Cary Lindsey, PhD

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Education

PhD, Geology University of Idaho Moscow, ID May 2018
Advisor: J.P. Fairley; Dissertation: *Statistical and Spatial Analysis of Heat and Mass Transport in the Yellowstone Caldera*.

BSc, Geology Mississippi State University Starkville, MS August 2013
Manga Cum Laude
Advisor: Dr. Brenda Kirkland, Senior Honors Thesis: *Geothermal Energy Potential in Oktibbeha County: Is Mississippi Really Hot?*

AAs, Physics Itawamba Community College Fulton, MS May 2011
With Special Honors

Professional Appointments

Research Geologist
Great Basin Center for Geothermal Energy 2023–present
Nevada Bureau of Mines and Geology, University of Nevada Reno

Strengthening the capacity of foreign countries to develop their geothermal energy resource base. DOS S-LMAQM-17-CA-1186. PI: Dr. Maria Richards

INnovative Geothermal Exploration through Novel Investigations of Undiscovered Systems INGENIOUS. PI: Dr. James Faulds

Research Geologist - Mendenhall Postdoctoral Scholar
GMEGSC 2021–2023
U.S. Geological Survey

Machine Learning Applications for Assessment of Geothermal Resources

Postdoctoral Scholar
Great Basin Center for Geothermal Energy 2018–2021
Nevada Bureau of Mines and Geology, University of Nevada Reno

Strengthening the capacity of foreign countries to develop their geothermal energy resource base. DOS S-LMAQM-17-CA-1186. PI: Dr. Bridget Ayling

Collaborative Research: Applications of Machine Learning Techniques to Geothermal Play Fairway Analysis in the Great Basin Region, Nevada. DE-FOA 0001956. PI: Dr. James Faulds. Multiple agencies.

Instructor
Great Basin Center for Geothermal Energy 2019
Nevada Bureau of Mines and Geology, University of Nevada Reno

Geothermal Geostatistics, National Geothermal Academy

Graduate Research Assistant
University of Idaho 2013–2018
Collaborative Research: Constraining heat flux from the shallow geothermal system, Yellowstone Caldera, Wyoming. NSF/EAR 1250381. University of Idaho/Washington State University.

New exploration methods applied to previously studied Known Geothermal Resource Areas in Southern Idaho and Eastern Oregon. DOE EERE 154756. University of Idaho/Idaho National Laboratory/Lawrence Berkeley National Laboratory.

Special Topics Instructor
University of Idaho 2017-2018

Power law Distributions in Fracture Networks, Geothermometry, Geostatistics

Teaching Assistant
University of Idaho 2017–2018
Geology 101 Lecture & Lab

Workshop Instructor
University of Idaho 2015
Refraction Seismology

Intern
Southeast Energy Efficiency Alliance 2012–2013

Compile and communicate data regarding southeast energy profile to local, state, and national decision-making agencies; educate local municipalities on new sustainable building code rollouts and enforcement.

Related Profession Skills and Training

- National Geothermal Academy, Conceptual Modeling Workshop, Great Basin Center for Geothermal
- Leapfrog Geothermal Training Course, Great Basin Center for Geothermal Energy
- TOUGH2 Workshop, Lawrence Berkeley National Laboratory
- Near Surface Geophysics for Hydrology Short Course, CUAHSI at University of Arizona
- National Geothermal Academy, Great Basin Center for Geothermal Energy
- Various Coding and Modeling Workshops, Courses & Training

Peer Reviewed Publications

Lindsey, C.R., Ayling, B.F., Asato, G., Seggiaro, R., Carrizo, N., Marquetti, C., Naón, V., Conde Serra, A., Faulds, J., and Coolbaugh, M., 2020, Play fairway analysis for geothermal exploration in north-western Argentina: *Geothermics*, v. 95, 102128, https://doi.org/10.1016/j.geothermics.2021.102128.

Lindsey, C.R., Neupane, G., Spycher, N., Fairley, J.P., Dobson, P., Wood, T.R., McLing, T., and Conrad, M., 2018, Cluster analysis as a tool for evaluating the exploration potential of known geothermal resource areas: *Geothermics*, v. 72, p. 358–370, https://doi.org/10.1016/j.geothermics.2017.12.009.

Lubenow, B.L., Fairley, J.P., Lindsey, C.R., and Larson, P.B., 2016, Influences on shallow ground temperatures in high flux thermal systems: *Journal of Volcanology and Geothermal Research*, v. 323, p. 53–61, https://doi.org/10.1016/j.jvolgeores.2016.04.039.

McMillan, N., Larson, P.B., Fairley, J.P., Mulvaney-Norris, J., and Lindsey, C.R., 2018, Direct measurement of advective heat flux from several Yellowstone hot springs, Wyoming, USA: *Geosphere*, v. 14, https://doi.org/10.1130/GES01598.1.

Mordensky, S.P., Lipor, J.J., DeAngelo, J., Burns, E.R., and Lindsey, C.R., 2023, When less is more: How increasing the complexity of machine learning strategies for geothermal energy assessments may not lead toward better estimates: *Geothermics*, v. 110, 102662, https://doi.org/10.1016/j.geothermics.2023.102662.

Olvera-Garcia, E., Simbe, S., Mangahas, L., Marbello, A., Mandig, A., Alcantara, C.S., Ayling, B., Richards, M., Wilmarth, M., and Lindsey, C.R., 2024, Expert-driven geothermal play fairway analysis for low to medium temperature hidden systems in northwestern Luzon Island, Philippines: *Geothermics*, v. 123.

Price, A.N., Lindsey, C.R., and Fairley, J.P., 2017, Interpretation of ground temperature anomalies in hydrothermal discharge areas: *Water Resources Research*, v. 53, no. 12, p. 10173–10187, https://doi.org/10.1002/2017WR021077.

Price, A.N., Fisher, A.T., Lindsey, C.R., Stauffer, P.H., and Gable, C.W., 2023, The influence of permeability anisotropy in the upper ocean crust on advective heat transport by a ridge-flank hydrothermal system: *Earth and Planetary Science Letters*, v. 619.

Extended Abstracts and Professional Papers

Caraccioli Salinas, P.D., Mordensky, S.P., Lindsey, C.R., Burns, E.R., and Lipor, J.J., 2023, Don’t let negatives hold you back: Accounting for underlying physics and natural distributions when selecting negative training sites leads to better machine learning predictions: Geothermal Rising Conference *Transactions*, v. 47.

DeAngelo, J., Burns, E.R., Mordensky, S.P., and Lindsey, C.R., 2023, Detrending Great Basin elevation to identify structural patterns for identifying geothermal favorability: Geothermal Rising Conference *Transactions*, v. 47.

DeAngelo, J., Burns, E.R., Gentry, E., Batir, J.F., Lindsey, C.R., and Mordensky, S.P., 2023, Development of shallow (2-m) temperature survey standard operating procedures and interpretation workbook: *Proceedings* of the 48th Workshop on Geothermal Reservoir Engineering.

Faulds, J., Brown, S., Coolbaugh, M., DeAngelo, J., Queen, J.H., Treitel, S., Fehler, M., Mlawsky, E., Glen, J., and Lindsey, C.R., 2020, Preliminary report on applications of machine learning techniques to the Nevada geothermal play fairway analysis: *Proceedings* of the 45th Workshop on Geothermal Reservoir Engineering.

Hart-Wagoner, N., Coolbaugh, M., Faulds, J., Mlawsky, E., Lindsey, C., Trainor-Guitton, W., and Brown, S., 2024, Preliminary regional play fairway workflow for the Great Basin region, USA: *Proceedings* of the 49th Workshop on Geothermal Reservoir Engineering.

Kraal, K., Lindsey, C.R., Zimmerman, J., Sladek, C., and Burgess, Q., 2024, New maps of conductive heat flow in the Great Basin, USA: Separating conductive and convective influences: *Proceedings* of the 49th Workshop on Geothermal Reservoir Engineering.

Lindsey, C.R., Price, A.N., and Burns, E.R., 2022, Exploring declustering methodology for addressing geothermal exploration bias: Geothermal Rising Conference *Transactions*, v. 46.

Lindsey, C.R., Ayling, B.F., Coolbaugh, M., Faulds, J., Conde Serra, A., Asato, G., Naón, V., Marquetti, C., Seggiaro, R., Carrizo, N., Peroni, J., Kaufman, J., Larcher, N., Castro, S., Azcurra, D., Elissondo, M., Carballo, F., Balbi, A., and Castano, M., 2021, Development of play fairway analysis for geothermal exploration in Argentina: *Proceedings* of the World Geothermal Congress.

Lindsey, C.R., and Golla, J.K., 2019, Multivariate statistical method validation using aqueous geochemistry from Yellowstone National Park: Geothermal Rising Conference *Transactions*, v. 43.

Lindsey, C.R., Trainor-Guitton, W., Ayling, B.F., and Poux, B., 2020, Statistical modeling of subsurface temperatures in the Great Basin: *Proceedings* of the 45th Workshop on Geothermal Reservoir Engineering.

Lindsey, C.R., Fairley, J.P., and Larson, P.B., 2019, Dimensional analysis calculation of conductive heat flux in Lower Geyser Basin, Yellowstone National Park, Wyoming: *Proceedings* of the 44th Workshop on Geothermal Reservoir Engineering.

Lindsey, C.R., Fairley, J.P., Larson, P.B., and McMillan, N., 2015, Stochastic modeling and analysis of temperature data from hot springs in Yellowstone Caldera, Wyoming, USA: *Transactions* of the Geothermal Resources Council, v. 39.

Lindsey, C.R., Lubenow, B., Fairley, J.P., and Larson, P.B., 2015, Ice box calorimetry: A test of applicability in non-steaming geothermal areas: *Transactions* of the Geothermal Resources Council, v. 39.

Lindsey, C.R., 2012, Geothermal energy potential in Oktibbeha County: Is Mississippi really hot?: *Transactions* of the Geothermal Resources Council, v. 36.

Lindsey, C.R., 2012, Evaluation of geothermal energy potential in the Mississippi counties of the Black Warrior Basin: Gulf Coast Association of Geological Societies *Transactions*, v. 62.

Mordensky, S.P., Lipor, J.J., Burns, E.R., and Lindsey, C.R., 2022, What did they just say? Building a Rosetta Stone for geoscience and machine learning: Geothermal Rising Conference *Transactions*, v. 46.

Mordensky, S.P., Lipor, J.J., DeAngelo, J., Burns, E.R., and Lindsey, C.R., 2022, Predicting geothermal favorability in the western United States by using machine learning: Addressing challenges and developing solutions: *Proceedings* of the 47th Workshop on Geothermal Reservoir Engineering.

Smith, C., Faulds, J., Brown, S., Coolbaugh, M., Lindsey, C., Teritel, S., Ayling, B., Fehler, M., Gu, C., and Mlawsky, E., 2021, Characterizing signatures of geothermal exploration data with machine learning techniques; an application to Nevada play fairway analysis: *Proceedings* of the 46th Workshop on Geothermal Reservoir Engineering.

Trainor-Guitton, W., Lindsey, C.R., Boyd, D.L., Ayling, B.F., and Mlawsky, E., 2021, Development of a geostatistical thermal model of the Great Basin region, western USA: *Proceedings* of the World Geothermal Congress.

Data Releases

DeAngelo, J., E.R. Burns, E. Gentry, J.F. Batir, **C.R. Lindsey**, S.P. Mordensky, 2022. Heat flow maps and supporting data for the Great Basin, USA, US Geological Survey Data Release. https://doi.org/10.5066/P9V5SQRD

Presentations & Posters

Aunan, M. M., C. R. Lindsey, A. N. Price, J. P. Fairley, and P. B. Larson, 2015. Characterizing hot spring connectivity using aqueous geochemistry in the River Group springs, Yellowstone NP, Wyoming. AGU annual meeting, San Francisco CA (poster).

Fairley, J. P., P. B. Larson, C. R. Lindsey, G. A. Villegas, M. M. Aunan, S. H. Nickelson, and A. N. Price, 2015. Comparing shallow ground temperatures in acid-sulfate and high-chloride, circum-neutral hydrothermal discharge areas, Yellowstone National Park, Wyoming. GSA annual meeting, Baltimore MD (poster).

Kirkland, B., C. R. Lindsey, C. Woodard, J. Simmons, G. Jasper, Joe D. Collins, N. Baghai-Riding, R. Tisdale, and G. Grant, 2012. Enhanced microbial precipitation of iron oxides in the Demopolis Chalk Formations. GSA annual meeting, Charlotte, NC (poster).

Lindsey, C.R., Golla, J., Multivariate Statistical Method Validation with Aqueous Geochemistry using Yellowstone National Park, Geothermal Resources Council Annual Meeting, 2019, Palm Springs, CA (oral).

Lindsey, C. R., G. Neupane, N. Spycher, J. P. Fairley, P. Dobson, T. R. Wood, T. McLing, and M. Conrad, 2017. Cluster analysis as a tool for evaluating the exploration potential of known geothermal resource areas. GSA annual meeting, Seattle WA (oral).

Lindsey, C. R., A. N. Price, M. M. Aunan, G. A. Villegas, and J. P. Fairley, 2016. Using a simple analytical model to test for equipment tampering at Porcupine Hill Geyser, Yellowstone National Park, Wyoming. GSA annual meeting, Denver CO (oral).

Lindsey, C. R., J. P. Fairley, and P. B. Larson, 2016. Geostatistical characterization of fluid pathway connection in hot spring clusters in the Lower Geyser Basin, Yellowstone National Park, Wyoming. GSA Rocky Mountain Section meeting, Moscow ID (oral).

Lindsey, C.R., J. Faulds, M. Richards, N. Wagoner, M. Coolbaugh, 2024. Evolution of Play Fairway Anaysis (PFA) from Regional to local scale: Argenta Rise study area. Geothermal Rising Annual Conference (poster).

Lindsey, C. R., A. N. Price, J. P. Fairley, and P. B. Larson, 2015. Calculating hot spring/atmosphere coupling using the coefficient of convective heat transfer. AGU annual meeting, San Francisco CA (oral).

Lindsey, C. R., B. L. Lubenow, N. J. McMillan, B. N. Jones, K. L. Schmidt, J. P. Fairley, and P. B. Larson, 2014. Applied ice box calorimetry for heat flux measurements. GSA annual meeting, Vancouver BC, Canada (poster).

Lindsey, C. R., A. N. Price, G. A. Villegas, J. P. Fairley, and P. B. Larson, 2015. Investigating a breached fault relay ramp with shallow seismic and temperature data. GSA annual meeting, Baltimore MD (poster).

Lubenow, B. L., C. R. Lindsey, N. J. McMillan, J. Meyers, K. L. Schmidt, J. P. Fairley, and P. B. Larson, 2014. Confirming robustness of shallow ground temperature measurements. GSA annual meeting, Vancouver BC, Canada (poster).

McMillan, N. J., P. B. Larson, J. P. Fairley, J. L. Mulvaney-Norris, A. Donnelly, G. Ching, and C. R. Lindsey, 2014. Mass flux measurements of hot springs in Yellowstone National Park using the deuterium oxide doping method. GSA annual meeting, Vancouver BC, Canada (poster).

Moody, A., C. R. Lindsey, B. L. Lubenow, J. P. Fairley, and P. B. Larson, 2014. Rain check: Variations in the geostatistical structure of ground temperature surveys, Yellowstone National Park, USA. GSA annual meeting, Vancouver BC, Canada (poster).

Nickelson, S. H., C. R. Lindsey, A. N. Price, and J. P. Fairley, 2015. Using shallow seismic refraction and ground temperatures to examine subsurface flowpaths at Burgdorf hot springs, Idaho. GSA annual meeting, Baltimore MD (poster).

Price, A. N., C. R. Lindsey, and J. P. Fairley, 2016. Analytical modeling of heat flux and subsurface flowpaths using shallow seismic refraction and ground temperatures at Burgdorf hot springs, Idaho. GSA Rocky Mountain Section meeting, Moscow ID (oral).

Price, A. N., C. R. Lindsey, J. P. Fairley, and P. B. Larson, 2015. Imaging near-surface controls on hot spring expression using shallow seismic refraction in Yellowstone National Park. AGU annual meeting, San Francisco CA (oral).

Villegas, G. A., C. R. Lindsey, M. M. Aunan, A. N. Price, J. P. Fairley, and P. B. Larson, 2016. Quantifying errors in heat flux measurements using a vertical sequence of thermocouple sensors, GSA Rocky Mountain Section meeting, Moscow ID (poster).

Villegas, G. A., M. M. Aunan, A. P. Sorensen, C. R. Lindsey, J. P. Fairley, and P. B. Larson, 2016. Preliminary reconnaissance of West Astringent Creek thermal area, Yellowstone National Park. AGU annual meeting, San Francisco CA (poster).

Media

Mlawsky, Elijah and Lindsey, Cary. “GIS-Based Predictions Advance Geothermal Energy Exploration.” ArcNews, ESRI. Winter 2024.

Service

- Technical Co-Chair, Geothermal Rising Annual Conference (2024)
- National Renewable Energy Laboratory Geothermal Student Competition Judge (2020 -)
- Department of Energy Geothermal Design Challenge Advisory Committee (2020)
- Review Committee, Nevada Undergraduate Research (2020)
- Global Leadership Team and Ambassador for Central America and the Caribbean, Women in Geothermal (WinG) (2020-2022)
- Annual Meeting Committee Student Engagement and Outreach Chair, Geothermal Resources Council (2020)
- Annual Meeting Committee Member at Large, Geological Society of America (2019-2021)
- Membership Chair, Nevada Petroleum and Geothermal Society (2018-2020)
- Volunteer Coordinator, Geological Society of America Rocky Mountain Section Meeting (2016)
- Member, Committee on the Status of Women, University of Nevada Reno (2024 -)
- Member, Campus Food Service Advisory Committee, University of Nevada Reno (2024 -)
- Member, Service Learning Council, University of Nevada Reno (2024 -)
- Reviewer: Geosphere & Geothermics (ongoing)
- Annual Technical Review Committee & Session Chair, Geothermal Rising (2019-2023)

Professional Affiliations

- Geothermal Resources Council, 2012–present
- International Geothermal Association, 2012–present
- Women in Geothermal (WING), 2013–present
- Geological Society of America, 2012–present.
- Association for Women Geoscientists, 2012–present
- American Geophysical Union, 2015–present
- International Association of Hydrogeologists, 2017
- Nevada Petroleum and Geothermal Society, 2018–present
- International Association of Volcanology and Chemistry of the Earth’s Interior, 2020–present