Wellsite geology

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- The wellsite geologist 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 got from the earth and insuring that the data are transmitted to the office in a concise but comprehensive, report.

Wellsite geologists's duties and responsibilities

- **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.

Evaluate and describe sample

- Lithology
- Reservoir analysis: consolidation; grain size; roundness; porosity; cementation;
- Description of constituents;
- Hydrocarbons show analysis and description: stain; surface florescence; cut florescence.
- Sample quality control and documentation.

- Log correlation/Interpretation
- Log Quality Control
- Casing point and TVD (True Vertical depth) determination

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.

- If necessary he have to advise

1) town personnel on changes in the well plan

2) Advise MWD (Measure While Drilling) and mud logging personnel of program requirements and revisions.

- **Forward**

---daily reports, files and interpreted data (e.g. lithology)

--- Interpreted Daily Log

--- Final Perforation Recommendations;

- Wellsite geologists are in contact with mudloggers and drilling engineers to ensure the drilling goes off without a hitch/problem.
- He has to make sure that the well follows the correct health and safety procedures.
- It is the wellsite geologist’s responsibility to decide when drilling should be suspended or stopped.
- He also have to compile reports and logs of the drilling process, as well as a final well report.

- It’s a tough job. Wellsite geologists work in some of the remotest parts of the world, and their careers can be very disruptive on their home and personal life. However, it’s a very well paid profession.
- It isn’t a typical nine-to-five office job.

Lifestyle





- A typical working day might be 12 hours on, 12 hours off, for three weeks, followed by a break onshore for another three weeks. Conditions on offshore rigs can be trying, with bad weather, plenty of noise and dirt.

SALARY & BENEFITS

New consultant wellsite geologists might earn between **£350 and £450**, and more experienced geologists are looking at around **£750 to £1,000** a day.

Pre Drilling Information
(collected by the wellsite geologist)

- 1) What this well is about? Is it an exploration (wildcat well) well, a delineation or development well ?
- 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?

Pre Drilling Information
(collected by the wellsite geologist)

- **5) Is the well expected to be dangerous?**

- Is it likely, that there is shallow gas, overpressure, H_2S , CO_2 ?

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!

Pre Drilling Information
(collected by the wellsite geologist)

- 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?

If yes, the WG. (wellsite geologist) is responsible for supervision log acquisition, than have to ask for parameters required for logging and preliminary interpretation. Get data on Rw and typical mineral composition of the area – if available.

- 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?

Pre Drilling Information (collected by the wellsite geologist)

- 10) To get as much information as possible about the project and make personal contact with the other exploration personnel involved.

Regional Geology

- It is important that the Wellsite Geologist be familiar with the regional geology of the area where the drilling is taking place.

Particular aspects:

- Nature and depth of basement within the basin.
- Geologic age of the section.
- Depositional environments and expected lithologies.
- Tectonic setting within the basin.
- Formation pressure anomalies.
- Hydrocarbon occurrences within the basin.
- Copies of geologically related articles should be brought to the wellsite!

Well Prognosis and Prospect Description

- **The Wellsite Geologist should be completely familiar with all aspects of the drilling prognosis. Particular attention should be paid to any sections which may require geological decisions**:
- Determination of Primary and Secondary Objectives.
- Determination of Casing Points
- Detection of Overpressured Intervals.
- Detection of Lost Circulation Zones
- Correlation and Detection of Marker Horizons.
- Determination of Geologic Basement
- Selection of Logging Run Intervals.

Wireline logs, mudlogs, lithlogs should be used as sources of these information.

Geologic Maps

- During the preliminary stages, much of the geological effort is directed towards **drafting subsurface maps,** covering the perspective field.
- A map is never finished, but the map must be as complete as possible with the data available at the present time.

The subsurface is usually much more complex than is generally envisaged!

Rigsite Information Sources

- 1) **Wireline Logging Unit**
- **Resistivity:** Water Saturation, Porosity, Hydrocarbon evaluation
- **Density:** Lithology confirmation, Correlation, Porosity, Overpressure detection, Gas/Oil contacts
- **Sonic:** Porosity, Mechanical properties, Over pressure
- **Dipmeters:** Structure, Well trajectory, Facies analysis,Sedimentology
- **2) Sidewall Cores:** Biostratigraphy, Geochemistry, Lithology confirmation, Hydrocarbon evaluation.
- **3) RFT:** Fluid sampling, Pressure detertermination, Oil/Water/Gas gradients

Mud-Logging Unit

- Cuttings Geochemistry, Lithology, Correlation, Density, Calcimetry, Hydrocarbons, Shale Factor (C.E.C.), Hole Stability, Bit Condition
- Hydrocarbons Total gas, Chromatograph, Gas Ratios, Connection gases, Trip gases, Oil shows
- Gases CO_2, H_2S
- Engineering Drill Rate, Formation Pressures

3) **MWD data**

- Directional (MWD), Dogleg — Borehole Trajectory
- Gamma Ray: — Lithology Determination, Shale Content,
- Resistivity : — Correlation, Hydrocarbon Evaluation, Pressure Indication, Sw estimations
- Density: — Lithology, Correlation, Pressure Indication, Gas/Oil Contact
- Others : — Coring, Biostratigraphy, Reservoir analysis, Porosity, Permeability

Dogleg

A dog leg refers to a **sharp bend** or deviation in the wellbore's trajectory.

- Dog legs can occur for several reasons:
- **Geological formations:** Unforeseen geological formations, such as faults, fractures, or hard rock layers, can force the drill bit to deviate from its intended path.
- **Wellbore instability:** Weak or unstable formations can cause the wellbore to collapse, requiring a change in direction to maintain stability.
- **Directional drilling:** Dog legs are often intentionally created during directional drilling to reach target zones that are not directly below the drilling rig. This technique is crucial for accessing reservoirs located

Dry Holes

- Dry holes should never be considered fruitless, because valuable data can be obtained from the well even if no hydrocarbons were indicated.

Successful exploration, in many cases, requires that many dry holes be drilled (even though the aim of the industry is to drill as few dry holes as possible).

Dry holes may be due to the following

- ***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.)

- ***4) 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) Poor log quality or incorrect interpretation techniques.

C) Drilling fluid contaminants masking hydrocarbon shows.

D) Failing to test a suspected reservoir.