Basic Openhole Log Interpretation
Daniel A. Krygowski, Senior Petrophysical Advisor, The Discovery Group

The Discovery Group offers a course in basic openhole log interpretation for your people, at your location, at a date convenient to your needs and internal schedules. The course will benefit geologists, engineers, geophysicists, and geotechs, and can be of benefit to other specialists who routinely work with those geotechnical specialists. The best class size is from about 10 to 25 people from a variety of specialties who can share their professional experiences in the context of a greater understanding of petrophysics.

Synopsis: The course assumes no logging knowledge, and seeks to establish an understanding of basic petrophysical measurements and interpretation techniques which can be applied to routine tasks, and upon which more complex and advanced information and techniques can be built.

The course:
- Offers a “hands-on” approach to basic openhole well log analysis and interpretation;
- Focuses on the traditional interpretation targets of lithology, porosity, and fluid saturation;
- Introduces a variety of interpretation techniques in the context of the availability of newer, more extensive, data;
- Is organized by the targets, or goals of the measurements, rather than by the physics of the measurements.

The course strives to provide a strong and coherent foundation for the understanding of other specialized interpretation techniques involving well log data, which are not covered here.

Course topics include:
- An overview of petrophysical well log data acquisition;
- Description of the common openhole measurements; acoustic, nuclear, and electrical;
- Determination of lithology, porosity, fluid saturation, and other properties from those measurements;
- Use of algorithmic and graphical techniques to determine those properties from the measurements that are made;
- Interpretation exercises to reinforce the interpretation methods that are covered.

Length: Three days

Equipment needed: Calculator with exponent functions, straight-edge, pencil or pen.

Topics for each of the log measurements follow the same sequence and information:
- Measurement goals
- Physics of the measurement, including the volume of investigation
- Operational parameters; conditions under which the measurement is best made
- Measurement names; tool and curve names from different vendors
- Log example; usually in the context of other measurements
- Interpretation details; details of the measurement goals
- Secondary effects: the environments and assumptions which affect the measurement and its interpretation
- Environmental corrections
- Quality control
- An exercise related to the primary interpretive goal
Basic Openhole Log Interpretation
Daniel A. Krygowski, Senior Petrophysical Advisor, The Discovery Group

Agenda: The times shown are best estimates based on previous presentations of the course. The times will vary to some extent, depending on the questions and comments of the class. Questions and comments based on the experience of the class participants are welcome, and often provide insights to local conditions and methods which would not otherwise be presented.

While formal break times are noted in the schedule, shorter breaks are often taken, as dictated by class needs.

Day 1
8:00 to 9:45  Course Logistics, Introduction
9:45 to 10:00  Break
10:00 to 12:00  Correlation/Lithology logs: SP, gamma ray, caliper, tension
12:00 to 1:00  Lunch
1:00 to 2:30  Correlation/Lithology logs, continued
2:30 to 2:45  Break
2:45 to 4:30  Porosity logs; sonic, density, and neutron

Day 2
8:00 to 9:45  Porosity logs, continued
9:45 to 10:00  Break
10:00 to 12:00  Porosity log combinations: lithology and better porosity
12:00 to 1:00  Lunch
1:00 to 2:15  Porosity log combinations, continued
2:15 to 2:30  Break
2:30 to 3:30  NMR, or Dielectric, or Gamma ray and Neutron spectroscopy
3:30 to 4:30  Resistivity introduction

Day 3
8:00 to 9:45  Deep resistivity logs; induction and laterologs
9:45 to 10:00  Break
10:00 to 10:45  Microresistivity logs; sensing close to the borehole, and why
10:45 to 12:00  Archie’s saturation equation and it’s parameters
12:00 to 1:00  Lunch
1:00 to 2:30  Saturation and parameters from pattern recognition techniques
2:30 to 2:45  Break
2:45 to 4:00  Water saturation and bulk volume water
4:00 to 4:30  Course summary

Time for hands-on exercises, which the class can do individually or in small groups, is included in the above schedule.

NOTE: While materials are available for Nuclear Magnetic Resonance, Dielectric, and Gamma Ray and Neutron Spectroscopy logging (and a common class time listed for those topics), those topics will be covered as time is available and based on the interest of course participants. It is possible that the material in those sections will not be covered in the available class time.
Basic Openhole Log Interpretation
Daniel A. Krygowski, Senior Petrophysical Advisor, The Discovery Group

About the instructor:

Dan Krygowski is a Senior Petrophysical Advisor with The Discovery Group, which he joined in late 2006. He has over 30 years of experience in the art and science of petrophysics, and in the development and design of petrophysical software. Dan earned a B.A. in Physics from the State University of New York at Geneseo. After earning M.S. and Ph.D. degrees in geophysics from the Colorado School of Mines (with a focus on petrophysics), he joined Cities Service Company, and worked in Denver and Tulsa. After CITCO, he joined Atlantic Richfield Company (ARCO). In both companies he gained experience in a variety of geologic and geographic areas in both technical and management positions in petrophysics.

After ARCO, he joined Landmark Graphics, and was a member of the PetroWorks development team as the team’s petrophysical Subject Matter Expert. He was also involved in interface design, and development of documentation and training materials. When Landmark closed its Austin, Texas office, Dan joined Chevron, working in deep Gulf of Mexico and Chad, Africa projects. He also supported internal petrophysical training efforts.

Since the late Cretaceous, Dan has taught the AAPG Basic Well Log Analysis course annually with Dr. George Asquith of Texas Tech University. Dan also teaches Basic Openhole Log Interpretation, a similar, but shorter course, and Petrophysics Elements, a much longer, lower-intensity course meant to delve deeper into petrophysical information and methods as part of participants’ regular job duties. Both are taught through direct client requests.

In these courses, and in others in development, Dan’s approach is one of sharing information, in that the experience of those attending a course can enlighten the group and provide a better understanding of the underlying science and the interpretive methods that are discussed. Participants are encouraged to share their knowledge and work together to increase the overall awareness of the topics covered.

In 2004, AAPG published George and Dan’s book, Basic Well Log Analysis, a second edition of George’s 1983 similarly-named book which was one of the AAPG’s all-time best selling publications.

Dan is a member of the Society of Petrophysicists and Well Log Analysts (SPWLA), American Association of Petroleum Geologists (AAPG), Society of Petroleum Engineers (SPE), Society of Exploration Geophysicists (SEG), the Denver Well Logging Society (DWLS), and the Rocky Mountain Association of Geologists (RMAG). He is a Texas Registered Professional Geoscientist.

Dan can be contacted at:
   DanKrygowski@Discovery-Group.com
   303.831.1515 x24