Adventures Within the Geothermal Community:
A Q & A with Cary Lindsey, a past GRC Scholarship Awardee

by members of the GRC Student Committee:
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In this feature, we interview Cary R. Lindsey, a PhD candidate in the Department of Geological Sciences at the University of Idaho and a self-proclaimed ‘hockey mom’ of three. As an undergraduate student at Mississippi State University, Cary attended the National Geothermal Academy in Reno, Nevada, USA in 2012. Her current research involves application of geostatistics and exploratory statistics to heat transfer in and exploration of geothermal systems. She has been a prolific member of the GRC, having attended Annual Meetings since 2012 and presented various papers, highlighting her past work in Oktibbeha County, Mississippi and Yellowstone National Park. Furthermore, Cary is a recipient of a 2015 GRC Graduate Scholarship award.

GRC: How were you introduced to geothermal science?
Cary R. Lindsey (CL): I think I’ve told this story from both angles. I’m not sure if geothermal brought me to geology or if geology brought me to geothermal, but they both kind of happened at the same time. I went back to college as a non-traditional student. I was actually a psychology major. I was a little intimidated by the intense math and science courses. So a couple of years after, I met a professor who really encouraged me to rethink that and consider a different direction. I looked into environmental science programs and somewhere along there, I happened to read an article about a geothermal energy project, and that was pretty exciting. I was also looking at a geology program. Somehow, I ended up switching my major to geology after my second year - I finished my two years of community college and transferred to Mississippi State to pursue a degree in Professional Geology. I wanted to do an undergraduate research project with my Honors college. I knew I wanted to do something geothermal, but no one at my university had known anything about geothermal energy. It was kind of a meteorology department [and] a few oil and gas guys there, but certainly no geothermal or heat transfer going on.
GRC: How did you work around this lack of geothermal expertise at your school?

CL: I started Google-ing which universities were doing what. I found Southern Methodist University’s geothermal lab (this was right after David Blackwell had completed the Google Earth geothermal overlay project). I called Maria Richards and Cathy Chickering and just asked for some help - some direction, as to what I could do. We talk about what could be done for Mississippi and how the map could be improved for the area. I [also] talked to Dave Blackwell about it. They gave me some directions that kind of sent me off. I ended up visiting those guys at Southern Methodist at one of their first Power Plays conferences. Met all their students and all the professors. They just took me under their wing for my last two years at Mississippi State and the rest was soon to be history.

GRC: Did your undergraduate background in psychology play any role in that?

CL: First off, being involved in geothermal is not always the easiest path to pursue. The industry is up and it’s down. It’s recreating itself, so you have to have a certain type of spirit to push through in geothermal. You can’t just do science, you can’t just do energy, you can’t just do policy - you have to be able to do all three of them. You have to be able to work with people, and know how to talk with them, how to understand and deliver what they want to them. I think a little bit of psychology helps sometimes when you’re trying to get your way or get your point across with people. That goes with any industry, but I like to use it in this one.

GRC: It seems like most of your research is rooted in statistics. Could you tell us a little more about it?

CL: Right now, my research project is in Yellowstone - certainly not an area we’re ever going to develop for geothermal. Because of that, it’s a really cool place to work - it’s pristine, it hasn’t been developed, so you can just go in there and see how the natural system reacts. I use geostatistics to look at [spatial] trends in temperature mostly and fracture networks and things like that. I think that can lead to better exploration, more economic exploration, and better reservoir characterization if we understand what’s happening because the near surface has so many clues as to what’s happening in the deeper subsurface. For me, geostatistics was a natural progression of my interests because it wasn’t something that I was first interested in when I came to the University of Idaho. I just found it when I was here - my advisor teaches a course in geostatistics. Then, you start tying in spatial analysis with GIS. I really think it’s just the direction that a lot of us should be looking into. You saw with the Play Fairway analysis - there’s a lot of spatial statistics involved with that. And even when we start producing these systems, it really matters that we’re monitoring them so that we’re sustainably producing these systems. Using some of the tools that we use with spatial analysis in the shallow subsurface lends itself to monitoring these systems once we start producing them.
GRC: Let’s talk about your GRC Award. Congratulations on receiving it. What have you been doing since then? How has it helped with your career track?

CL: One of the things with awards like these is that it means a lot to get them. Personally, it meant a lot to get it, because it’s from your peers, the people in the industry that you want to be in, who are saying: “Hey, you have an idea we’re interested in”. It’s not the National Science Foundation, it’s not some random group of folks in a random building, but it’s people whose opinions you really care about. So even just receiving the award does something for you. And of course, being able to write a scholarship application and get it funded means something for your CV. It means you can present an idea in such a way that people understand the value in it.

But it also gave me the opportunity to look at a pretty interesting project that I had in the back of my head. It ended up not being exactly what I wrote it to be, but it ended up being a pretty interesting one nonetheless. We looked at this field area in Yellowstone called Porcupine Geyser. It was labeled as a ‘geyser’, but nobody’s actually seen that behavior - except for a couple of drunk guys back in the 80s. So nobody actually knows whether it’s a geyser or not. For all intents and purposes, it’s a hot spring. We dropped these loggers, which are what I wrote my grant proposal for. I wanted some of these U-12, stainless steel temperature probes. These can handle hot springs, [since] they have a rubber seal on them, so you can drop them in on a hot spring and they can log temperatures for a really, really long time. We tie these up with some pear cord and drop them in hot springs. I was looking for hot spring response to earthquakes or shorter seismic activity. We didn’t happen to see any of that.

On the very last day I had this logger in, all of a sudden, the temperature of this logger dropped by 45 degrees and it recovered almost instantaneously. We argued about what had happened to it. Had somebody stumbled across it and pulled it out then dropped it back in? Had there actually been an event causing such a drastic temperature change in the spring? Another student, an undergraduate at the time, worked with me and we developed an analytical model to plot what that temperature recovery would have actually looked like had somebody actually pulled it out and dropped it back in. What we found was that the [modeled and empirical] curves did not match. We were able to disprove that somebody had pulled it out and dropped it back in. We don’t know what happened. We were not able to explain for the amount of temperature drop what happened. That was a really nice opportunity to do something that wasn’t what I was doing everyday - it didn’t have anything to do with mapping heat flow. [The experience] made me develop an analytical model, which I thought was really hard to get for a long time. And I got a conference presentation out of it - I presented the results at the GSA in Denver. None of that would have happened without the GRC scholarship.

GRC: What’s the most exciting thing you’ve witnessed while on a geothermal field outing?

CL: A few years ago, I went to a workshop - it was a near-surface geophysics workshop for hydrology that was hosted by CUAHSI (Consortium of Universities for the Advancement of Hydrologic Science, Inc.) - great workshop if you ever have the chance to go to it. I found out through Iris Pascal at New Mexico Tech that you can actually just borrow seismic refraction equipment for free. All you have to do is pay for the shipping, and if you have an NSF grant you get priority. We borrowed some seismic refraction, some geophones. They even sent us the source, the thumper that you attach to a truck. Of course, we didn’t use that for our fieldwork, but we did...
use it to teach a class on. We took the stuff out to the Alvord Basin in Southeast Oregon, and we were going to do a seismic survey over this stepover in a fault. We were trying to look at the fluid breakthrough in this relay ramp, so we were running this seismic line, and our source was a sledgehammer and a big steel plate. We'd put that plate down and swing the sledgehammer about 8 times, and then move a few metres down the line and do it again. We had some graduate and undergraduate students and my advisor out there. I was sitting, running the computer, and recording our work.

One of the undergraduates was swinging the hammer at the time. He got about a third of the way down the line we were working on, and when he swung the hammer and hit that plate, we could feel it probably 30 metres away. You could feel it move through the ground, like the ground was hollow underneath us. And everybody just stopped and looked up, and we were like “We’re on top of the fluid, on top of this massive spring or something”. We had everybody move away. Since I was the graduate student on the project, Jerry looked at me and said “Okay, let’s finish this”. He swung the sledgehammer down the next 2 stops, which is all we needed to finish that line. I just sat there hoping the next swing of the sledgehammer didn’t break us through and send us down into some massive geothermal cavern. It was a great story to tell [for] later - we probably weren’t in any major danger, and I think if we were we would have stopped and done the line somewhere else. It was pretty weird to feel that, but also awesome to think of all the implications. When we looked back at the survey data, we weren’t over empty caverns. We probably were right over the main upflow zone through that relay ramp, so it was pretty cool to see that in the results of our survey.

**GRC:** Gosh, death by geophysics, wouldn’t that be something?
**CL:** Right? *Laughs* How we all want to go right?

**GRC:** How have you promoted your work?
**A.** I go to the geology conferences because I am a geologist and because it is also important to have a presence at those events. There are GSA (Geological Society of America) and AGU (American Geophysical Union) to consider, although they’re not specifically geothermal. I’ve presented at the National Park sections about my Yellowstone work. I’ve also presented in specific sessions that are geared towards geothermal. I went to Power Plays during my first year. Stanford is phenomenal, but also intense. Roland Horne is a great host for that event. Of course, GRC is the best geothermal one out there. I think we should have more student presence at GRC. We should really open the doors to GRC for local universities where the Meeting is hosted. GRC is our community, and it’s my favorite.

**GRC:** As your candidacy is nearing completion, what are your plans for the future?
**CL:** I see myself continuing my research. While it is exciting that I am graduating in a couple of months, I still have a book full of ideas, with things I’ve jotted down and thought: “Oh, I could do this with cluster analysis”; “I could do this in Yellowstone.”; “Wouldn’t it be cool to work with an undergraduate and have them go through some statistical process?”. This is just the beginning for me. Whether I end up in the industry or...I’m looking at universities, liberal arts colleges, community colleges. Wherever I go, I will certainly continue my research. Now that I’ve spent so much time with writing, I’m actually enjoying the process. Hopefully, I’ll also be able to mentor other students. I love working with undergraduates. I love statistics, geostatistics, and data. I’ll mention the National Geothermal Data System - there is so much stuff out there for free. We could just go grab it and do these really cool models and use exploratory statistics with it. That’s certainly something I look forward to doing.

**GRC:** Given your previous response, how would you envision yourself as a mentor?
**CL:** I have some alternate visions as to what’s that going to be like. I kind of imagine myself being this really quirky geology professor who wears big chunky necklaces and sensible shoes and makes all of her students do a lot of statistics. I imagine exposing my students to a side of science they all wouldn’t get to, especially in a two-year college. I want people to understand that science isn’t just
what happens in the classroom - it’s about being creative, being a thinker, stepping up outside the box and trying something that maybe no one has done before or doing something in a different way that people have not tried before. Really, I just want to encourage people to find what it is they care about and to find what excites them. If that’s geothermally related, then great. If it’s statistics or generally just science or if it’s not, I just want them to feel like they can talk to me about what excites them and guide them on how they could do it at a four-year university or alternatively, how they could do it with an associate’s degree. I just want to offer people a way to their path because I think there were so many people who helped me find what it was for me. I would not be here if my adviser at Mississippi State had not managed to scrape up enough money to pay me 10-15 hours a week to do a research project or if the folks at SMU had not been able to encourage me to do undergraduate research. Personally, it’s just about offering some advice at the right moment or being able to go eat a brownie and cry in my coffee in my office while they’re having a hard time in class like Calculus 3. Whatever issue it is, I just want to be there for my student.

GRC: Finally, do you have any advice to give to future GRC scholarship applicants?

CL: I really think that it’s important that you understand the scope of your project. You can only do so much. You need to tailor your proposal to the organization and to the amount of money that they are funding. If they want results back from you at a certain time, be sure you can accomplish what you say you can accomplish in that given time. Make it easy to read. Be really clear in what you’re going to do. Fill the application out correctly. A lot of applications get tossed out, simply because people did not follow the rules, so write a really nice succinct proposal, do it right, and submit it on time. The GRC get quite a few applicants, but they don’t get a thousand. You just have to put your neck out there and be willing to apply for them. Just because somebody tells you no, it does not mean your work is not valid. It just means that they had other things they wanted to fund that day. Just keep trying and go to the next place. Try again next year. Take the feedback to heart and make the adjustments and understand that everybody wants you to succeed. Nobody is out to crash your dreams or anything. Also, talk to other people who have been successful with it, and see what works for them.

We thank Cary for participating in this interview. We hope to extend this work to future Bulletins, either in interview Q & A format (like this one) or as a more detailed profile of other past GRC scholarship winners or of any professional or academic in the geothermal industry. If you’d like to nominate anyone (even yourself!) to be featured in future editions, please contact Anh Lay at alay@geothermal.org.

The Geothermal Resources Council (GRC) has announced the 2018 GRC Scholarship Awards:

• Three (3) GRC Undergraduate Scholarship Awards – to be eligible for one of these awards, the candidate must be a third or fourth year undergraduate at an accredited academic institution at the time of the award (Fall 2018). The award will consist of a $250 stipend and travel expenses to attend the GRC Annual Meeting. Each recipient will be required to either present at the meeting (poster or paper such as from a senior thesis) or prepare a report for the GRC Bulletin describing what they learned from attending the meeting and how they would utilize what they learned for their educational or career path.

• Five (5) GRC Graduate Scholarship Awards of $2500 – to be eligible for one of these awards, the candidate must be enrolled in a graduate-level program at an accredited academic institution at the time of the award (Fall 2018). Each recipient is required to submit a paper on his/her research (or research progress) to be published in the GRC Transactions and deliver results at the meeting as either a poster or oral presentation. If the recipient presents in the year of the award then the full $2500 is awarded; if the recipient defers to present/publish the following year then $750 is withheld to cover travel expenses for when the recipient presents.

More information on the GRC Website at: https://geothermal.org/students.html#scholarships

If you have any questions regarding the GRC Scholarship Awards, please contact Brian Schmidt at bschmidt@geothermal.org or (530)758-2360, ext. 104.