How does a Professional Geologist

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What Does a Professional Geologist Do
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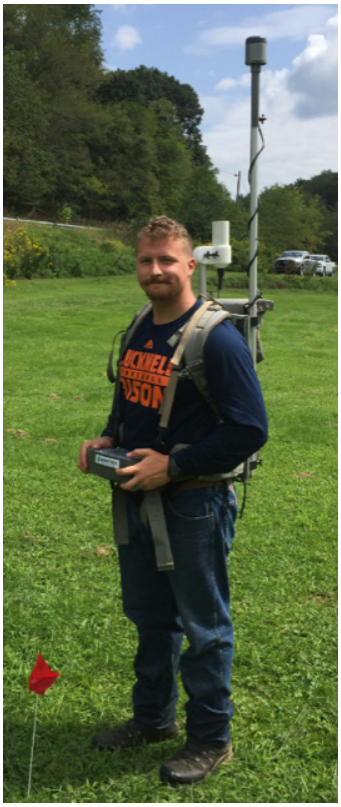
UTILIZE GEOPHYSICS

Geophysics is a geologic specialty that requires additional training in math and physics. A geophysicist applies these principles to remotely characterize various subsurface features that a Professional Geologist (PG) uses in different types of investigations.

- A geophysicist can be licensed as a PG. Investigation and exploration project teams often include a geophysicist as a critical team member.
- The project team investigates a target site by compiling extensive background info and identifying data gaps to be addressed by geophysical methods.
- The team's geophysicist reviews the existing data and will often use forward computer models to examine the feasibility of various geophysical methods before deciding on the most effective approach.
- The geophysicist coordinates schedules with the land owner, collects and processes the data, and interprets the final results often using inverse computer models and 2-D or 3-D data gridding algorithms.
- PGs working in energy and mineral resources, environmental and water resources, and the engineering sector can use different geophysical methods to effectively and efficiently focus their data needs.



Magnetometer and GPS configuration for detailed mapping of abandoned gas wells, Appalachian Basin.

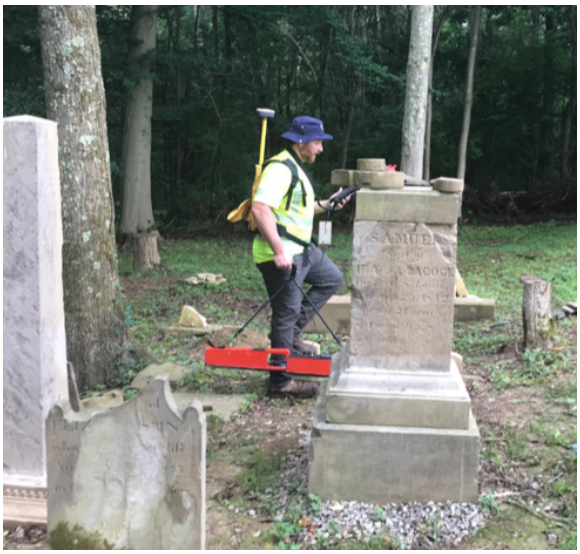
Geophysical Well Logging Methods

- Interpreting geophysical well logs can optimize locations for hydrocarbon or water resource extraction, help prove reserves for mining projects, and for contaminant investigations and remediation efforts.
- After drilling a borehole, logging tools are lowered in the open hole that measure the physical properties of the rocks, such as bulk electrical resistivity, the abundance of hydrogen atoms, or the configuration of the electron cloud surrounding various atoms that comprise the rock matrix and fluid in the pore spaces.
- These geophysical responses are a surrogate for identifying such things as rock type, pore fluid composition, and saturation along with the rock porosity and density.
- The geophysical well logs are correlated to understand local/regional stratigraphy and structure and to help select the best intervals for water or hydrocarbon extraction.
- Geophysical well logging can also determine the effectiveness of the grout used to seal the well casings in place, which is referred to as the well completion integrity.

Seismic Methods

- A geophysicist uses seismic surveys to focus data collection for exploration, engineering, or environmental projects when a large number of test pits or borings are not cost effective due to a large project area, a deep target zone, or a need for high-resolution subsurface characterization.
- Seismic methods measure the time for an acoustic wave to travel from its source to a target and back to the surface where an array of geophones measure its characteristics and it is recorded by a seismograph.

- Reflected acoustic compressional and shear waves create an image of the subsurface stratigraphy to extract rock and pore fluid properties. This data is used to create models of the near surface stratigraphy.
- Environmental or engineering PGs can extract overburden and bedrock properties to correlate rock stratigraphy, identify faults or discontinuities, determine depths to specific features, such as a targeted formation top for exploration, estimate rippability for infrastructure/engineering projects, or to provide high resolution 2-D or 3-D images for environmental work (i.e. contaminant migration).



Using electromagnetic induction methods to map grave locations at an abandoned cemetery, Pennsylvania.

Electrical Methods

- Electrical surveys are divided into three general categories, (1) electromagnetic induction (EMI), (2) ground penetrating radar (GPR), and (3) galvanic resistivity.
- Near surface EMI can rapidly screen areas for the presence of buried archeological features, buried hazards and contaminated soil or groundwater.
- Deep EMI is used by a geophysicist to map conductive features associated with ore deposits, water filled fractures, or to examine coastal water areas for salt water intrusion.
- GPR is often used to delineate and estimate the buried depth of utilities, pipes or underground storage tanks, and to map near surface stratigraphy and buried archeological features.
- Galvanic resistivity can map near surface features and stratigraphy in areas of electrically resistive soil (e.g. sand) or bedrock (e.g. granite). Typical uses include mapping karst features for foundation design, delineating sand and gravel deposits for mining, identifying rock fractures for water resources or contaminant investigations, or monitoring landfills or earthen dams for engineering studies.

Gravity and Magnetic Methods

- A geophysicist uses gravity surveys to delineate karst features and voids to assist with foundation design projects, identify salt domes, pillows, and anticline cores along with rock structure for energy resources and map buried valleys for water resources projects.
- Magnetic surveys are used to map ore deposits or rock structure for energy resources, detect buried hazards like metal drums or abandoned well casings, and to detect unexploded ordinance (weapons).

Work Resources:

AutoCAD/GIS, data processing and presentation software with forward and inverse modeling capabilities, 2-D and 3-D data gridding software, seismic and GPR data processing software.

Work Environment:

Office and field work. Field work often entails irregular or long hours working weekdays and weekends in varying and difficult outdoor conditions throughout the year.

Helpful Skills & Experience:

Landowner relations, ability to work in remote areas in close quarters with small project teams to meet aggressive schedules, ability to compile, organize, and analyze large amounts of data using really cool software.

Tools of the Trade:

Field book, multimeter, soldering iron, survey stakes or pin flags, survey tape, tape measure, camera, portable field-hardened computer, data transfer cables, data loggers, high accuracy GPS, ATV, brush cutting and geophysical equipment.