WELLSITE GEOLOGY

Petroleum Geoengineering MSc
2020/21 I. semester

MFFTT710007

COURSE COMMUNICATION FOLDER

University of Miskolc
Faculty of Earth Science and Engineering
Institute of Mineralogy and Geology

Course Title: Wellsite geology	Credits: 3

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **lec.1, sem. 2**

Neptun code: MFFTT710007

Type of Assessment(exam. / pr. mark. / other):**pr. mark**

Exercise: solving a task in a virtual drilling programme using the tools and software introduced during the course.

Grading limits:

90-100%: excellent,
80-89%: good,
70-79%: medium,
60-69%: satisfactory,
0-59%: unsatisfactory.

Position in Curriculum (which semester): **third**

Pre-requisites *(if any)*:

Course Description:

Acquired store of learning:

Study goals:The topic introduces the tasks and roles of a wellsitegeologist during drilling, well-test and production operations in cooperation with the drilling supervisor, the rig personnel, subcontractors and the company's office. It provides an integrated knowledge base how to control, evaluate and document the respective data from the geological point of view and assists to the operative decision makers. Up-to-date tools and equipment sets assisting the geologists are shown.

Course content:Preparing a well-logging programme; tools for sampling, evaluating, describing and analyzing the formations; records and reports; decision points during drilling; log types, wireline logging and logging while drilling; temperature, caliper, resistivity, self potential, gamma ray, neutron, sonic and acoustic logs and the uses of these; mud-logging; log interpretation; coring technologies, working with cuttings and core samples; drilling hazards and drilling bit optimization; integration with seismic and sequence stratigraphy.

Education method:Lectures with presentation slides, exercises on sheets and with computer.

Competencies to evolve:

T1, T3, T4, T5, T6, T8, T9, T12, K2, K4, K5, K6, K7, K10, A1

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- Seubert B.W. The Wellsite Guide. An introduction to Geological Wellsite Operations. 1995, 135p.
- Asquith, G. B; Gibson, C. R: Basic well log analysis for geologists. American Association of Petroleum Geologists, 1982, 216 p.
- Wellsite Geology. Reference Guide. Baker Hughes INTEQ.
- Chapman, R: Petroleum geology. Elsevier Science, 1983, 415 p.
- Darling, Toby: Well logging and formation evaluation. Elsevier, Gulf Professional Publishing, 2005, 326 p.
- Ellis, Darwin V; Singer, Julian M: Well logging for earth scientists. Springer, 2007, 692 p.

Responsible Instructor(*name, position, scientific degree):*

Velledits Felicitasz Dr., Phd, part-time associate professor

Syllabus
Thursday: 12:00 – 15:00

Date	Lecture
2020.09.10.	Velledits F.: Introduction: Task of the wellsite geologist, Dilling a well
2020.09.17.	Velledits F.: Coring, Wellsite stratigraphy
2020.09.24.	Pugner S.: Mud logging services.
2020.10.01.	Pugner S.: Cuttings&Core description methods
2020.10.08.	Pugner S.: The role of mud logging units in the prevention of kicks/blow outs.
2020.10.15.	Vass I.: Mud gas logging techniques and interpretation – conventional vs. advanced
2020.10.22.	Test 1.
2020.10.29.	Well visit
2020.11.05.	Velledits F.: Quick look of the logs at the wellsite
2020.11.12.	Balogh J.: Wellsite Geology. Operation geology.
2020.11.19.	Balogh József: About MOL group, Exploration&Production (UPSTREAM), Difference between operation geologist, and wellsite geologist. Applied disciplines in wellsite geology, skills needed for WG., Main stages of WG
2020.11.26.	Majoros P.: Visulization of mud logging data
2020.12.03.	Majoros P.: Pore Pressure Prediction
2020.10.	Test 2.

Midterm exam

1. Who is a wellsite geologist? What are the wellsite geologists's duties and responsibilities?
   WG is an important link in the chain of communications between wellsite and management.
   On his shoulder rests the responsibility for obtaining every possible information which can be wrested from the earth and insuring that the data are transmitted to the office in a concise but comprehensive, report.
   Wellsite geologists supervise every stage of the drilling process. They study and analyse rocks from the wells in order to direct the drilling, and identify the rock formation of the drilling.
   They use specialised tests, rock-cutting data, wireline data, core samples and other measures to do this.

2. What is casing point?
   1) The casing point is the point in a drilling project when well drilling operations cease and the well owners must decide whether the well should be completed or plugged & abandoned.
   2) Casing point may also refer to the depth to which casing is set in a well. Depth, at which drilling an interval of a particular diameter hole ceases, so that casing of a given size can be run and cemented. The casing point may be a predetermined depth, or it may be selected onsite by a pressure team.
   In many cases, weak or underpressure zones must be protected by casing, or overpressure zones

3. What king of information have to collect the wellsite geologist before drilling?
   1) What this well is about? Is it an exploration well, a delineation or development project ?
   2) Get a copy of the well montage, the seismic line(s) through the well and a copy of the drilling program.
   3) What is the expected reservoir? What is the stratigraphic sequence above and below it. Collect and copy reference material of the regional geology.
   4) To compare the findings in this well against data that exist already.
   Does this well confirm the understanding of the regional geology or is it a surprise?
   5) Is the well expected to be dangerous?
   Is it likely, that there is shallow gas, overpressure, H_2S , CO_2 ?
   6) Is the well to be straight or deviated ?
   7) Are there special requirements for confidentiality? Have to encode part or all of the report?
   8) Have the wellsite geologist supervise any wireline logging? Does the supervisor require a quick-look interpretation of wireline data?
   9) In some cases WG have to witness other operations which are not strictly the wellsite geologist's duty, such as perforating, testing or rig positioning?
   10) To get as much information as possible about the project and make personal contact with the other exploration personnel involved.

4. What could be the reason for a dry well?
   1. The trap was absent or open: Due to poor seismic quality or incorrect interpretation of data.
   2. The trap shifted position: This may be due to faulting or folding.

3. A crooked hole: Traps formed by faults, and those around the flanks of salt diapirs require highly accurate directional drilling, and reservoirs can be missed by slight deviations from the projected borehole trajectory.
(Crooked hole: a wellbore,that has deviated from the vertical.)
The reservoir rock may be absent due to: shaling out, faulting out, erosion off a structural high, failure to drill not deep enough.
5) No oil or gas in the reservoir: this can occur because there was no supply of hydrocarbons available, the trap developed after the hydrocarbons had migrated, or the hydrocarbons may have “spilled-out” or had been flushed out of the reservoir.
6. Failure to recognize hydrocarbons during drilling: due to
A) excessive mud weights causing flushing of the formations and a thick filter cake build-up.
B) small diameter holes causing only a small volume of rock being crushed and carried to the surface for observation.
C) Poor log quality or incorrect interpretation techniques.
D) Drilling fluid contaminants masking hydrocarbon shows.
E) Failing to test a suspected reservoir.

5. What do you know about hydrogen sulfide, H_2S?
H_2S or sour gas is extremely dangerous and toxic. It can cause sudden death, even in very small concentrations. H_2S is heavier than air, it is soluble in water and hydrocarbons and H_2S is explosive when mixed with air. If H_2S is coming to the surface the well should be shut in, crew members have to move higher on the rig rather than lower to escape from it.
Do not attempt to rescue a person who has been overcome by H_2S without a breathing apparatus!

6. Compaire the advantages and disadvantages of the core and chips.
Advantage of the chips: the sheapest sample of the subsurface rock, it gives information on lithology and CH content.
Disadvantage of the chips: porosity, permeability measurements are not possible.
Benefits: cutting are the only „continuous” visual record. We can evaluate shows.
At the well site rocktype and lithological composition, colour, texture: grain size, shape, sorting. fossil content if any, matrix, porosity, CaCO3/MgCo3 ratio can be determined with the help of cuttings.
In the lab form thin sections the microfacies can be determined, and paleontological examination can carried on.
Advantage of the core:
It is the only means of obtaining high quality samples for geological examinations and petrophysical measurements (porosity, pemeability). Allows direct observation of grain size, sorting and sedimentary structures,wich leas to interpretation of the depositional environment. Depositional environment is used to assigning geometry and architecture in reservoir models. Allows calibration to logs, thus enabling direct interpretation from logs in other well in the reservoir.
Disadvantage: very expensive

7. List the functions of the mud?
1. Remove cuttings from the well. 2. Control formation pressure. 3. Seal permeable formation. 4. Maintain wellbore stability. 5. Cool, lubricate and support the bit and drilling assembly.

8. Drill stem test (DST)

Ais a procedure for isolating and testing the pressure, permeability and productive capacity of a geological formation during the drilling of a well. The test is an important measurement of pressure behaviour at the drill stem and is a valuable way of obtaining information on the formation fluid and establishing whether a well has found a commercial hydrocarbon reservoir.

From a record of the pressure readings a number of facts can be inferred about the formation.

9. What are the advateges and disadvantages of Gas Chromatograph?

Separates 970 components within a reasonable analysis time. By using a combination of oven temperature and stationary phase chemistry (polarity) very difficult separations may also be carried out – including separations of chiral and other positional isomers. GC is excellent for quantitative analysis with a range of sensitive and linear detectors to choose from. A practical upper temperature limit for conventional GC columns is around 350-380 °C. Analyte boiling points rarely exceed 400 °C in GC analysis and the upper molecular weight is usually around 500 Da.

Advantages: Fast analysis. High efficiency – leading to high resolution. Sensitive detectors (ppb). Non-destructive – enabling coupling to Mass Spectrometers (MS). High quantitative accuracy (<1% RSD typical). Requires small samples (<1 mL). Rugged and reliable techniques. Well established with extensive literature and applications.

Disadvantages: limited to volatile samples. Not suitable for samples that degrade at elevated temperatures (thermally not stabile). Not suited to preparative chromatography. Requires MS detector for analyte structural elucidation (characterization). Most non-MS detectors are destructive.

10. What is Skin?

All additive pressure drop which appears in the vicinity of the well, compared with the

Miskolc, 2020. szeptember 07.

Dr. Velledits Felicitász
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