Drilling Engineering

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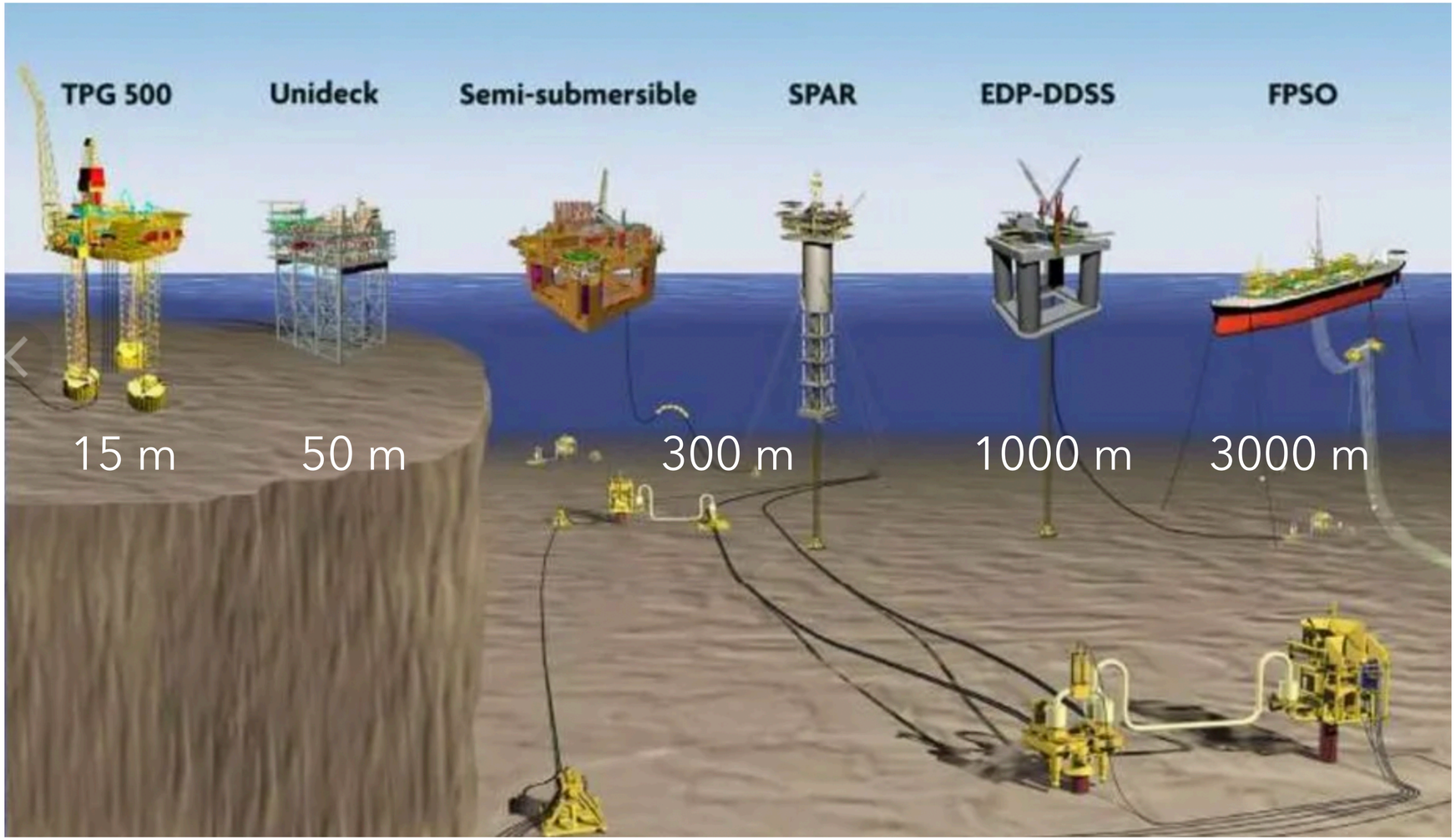
Main constructions offshore drilling rigs for different water depth



There is 5 different offshore drilling rigs

Spiral-weight drill pipe

Advantage over smooth-walled ones

- Spiral pipes have a smaller contact area with the borehole wall, which means a lower risk of sticking
- And if we have zenith angles above 60 degrees, then there is research that these spiral pipes can slightly swirl the flow of drilling mud, preventing cuttings from settling on the bottom wall of the well, which also indirectly reduces the risk of sticking

Special aspects of working with a oil-based mood

Advantages:

- have high stability over time (can be stored for a long time and reusable
- can be stored for a long time and used repeatedly);
- Inert against clays and salts;
- have good anticorrosive and tribotechnical properties;
- can be weighted with any standard weighting agents;
- have high thermal resistance (up to 220...220 C);
- almost do not filter into permeable reservoirs, and their filtrate does not adversely affect
- on productive oil reservoirs, as it has a general similarity with the reservoir oil.

Disadvantages:

- high cost (200...625 $/m3) and scarcity of basic components;
- fire hazard;
- difficulty of clearing from sludge;
- difficulty of electrometric works;
- environmental hazards.

Additional equipment

- tank;
- disperser;
- closed circulation system.

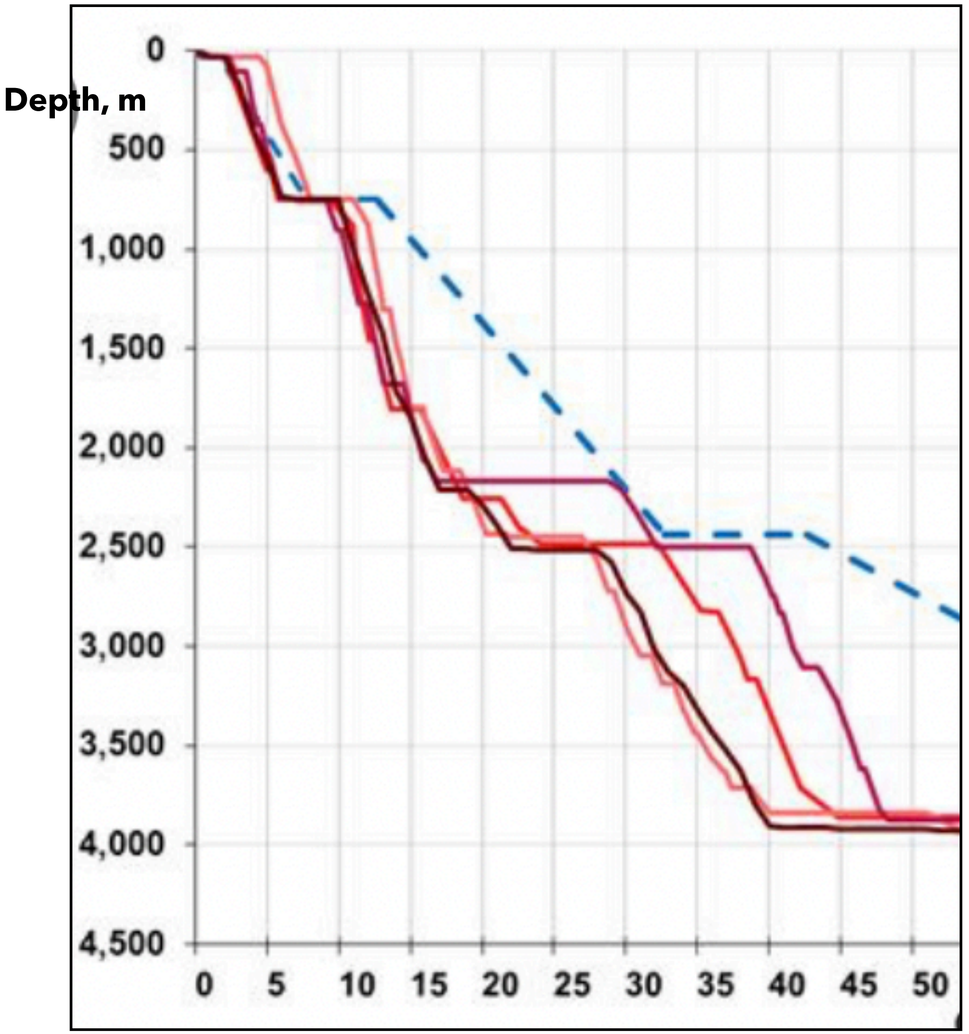
Safety conditions

- control of gassiness of the drilling site
- control of temperature of drilling fluid at the wellhead below the flash point
- Purification of drilling mud from drilled rock and gas, deactivation of cuttings during their disposal

Mechanical penetration rate

The RPM reduced cases

- Pyrite is an extremely abrasive and hard mineral. It is necessary to use the minimum RPM to reduce damage to the gauge crowns, but with the necessary WOB for efficient drilling of high-strength rocks.
- In practice low rotation speed results
- During the drilling process, the mechanical rate of penetration decreases, provided that the process is carried out at p = const and n = const. In this case, the decrease in the mechanical rate of penetration is only due to wear of the teeth.
- Circulation system capacity is not pretty goof
- Circulation parameter become too high which can make hydrofracturing
- Vibration prevention



Slope changing tell us about RPM change

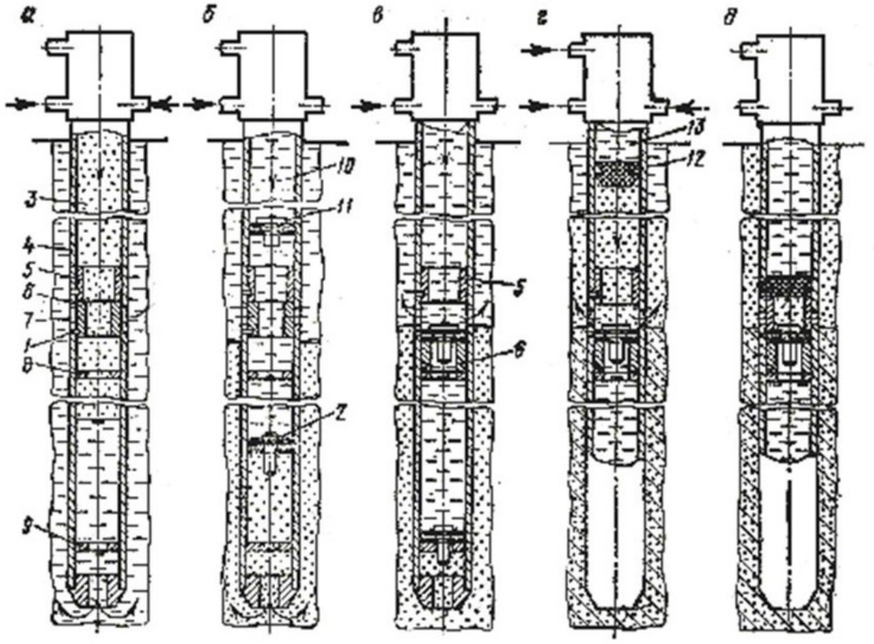
Two-stage cementing process

Reasons

- high probability of rock fracturing due to high design downhole pressure at the end of cementing;
- design pressure at the cementing head greater than the maximum pressure developed by the cementing unit;
- The necessity of simultaneous participation of an excessively large number of cementing units and mixing machines;
- Long cementing time;
- High cementing time;
- different temperature conditions.

Describe

- The essence of two-stage cementing: the whole cementing interval is divided into two parts (stages). In this case the string is supplied with a stage cementing sleeve (SSC). Stage I is cemented through the casing shoe (as in the direct single stage cementing method), and stage II is cemented through the SSC. Special cementing heads are used for this method



Scheme of two-stage cementing:
a - pumping of grouting mortar for the lower stage; b - before placing the 1st plug on the «stop ring", resetting the 2nd plug; c - landing of the 2nd plug on the holding sleeve, cutting of studs, its lowering to the stop, opening of holes in SSC, flushing of the upper interval during the 1st stage; d - cementing of the second stage, resetting of the 3rd plug; e - the 3rd plug is inserted into the upper sleeve, the studs are cut off, it is lowered to the lower sleeve, the holes in SSC are closed, cementation of the second stage is completed
1 - studs, 2 - first plug, 3 - cement slurry for 1-stage cementing, 4 - casing, 5 - sleeve
6 - holding sleeve, 7 - holes, 8 - stopper, 9 - stop-ring, 10, 13 - selling fluid, 11 - second plug
12 - third plug

Mud loss

Reasons

- The mud loss of flushing fluid is usually observed when drilling the 2nd hole in cavernous, fractured and porous formations, as well as in strongly drained productive formations.
- Mud loss occurs when hydrostatic pressure of the drilling fluid column is greater than formation pressure.
- Mud loss begin when the reservoirs have sufficient hydraulic conductivity and the pressure drop in the well and in the reservoir is above a certain value, called the critical value.

Prevention methods

- The mud loss of flushing fluid is prevented by using special drilling fluids with the lowest possible density for the given conditions, high viscosity, strong structure and minimum water drainage..

Liquidation methods

- reducing the pressure drop between the well and the reservoir, which absorbs the fluid, or changing the parameters of the flushing fluid;
- isolation of absorbing reservoir from a well, sealing the channels of absorption with special materials, cement slurries and pastes;
- drilling without circulation;
- selection of cleaning agent formulations, including gas-liquid mixtures and foam;
- application of plugging devices preventing the spreading of plugging mixtures deep into the intake channels;
- bridging cracks and cavities with the use of high-strength fabric covers;
- liquidation of caverns and fractures with the delivery of the lumpy material to the intake zone;
- drilling of wells in conditions of catastrophic absorption without bringing flushing fluid to the surface;
- isolation of absorption zones by "hidden" casing.