



Career Pathways in Geothermal Energy

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My Background

- Bachelor & Master of Science in Geology
 - Thesis - structural controls of geothermal systems
- Geothermal exploration & development with a private company & as an independent consultant
 - Analysis of systems in over 40 countries
- Geothermal Analyst at NREL
 - Financial analysis, market research, and geologic and geophysical exploration studies to reduce geothermal costs and increase deployment



Geothermal Employers

- Power plant owners/operators
- Consulting firms
- Service companies
- National Labs



Geothermal Careers



- Science: geologists, geochemists, geophysicists, hydrologists, ecologists
- Engineering: reservoir engineers, well testing, electrical, environmental, mechanical
- Drilling: rig operators, drillers, roustabouts
- Construction: carpenters, equipment operators, electricians, plumbers
- Operations: plant managers, suppliers, maintenance staff
- Permitting
- Business Development
- Finance

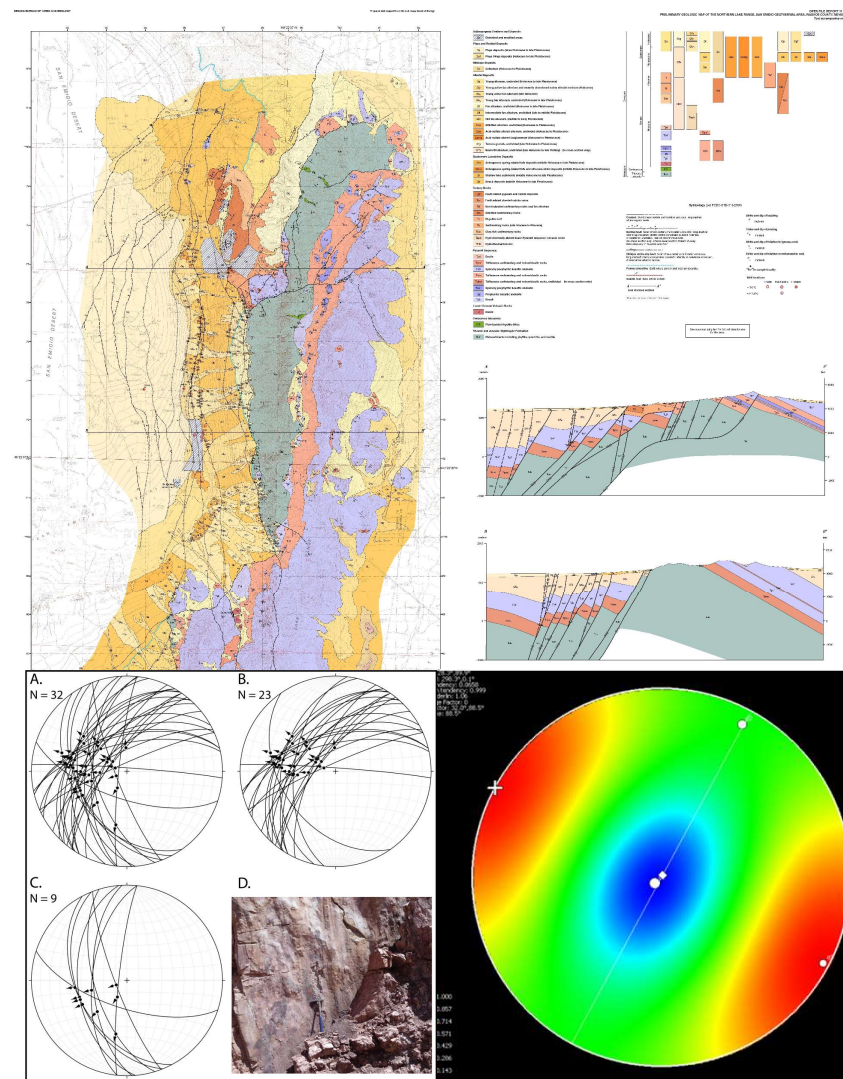
Source: Bureau of Labor Statistics https://www.bls.gov/green/geothermal_energy/geothermal_energy.htm#occupations

Useful Degrees & Certifications

Bachelor through post-doc

Others to consider:

- Professional Geologist license
- MBA
- GIS certificate

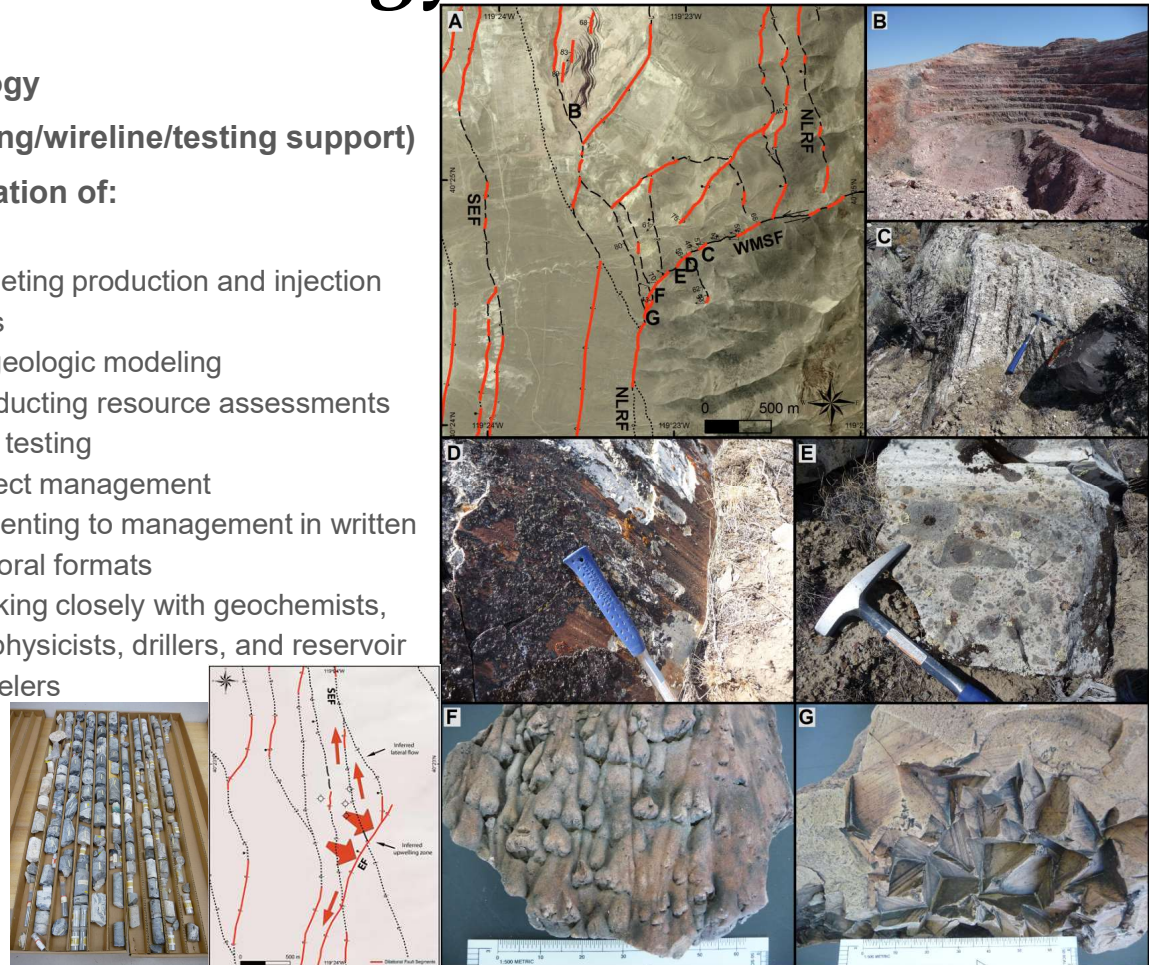


Useful Coursework

Structure	Geochemistry	GIS
Hydrology	Geophysics (potential fields, EM, seismology)	Remote Sensing
Field mapping	Sedimentology/Stratigraphy	CS/Programming (Python etc.)
Mineralogy	Hydrothermal Alteration & Ore Deposits	Statics/Thermodynamics
Petrology	Drilling Engineering	Fluid Mechanics/Hydrodynamics
Geomechanics	Basin Analysis/Sequence Stratigraphy	3D Modeling/Reservoir Simulation
Reservoir/Petroleum Engineering (EOR)	Volcanology	Machine Learning
Petrophysics		Statistics/Calc/Trig/Diff EQ
		Writing/Public Speaking

Typical Activities: Geology

- Exploration/Development/Operations geology
- Wellsite geology (core & mudlogging, drilling/wireline/testing support)
- Job duties will likely include some combination of:
 - Reviewing and organizing existing datasets
 - Data mining
 - Mapping of geologic framework, alteration, and geothermal surface manifestations
 - Constructing cross sections
 - Structural analysis
 - Borehole image log analysis
 - Drill cuttings analysis
 - Thin section & XRD analysis
 - Planning and interpreting geophysical surveys
 - Building conceptual models with geologic, geochemical, and geophysical data
 - Targeting production and injection wells
 - 3D geologic modeling
 - Conducting resource assessments
 - Well testing
 - Project management
 - Presenting to management in written and oral formats
 - Working closely with geochemists, geophysicists, drillers, and reservoir modelers



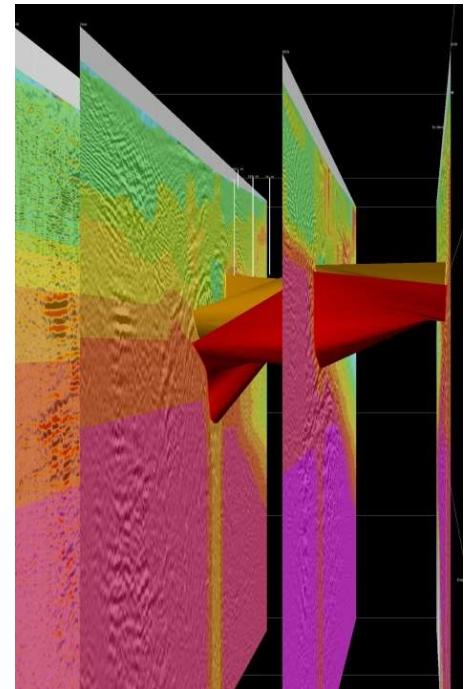
Typical Activities: Geochemistry

- **Aqueous and gas sampling of:**
 - Hot springs and fumaroles
 - Gas and brine during well tests and from operating fields
- **Analyze and model data to:**
 - Aid in exploration and building conceptual models
 - Guide and maintain optimum production and injection in operating fields
- **Work closely with geologists for co-interpretation of data and updating models**
- **Design and implement tracer tests to coordinate with reservoir modelers**
- **Monitor plant operations to prevent corrosion and scaling**
- **Presenting to management in written and oral formats**



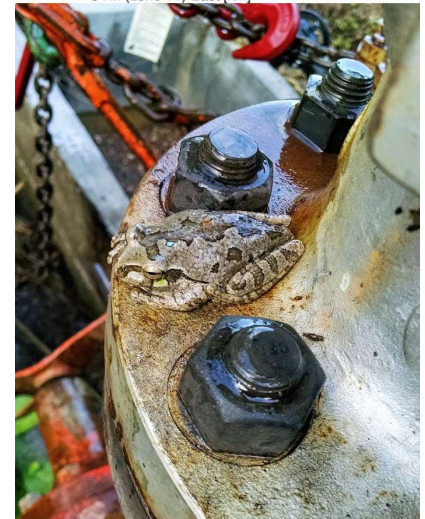
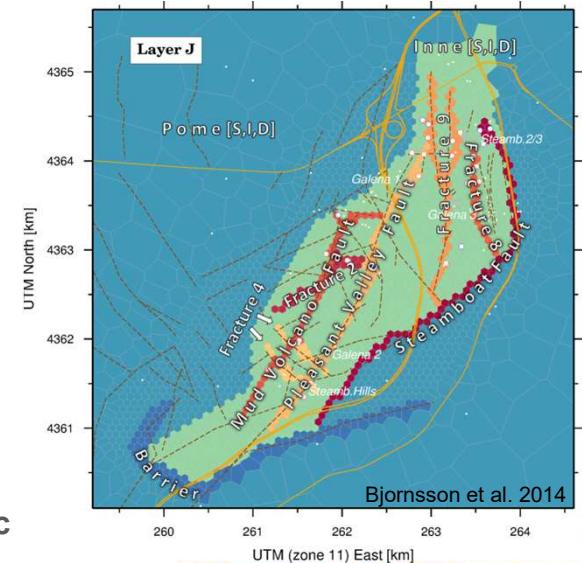
Typical Activities: Geophysics

- **Work closely work other specialties to design and oversee geophysical surveys**
- **Interpret results and incorporate into geologic and conceptual models**
- **Electromagnetics and potential fields:** Magnetotellurics (MT), gravity, and magnetics, for exploration and development of resources. Usually working closely with both geologists and geochemists in exploration and development. Contributing to conceptual models, resource assessments, well targeting. Responsible for design of surveys, managing subcontractors and/or field teams, modeling data.
- **Seismology:** Designing and monitoring of micro-earthquake arrays for operating fields to assist with understanding reservoir management, particularly injection.
- **Reflection seismology:** Not used extensively in geothermal but depends on the setting. Geophysicists and geologists work together for interpretation and sometimes to design new data acquisition.



Typical Activities: Resource Engineers & Modelers

- Design well test programs and equipment
- Implement testing of new wells
- Support power plant operations for developed fields with well tests as needed
- Collect and model data
- Can be conducted by people with the following background: geologists, geochemists, reservoir engineers, and civil engineers, but does require specific training.
- Develop, maintain, and test numeric reservoir models
 - Power capacity estimates
 - Wellfield operations
 - Well targeting
- Works closely with well testing person, geologists, and geochemists



Potential Internships

Open Mountain Energy (currently posted)

National Labs: NREL, LBNL, SNL, INL, LLNL, ANL, ORNL, LANL, NETL, BNL, Ames
(e.g. SULI – Science Undergraduate Laboratory Internships)

DOE: Internships, fellowships, Science Graduate Student Research program

Ormat Technologies Inc.

Calpine

Fervo Energy

Geologica

Iceland School of Energy



Resources

Geothermal Resources Council (scholarships)

International Geothermal Association

Stanford Geothermal Workshop

OpenEI.org

Great Basin Center for Geothermal Energy

Think GeoEnergy (news, jobs, internships, etc.)

Women in Geothermal (WING)

World Geothermal Congress

New Zealand Geothermal workshop

Nevada Petroleum & Geothermal Society

(many conferences & associated courses are either free or offer reduced prices for students)

Geothermal Programs at Universities

[Stanford University](#)

[University of California, Davis](#)

[Southern Methodist University](#)

[University of Utah](#)

[Cornell University](#)

[University of North Dakota](#)

[Oregon Institute of Technology](#)

[University of Nevada, Reno](#)

[Idaho State University](#)

[University of Dayton](#)

[University of Texas, Austin](#)

[University of British Columbia](#)

[National Geothermal Academy](#)

[Institut Teknologi Bandung](#)

[University of Auckland](#)

[Boise State University](#)

[Texas A&M University](#)

[Tohoku University](#)

[Colorado School of Mines](#)

[Hebei University of Technology](#)

[Kyushu University](#)

[Pennsylvania State University](#)

[San Diego State University](#)

Thanks for Listening & Questions

