd be seventy-five now, maybe eighty, but probably still a crackerjack. And that would be a precious one to get, 'cause it will be unwritten history—and he might talk to you now in a way that he might not have then

GS: The passage of time, where people are willing to talk.

GA: Absolutely. And he would know about that. He'd know if there'd been a discussion of a monument.

GS: Well let's move to your more recent work, the educational work. And could I ask you to talk a little bit about how you use the Lake in your work with public school teachers, or in the classes that you teach up at the university?

GA: Sure. I mean, it's hard not to launch into my lectures, which I won't do.

GS: Do you use it as a field trip location?

GA: Oh yeah. That's great, 'cause I didn't state the obvious. What I believe in is that we actually turn people off to science. I think almost everybody starts out liking science—first grade, second grade, third grade—by the time you're in fifth grade it's not quite so cool, and by the time they're in high school finally it's the kids with the glasses

that are nerds sitting somewhere and it's not neat. So how do we turn people off to science? We make it irrelevant. We chain 'em to their desks. We have them watch places that they don't understand. And we use vocabulary that they don't get. And we never take them outside. So how do you turn people on to science? You make it relevant to what they see. You let them go outside. And you realize that much of science is accessible. And I think earth science is the most accessible. And secretly—well, I think that secretly everybody wants to be an earth scientist, and they just haven't been open to it. So Earth Science Education takes teachers outside and just explains what they see, and they get it, and they love it. So we do the rock cycle by going to cemeteries, by going to Temple Quarry, by seeing things outside. Utah is remarkable geology. (A) it's very diverse—we've got these three physiographic provinces because for the last six hundred million years we've been where Earth has accommodated change. I mean, this is a big deal. So we've got big, bold red on one side and we've got this sort of subtle, grey beauty on the other side, then we've got the Rocky Mountain majesty on the other side. So we've got all this stuff. We have rocks of every timeframe, rocks of every type, except one special kind that's in the deep of the oceans; we don't have one, what I would consider, minor rock type. We've got all the others. We've got timeframes. We've got the fossils. We're where it's at. And, you can see it. So we don't have all this nasty green stuff covering up the good stuff.

And one of the things that the Museum of Natural History of Utah taught me, they had, as they were figuring out how to make their new museum, they needed to think about who goes to the museum, who was their audience. Number one was people—and this is not in the right order, this is the order that they were thinking about—we all know

it's somebody who wants to go up there and understand something. The next group is somebody who wants someone else to understand things; that's actually who's deciding whether you're gonna go to the museum. The next one is a group of people who wants to see how you teach it. The next one is ... I may have forgotten, oh yes, it's "the thing to do." And the final one is for peace. I'm not interested in peace, but quite a few people will go to an arboretum for the quietness of it. So, the group you're really teaching, when I'm teaching, are teachers. And I ask them at the beginning—and I may remember what that fourth one is, it's similar to these here. But many of them [teachers] do wanna understand it, but most of them want to be able to teach it to someone else. They wanna be able to teach the water cycle to someone else. They wanna be able to cover the Utah curriculum, even if they're not interested in it themselves, to be able to convey it. And Great Salt Lake is a very direct teacher.

So, *the* water equation is: if you change what comes in and you change what goes out, you change the volume of the Lake. That's very easy. We all are interested in climate change, even if they wonder if it's hocus pocus. Great Salt Lake, Lake Bonneville, things were different back in Lake Bonneville; they get that. They understand the Lake fluctuates—Davis County loves Great Salt Lake. They have the sunsets and they are beauties, they see the shorelines. Davis County teachers are actually very interested in understanding Great Salt Lake itself. Almost all of them are interested in the smells. But this idea that you do Lake Bonneville and Great Salt Lake at the same time, it is such a remarkable recorder of Earth's processes. They love the idea that this lake is teeming with life, and that the nasty smells are life, not death. Well, maybe a combination of the two. They are fascinated that the idea that some diatoms are crunchier than others, and

that a brine shrimp really can't handle crunch—I mean, the teachers understand food and this. It's such an accessible system. And so I've used Antelope Island, which people like to get out to. They like exercise. They get it.

Now, one of the difficult things about using Great Salt Lake is it's hot out there. And I used to teach workshops in summertime, and after one sort of Bataan death march with people walking around, they said "Don't ever do that again to teachers." I said, "I won't." And then you can't have workshops be in the springtime [May, June, July] because you can get eaten alive. And if they have their hoods of their jackets over their heads and they're holding on to each other walking along, they're not looking at the shoreline. So you can't do it then. So there's really just a narrow opportunity of October. And what most people in Utah know is that September, October, November out on Great Salt Lake is wonderful.

Now for the university students, what I use, it's very easy to look at shorelines and to see processes at work. And one of the things that university students sometimes aren't aware of is that observation trumps. They're taught so much about models—climate models, facts coming out of books—they haven't been outside much to observe. And so (A) they love to slip their collars and just be outside for the joy of it. But it's very easy to observe Great Salt Lake/Lake Bonneville evidence. I do a little piece of research that I really would like to turn out to be published, minor publisher, not a big deal publisher. The causeway to Antelope Island was reconstructed after the 1980s. I think it opened up in 1991, I'd have to check that. But it'd been refurbished, so both sides were the same angle, both sides had the same material on it. And they don't look the same now. So students just doing some measurements, going out there saying, "How could this

be?” recognizing that their data isn’t looking the way they expect it to do. How do you decide what grain side if it’s too much diversity? I mean, that’s a wonderful way of being able to say, “What you’re learning in a book sounds so simple, but if you’re coming out and actually doing this—” That’s a neat university student research project to know how much change there’s been.

Tooele loves Great Salt Lake. And so another thing we did is, with US Magnesium, we established a little park, and it’s at the north end of Stansbury Island. Nobody knows about it. But you can actually do some kinesthetic learning, which teachers love. I know people roll their eyes when I do directional yoga. And we do landform yoga and people take these positions, but they remember them because some people learn visually, some people learn by ear, some people learn kinesthetically. Almost everybody learns differently; they can use different things at the same time. So this particular little park is you can go out there and every hundred feet you walk is a thousand years of time, and every foot you go up or down is a hundred feet of elevation. So you can actually walk around this itsy bitsy park and you can go up to this little crest and then you stop at Stansbury and you can do this. And you get up to this little crest and it is to the Bonneville level, then you go straight down to Provo level, and then you wander down to the present and get back there to the beginning of the world. Now, some people don’t get that model at all, ’cause they know that when the sign says fifty-two hundred feet that they’re not at fifty-two hundred feet and that really confuses them. This walk doesn’t work for everybody. But they’re there and see the Lake.

And one of the great things that happened there [Stansbury Island] is there are these folks, and I won’t use names ’cause I may be wrong in terms of blaming them for

everything. But there was this battleground of closing Stansbury Island to accessibility. And the way that didn't happen was it was a patch of state land at the north end, and then eighty percent of the island is public land. But, along the road there had been private land and it was acquired. And the private landowners along the road went to the county commissioners and shut down the road, put a big sign that says, "No trespassing." And you couldn't go out on this island that's BLM land, it's public land. Maybe that's what we should make into a national park, just have Obama, in this last moment, declare, instead of the wilderness or anything else, declare Stansbury Island. That would be so ludicrous nobody would even get it. Anyway, the private landowners along the road shut that down but they'd forgotten, there was an itsy bitsy patch of state land at the very north end. So, some of us got involved with saying "That's state lands, you gotta rehear this." And what US Magnesium did, not from the goodness of their heart I assure you, but they would love to have that road be public rather than have to maintain this road. They'd come to us and said, "Genevieve, Earth Science Education, Don Mabey, give us some kiosks." And I said, "I wanna do the kiosks. We'll do the kiosks. We've done the kiosks. That's fine. But let me do this kinesthetic learning piece." Because I've always wanted to. But I wanna do it on Antelope Island. I wanna do it in a variety of places. Can you imagine having a bike race on Antelope Island where you actually went to the 5200 Bonneville level of Lake Bonneville and then you had to go down the three hundred feet and then you had to come over to the Provo level of Lake Bonneville? It would be awesome, just to make the hydrograph be the ups and downs. So they did that. And that was fine. And the county wasn't particularly interested in it, but it was all right. But having the kiosks up there was fine—and we worked with the county and put the signs

up. We go out there two weeks after they'd put up the kiosks, and I was there with a University of Utah class. We'd done a service learning project out there as well. And the US Magnesium person said, "I think you're gonna be upset." So I say, "I'm interested." So someone had shot a rabbit, at least I assume they'd killed a rabbit, hung it on the kiosk, and shot it again. So there was blood all over the kiosk. Now the county had had zero, well, minimal interest in this. They'd done it. But let me tell you, shootin' rabbit carcasses on county park facilities made that park be something to be protected. So it's on bike routes. So that's a nice park that's there. And there have been no more future, past rabbits shot there, as far as we know. There've been no twisted ankles. I think everything's fine.

So Tooele is interested, and US Magnesium is very interested in having school folks, teachers learn about Great Salt Lake and its constituents. So I taught a nice, heavy duty course. You could come to two Saturdays, kill them off, during football season—why didn't I think of that?—in September, October, and get a full course from Genevieve. But it didn't work at all. It didn't work 'cause it was football season. And two Saturdays at the beginning of the fall, and you can't do it other times. So what the teacher said was, "We wanna go out with *the* Genevieve Atwood after a hard day of teaching in school. We just wanna go out on either Wednesday night or Thursday night to places and have you tell us what we see." I thought, *Well I'll try it*. And of course bunches of places are near Great Salt Lake. So it's one of the most magical courses taught. And here are these teachers that have been teaching all day long. So there are something like ten Wednesdays and Thursdays in September, so you have September sunsets, it's before the days are really short. We meet at something like—I forget—I think it's five o'clock, five

to seven in the evening. And they get minimal credit. And they learn to appreciate places in their county. It isn't all Great Salt Lake. Of course we do one on mining, but we do the US Magnesium ponds. So they go out there and they see the pretty crystals and Tom Tripp tells them about evaporation and they taste that brine. Man, is it salty. You just say, "I don't need salt for a month after that." And that's another way that Great Salt Lake is used.

And so about reaching teachers... This idea that if you have a sense of place you're grounded—another concept is, kids who don't have a sense of place don't do as well in school as kids who have a sense of place, and that a sense of place can be taught. And one of the ways is by heritage, so you go to Italy and find where your group was that mined here and you have a sense of place of Italy. But you can also have it be just by landmarks. And Great Salt Lake is an interesting landmark. So in Salt Lake County it would certainly be, for example, Mount Olympus or Lone Peak, and then Farnsworth Peak. And so doing the same thing in Tooele, Great Salt Lake is a way of helping anchor—to give locals a sense of place, a landmark. I mean, sure we always look high. Jared Farmer, ya know, Utah Lake versus Mount Timpanogos. This is the idea of how important Great Salt Lake is and that you can orient with respect to Great Salt Lake. For the counties that actually Brigham Young established by watersheds, the Great Salt Lake is very meaningful to them.

And I think that groups like the FRIENDS of Great Salt Lake promote a sense of place through Great Salt Lake. Don's a significant donor to their scholarship program, I work with them occasionally. I think that Lynn de Freitas has invested her extraordinary talents in being able to just keep working on FRIENDS of Great Salt Lake issues. Don

was on their board. I work with them and Andrea Nelson, this sort of landform yoga kinda thing. We earn our t-shirts. I think another group would be Davis County. I think Davis County and their bird festival, Neka Roundy is phenomenal, she works there. Antelope Island staff interest varies a lot who their naturalist is. So they can have a naturalist there. So now they have Jolene—she's great. I think the whole world wants to go out there on January 1st. And we've gone out to Antelope Island January 1st probably for thirty years now. And we went out this last time and they were having a hike that looked as if they were having some kind of weird celebration. I mean, there were cars everywhere, they were walking across there [the island]. And I think this idea of getting people out to Great Salt Lake as something special then becomes infectious.

There's sort of two sides to Great Salt Lake: this idea of bonding by adversity. It's something that geologists do. It's something that hunters do. And I think it's something that humans do, that if it isn't too adverse you just remember those times. So I don't even apologize for the bad times at Great Salt Lake. I mean, sure you don't want them to get heat exhaustion, you don't want them eaten by the little no-see-ums. But I think there's an element of Great Salt Lake that has a little bit of challenge, and certainly it requires understanding. I mean, everybody can fall in love with a sequoia tree, there's trouble if you don't. But once you've decided that you've embraced this lake, it's not a snootiness, it's not a superiority, it's a bondingness. And then you find other people who like it and it's a connection.

Don do you wanna throw yourself into this at all?

DM: I think it's kind of interesting how we got involved in this. We went to a grandparent's day down in Sandy. Which school was it?

GA: Sunrise Elementary School.

DM: And they were very aware of earthquakes. The kids knew what to do in the event of an earthquake. But what they were studying was the San Andreas Fault. There they were with a beautiful view of the Wasatch Fault. And it just turned out that the teachers had no resource to the local geology that they could use to teach the kids. So we started out to just give the teachers an idea of what they could see from the schoolyard, as a way of teaching earth science. And I think it's been pretty successful.

GA: And the corollary of that, you see, is you don't have to go to the Pacific Ocean to see processes. So Great Salt Lake has so much with respect to the interactions of the geosphere, biosphere. It wouldn't be there if it weren't for the tectonics. It really is a very accessible way to teach earth science. You know the water goes downhill to it. You have a clue about pollution processes, about all this biology. You know it ties into weather and climate. You've got great examples of how humans are kind of screwing it up. So you've got the geosphere, hydrosphere, atmosphere, biosphere, anthrosphere, human footprint, right there. And there's a fascination with it. I think there's a beauty that people recognize when they see a sunset across it. There's the stinkiness. I mean, it has a presence. And so it's a great teacher. Whereas when you're at an ordinary lake—I mean, even a lake like Utah Lake could do the same. I think you can go almost anywhere, 'cause just even here we've got drainages, we've got rocks that don't quite belong here. I mean, you can teach people, and I think people love to hear about *their* school and *their* neighborhood and what they can see right here. But there's something about Great Salt Lake that's big enough that you can teach lots of people about it, process enough that they can sort of say, "I guess I kind of get it." And we've really learned that the Lake's

natural processes have value. And I'm not gonna argue that everything natural is good, but we really can see that things we've done to Great Salt Lake are bad. This idea of the railroad going across there and making a north part and a south part, so now the natural probably couldn't reestablish. And that idea that Great Salt Lake is a teacher is a good one.

GS: So, we've been here quite a while, but maybe close today with asking you about your favorite places on the Lake. I've asked everybody this question and I try to get to those special places. And you don't have to share an exact location if there's a hidden gem. But it's a lake that many people see from a distance and most people, if they go out, see it from the south end or from Antelope Island. But are there other special places?

GA: Oh, there are lots of special places. My most special place is a place called Unicorn Point, and it is on Antelope Island. And it's just at the very southern tip of the island. When you see a diagram, one of those Rorschach—maybe it isn't Rorschach—but you see something and then suddenly it all comes together, it's either the wine glass or the two people, that you just say, "I didn't get it, then I came back." So, when you're at the southernmost tip of Antelope Island and you climb up just to get a view of what's going on, and you look out there and there are vegetation changes and the bay and lagoon look just like a unicorn's head and mane. And when I first recognized this it was a glorious day—and you have all of the Wasatch Front behind you, and you're looking from the island to the people, rather than the reverse, which you do most of the time. So you're sort of from the inside of the Lake looking to the margins rather than vice versa. And then we looked down and it was just this very odd set of shorelines, and it turned out that it looked like a unicorn. And now it's called Unicorn Point. And so it had an eye,

which someone had sort of dug into it, and a shoreline that made the horn—I'm not doing a very good job on this unicorn—but it had a mane that was terrific, and it had another shoreline. And so it wasn't perfect, and I drew it even worse than it is, but there was just that whole idea of seeing just the magicalness of the unicorn and symbology and shorelines there that was wonderful.

And we were lucky. The folks on Antelope Island support research on the island—so what I did in 1998 is went around Antelope Island and resurveyed them. And you may think that the difficult part of surveying is the rod man and staff. Well the difficult part of surveying is not the person holding the rod, it's the person behind the instrument, which was Don, so Don Mabey. And I had something like sixteen hundred points, data rich, on 1986-87 shoreline evidence. And we really nailed the shorelines around Antelope Island. And then my advisor, Don Currey, said, "Well, you're not coming out with what most of us have thought about this. I think you better test your hypothesis around the whole Great Salt Lake." So we did that too.

So I think that there are a couple favorite places in part because of what we were doing. And just watching Don going across salt flats carrying surveying equipment in these places. So Strong's Knob is another place that I think is really neat. And it's changing because there is so much industrialization. But there's something called the Finger Point, which isn't Lady Finger Point, it's the Finger Point, and it's on the west side of the Lake. And it's always windy, not really heavy duty wind, but there's no bugs. I mean, part of finding good places at Great Salt Lake is eliminating the bad stuff: eliminating the smells, eliminating the heat a little bit. And you don't usually have to do that in some places. And this one you get an expanse of just openness looking east across

the Lake—you're on these lagoons. And to me they're interesting because one side's higher than the other side, which is telling you something about the wave energy, which is telling you something about the wind energy, which is telling you something, perhaps, about which way the wind was blowing, and maybe you can figure out global climate based on this one place—just kidding. So anyway, it's a wonderful spot scientifically. And it's just nobody's really there. I think there's an element of this idea that's behind wilderness of being able to sort of say, "I'm a part of nature. Not too many folks have been here. I can come back. And besides, I don't totally understand it. I mean I do understand why it's different here but I'm still curious about how did this place come to be."

So where's your favorite place to be, Don?

DM: I think the south tip.

GA: Of Antelope Island? I forgot about my really favorite place.

GS: And where is that?

GA: I row on Great Salt Lake. So I'd say my absolute favorite place is when I'm actually on the water, and that ever present wave motion and quiet. We're not very good rowers. This is the Huntsman Wellness Program. So I get to be a part of that. And this person, who was the original leader of the program, did dragon boats out in Savannah, Georgia or something. And because they'd said, "Oh, breast cancer people shouldn't be using their arms," and she said, "This is just ridiculous. It's based on one study of one doctor who found three people that had had bad occurrences. Of course we should have women getting out there and doing dragon boats." And so she said, "I'm gonna do dragon boats in Great Salt Lake." And everyone said, "I don't think you are. It's about specific

gravity, they can hurt themselves. This is not a good idea.” And she said, “Well, then I’m gonna row racing shells.” So she set up this program. And we have this wonderful coach. So I guess it’s the whole experience. But usually when you’re rowing—and I’m not a terrific rower, but I really like to row—when you’re on the Charles River, you’ve gotta make sure you don’t run into someone. Or you’re on the Potomac and you’ve gotta make sure you get back to the boathouse. Or you’re ever aware that you could t-bone another expensive shell. But when you get out on Great Salt Lake it’s really the opposite, because no one’s there. I mean, there sort of is. But let’s say you go out on Saturday morning and two groups of two have gone off and one group of one, and that’d be a pretty busy morning. And then you have the Huntsman Group, and we’ve got a group of four that we’ve put together. And our coach is a very tall, gorgeous, strong rower. She can barely fit her hips into the coxswain’s place. I mean, this is not your tiny coxswain that you slipped into the back gunnels. And so she really can’t even fit in that part. And we’ll get out in the middle, and we’ll take our break. She’s got good balance, and she’ll stand up in the back. There we are supporting her like water spiders with our oars—just making sure she’s there. And she will read us poetry. And that is the most magical place on Great Salt Lake, ’cause there’s beauty and camaraderie and water and peace—of course, that’s on a still day. Sometimes we get in trouble.

GS: It’s an interesting fact that most people think of the Lake as being seen from the shore—being on the Lake itself is a real rarity.

GA: It is a rarity, and it is very strange. And for me, who feels “I’m *the* Genevieve Atwood, I’ve got my PhD, I understand Lake processes, I’m not gonna have surprises.” I get *lots* of surprises. For example, watching *how* quickly the Lake responds. So wind

goes across the Lake's surface, the surface gets a little bit of an unevenness, the unevenness then allows more energy to be transferred into the Lake's surface, eventually you're starting to get the Lake's buildup, and the wave processes. And we actually did at one point get rescued. And so we were sitting there and saying, "I wonder what they're signaling out there." I'm off in the rowing position, sort of the power seven, near the cox—and indeed they said, "We're rescuing you."

[all laugh]

GA: We came back. And what's worse than biting into an apple and finding a worm? Do you remember that joke?

GS: I don't.

GA: Finding half a worm. And as we were coming back we found half a shell. And we were so worried, but it turned out that was another group's boat but all the rowers were okay.

So Great Salt Lake needs to be understood and it needs to be respected. Maybe that's the final thing. I think, in the 1960s there was a mantra of earth scientists: nature to be commanded, must be obeyed. And I think Great Salt Lake gives us lots of clues of, nature to be commanded. It's like a garden. That's fine, we can make our gardens, that's good—but you gotta kind of understand what the commands are for gardening. And I love how Great Salt Lake is kinda grumpy sometimes, as well as a great instructor.

GS: All right, well that is a great place to end. And I thank you both for a really great interview.

GA: Well thank you. And you do get us talking. You get me talking. So thank you very much.

DM: My favorite memory is we spent our honeymoon on Antelope Island.

GA: [laughs] We did. We were working out there. And we decided—hmmmm, Don's just been one of my best friends, and we decided to get married. And, I mean, we're not gonna take a break from our field season. So it was out there. And gosh it was cold. So they, per usual, dropped us off, 'cause you see that's when you couldn't get to the island except by boat.

GS: And what year was that?

GA: '87. I was thinking about how high the Lake was rather than when my marriage was [laughs]. 1987. When Don had left the Survey.

GS: All right, well thank you both again.

END OF INTERVIEW