中油测井技术服务有限责任公司

China National Logging Corporation

CNLC International Kazakhstan Inc. LLP

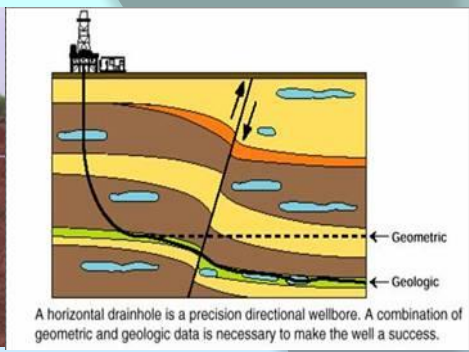
Prepared by:
Gulmira Ashikova, *Leading Marketing Specialist*

Wireline Logging

Mud Logging

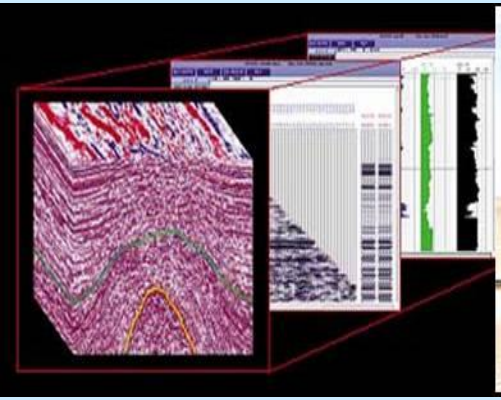
Perforation

Well Testing



MWD/LWD

Scope of Services



Formation Evaluation

Well Completion

Hydraulic Fracturing/ Acid treatment of Formation

Coiled Tubing Operations

«CNLC International Kazakhstan Inc» LLP is one of leading oilfield service companies. The Company was founded in August 2002. Company head office is located in Almaty, has 5 branches in Aktobe, Kyzylorda, Aktau, Atyrau and

Providing of major wireline logging services in Kazakhstan:

- **Openhole wireline logging;**
- **Casedhole wireline logging;**
- **Perforation;**
- **Mud logging;**
- **Well testing**

ZHANAZHOL BASE IS MAIN BASE, WHERE LOCATED WAREHOUSE FOR 6 SET OF RADIOACTIVE SOURCES AND EXPLOSIVE GOODS WAREHOUSE WITH STORAGE CAPACITY OF EXPLOSIVES FOR 100000 SHOOTS.

WAREHOUSE FOR 6 SET OF RADIOACTIVE SOURCES

EXPLOSIVE GOODS WAREHOUSE WITH STORAGE CAPACITY OF EXPLOSIVES FOR 100000 SHOOTS

Temporary explosive good storages

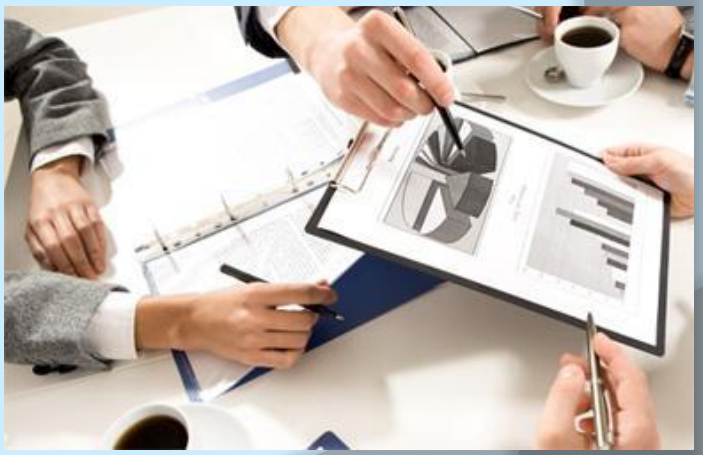
Presentation Topic:

- Research&Development;
- Core Analysis;
- Reservoir evaluation;
- Coiled Tubing Operations, well stimulation and relevant engineering services;
- CBL and borehole gauging;
- Bridge plug setting;
- Fishing Operations.

Research Works (R&D)

Research work (abbr. - R & D) is a scientific work related to scientific research, research, experiments in order to expand existing knowledge and obtain new knowledge, to test scientific hypotheses, to establish regularities that are manifested in nature and in society, scientific generalizations, scientific substantiation of projects

The main result of research is the report on the implementation of scientific research, it is also possible to create mock-ups, as opposed to development work, which results in a prototype product, design documentation or a new technology.



In accordance with contract for the performance of scientific research, the contractor undertakes to conduct scientific research, determined by the technical task of the customer, the customer undertakes to accept and pay for the work.

Terms of the contract for the performance of scientific research should comply with laws and other legal acts on intellectual property.

Research & Development

RESEARCH REPORTS/MATERIALS RENDERED TO CUSTOMERS INCLUDES:

- Influencing factors of low oil rates and a large drop in oil production and proposed options for regulation;
- Techniques of oil reservoir engineering, detailed geological models and numerical modeling, determination of rational limits of technical operation policy;
- Tracking the dynamics of production of the deposit, providing a proposal for measures to regulate production wells;
- In combination with the distribution characteristics of reservoirs, oil and water, the design of well placement options;

BACKGROUND DATA
(ON THE BASIS OF WHICH FURTHER SCIENTIFIC RESEARCH IS CONDUCTED):

- Static parameters: complex logging curves, stratification parameters, perforation parameters and basic parameters of oil reservoir interpretation, physical properties at high pressure and analysis of core parameters;
- Dynamic parameters: parameters of well testing, daily reports of water-oil wells, monthly reports;
- Control parameters: annual temperature data, pressure control data; laboratory data on the analysis of oil and water;
- Advances in preliminary research ...

Research Works (R&D)

To carry out these works, it is necessary to possess:

1)**Accreditation certificate for the Test Laboratory** accredited by the National Accreditation Center of the Republic of Kazakhstan (issued by the Committee for Technical Regulation and Metrology of the Ministry of Industry and New Technologies of the Republic of Kazakhstan).

2)**The license for scientific research** with subspecies:

- Preparation of feasibility studies for hydrocarbon deposits;
- Preparation of technological regulations for hydrocarbon deposits;
- Drawing up project documents for hydrocarbon deposits;
- Design (technological) of petrochemical industries.

3)A license for activities related to trafficking in precursors.

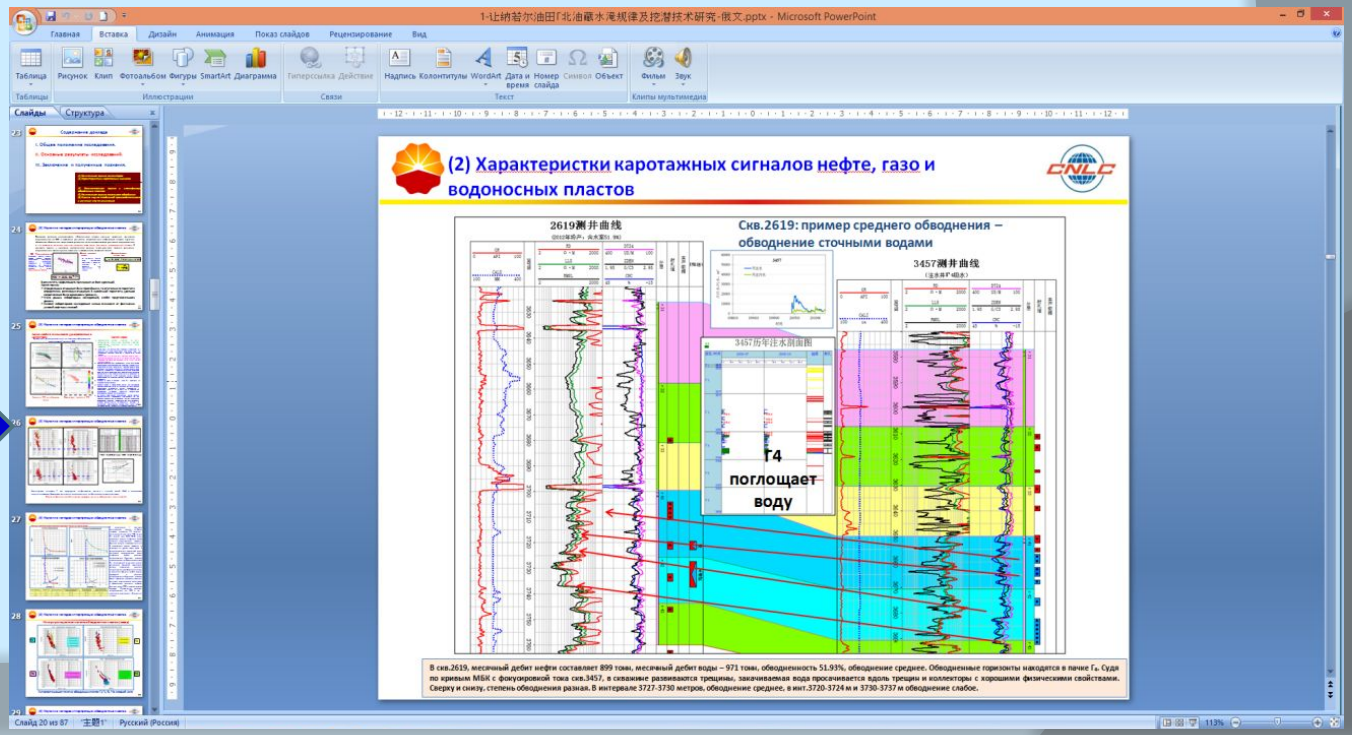
Research Works (R&D)

Research work is carried out throughout the year

At the end of the year all materials, conclusions on the conducted research are transferred to the Customer

In December invoicing to the Customer

The results of the research on each topic contain 80 - 100 pages in the PPT format.



R&D Service Experience:
The Contracts concluded in 2012 – 2018 y.:

Names of Projects	Customer	Price in KZT, exclude VAT	Period (year)
Wireline logging evaluation of Carbonate rock in North Truva oilfield.	CNPC-AMG	42 180 000	2012
Technical study of the flooded $Г_3Г_4$ reservoirs Гс package in Zhanazhol oilfield.	CNPC-AMG	73 000 000	2013
Integrated evaluation of logging materials of the southern hard-to-recover part of Дsouth and increase in the output at the Zhanazhol oilfield.	CNPC-AMG	78 000 000	2013
Integrated logging interpretation and evaluation of the exploration block of the eastern part of the Caspian basin	CNPC-AMG	61 473 213	2014
Technical study of policy development of Asouth and tracking its development on Zhanazhol oilfield.	CNPC-AMG	73 767 857	2014
Technical study of the regularities of watering the Gs reservoir and improving the development efficiency of Zhanazhol olfield	CNPC-AMG	61 473 214	2014
A technical study on the detailed description of the southern hard-to-extract part of Du and the optimal engineering design of the Zhanazhol oilfield.	CNPC-AMG	85 201 875	2014
Integrated logging interpretation and evaluation of the exploration block of the eastern part of the Caspian basin.	CNPC-AMG	61 473 213	2014
Investigation of the technology of steam cycling and evaluation of the effect of the development of a reservoir of high-viscosity oil at the Kumsai post-salt oilfield.	KMK Munai	91 000 000	2014
Research and regulation of the development system of the North Truva oifield.	CNPC-AMG	148 230 000	2015
R & D: Optimum design of the development system of the Kenkiyak subsalt oilfield.	CNPC-AMG	57 645 000	2015
Investigation of the technology of steam cycling and evaluation of the effect of the development of a reservoir of high-viscosity oil at the Mortuk supersalt oilfield.	KMK Munai	134 000 000	2016
Research and evaluation of reused reservoirs in drilled exploratory (evaluation) wells at the central block.	CNPC-AMG	57 000 000	2016
R & D: Tracking study of the development of thorough flooding of over-salt heavy oil deposits on blocks III and IV of the Kenkiyak uppersalt oilfield.	CNPC-AMG	57 000 000	2016

R&D Service Experience:
The Contracts concluded in 2012 – 2018 y.:

Names of Projects	Customer	Price in KZT, exclude VAT	Period (year)
R & D: Technical study of reservoir evaluation, reservoir lithology, selection of the optimal well location in the central part of the eastern part of the Caspian basin.	CNPC-AMG	85 500 000	2016
R & D: Tracking study of the waterflood development project and evaluation of its efficiency at the North Truva.	CNPC-AMG	142 500 000	2016
R & D: Technical study on a careful description and optimal development mode for the low-permeability carbonate oilfield of the Zhanazhol oilfield	CNPC-AMG	57 000 000	2016
R&D: «New exploration areas and research exploration and arrangement of new wells on Eastern flange of Peri-Caspian basin»; R&D: «Predict and recognize fluid features of carbonate collectors on Central block».	CNPC-AMG	171 000 000	2017
«Technical Research the Development Policy of non-volatile oil deposits with low pressure on North Truva oilfield.	CNPC-AMG	142 500 000	2017
«Technical Research of the Evaluation the Development Efficiency of the Asouth Gas Cap and optimal arrangement of the Zhanazhol oilfield»	CNPC-AMG	28 500 000	2017
«Research of the expansion of exploration and development of Zhanazhol oifield, reservoir evaluation and arrangement of well locations»	CNPC-AMG	90 000 000	2018
«Investigation of a reasonable development strategy and key technology for the stable gas production in gas caps at Zhanazhol oilfield»	CNPC-AMG	75 000 000	2018
«Research of technical measures to stabilize the oil flow and control of water showings on the North Truva oilfield»	CNPC-AMG	210 000 000	2018
«Evaluation and optimal selection of areas in the border areas on the Central territory of the eastern part of the Peri-Caspian basin"	CNPC-AMG	90 000 000	2018
«Initial description of oil-bearing deposits in the slope area on North Truva oilfield and Takyr structures»	CNPC-AMG	90 000 000	2018
«Kenkiyak subsalt oilfield Development Project»	CNPC-AMG	165 000 000	2018
«Attachment No.1 to Zhanazhol oilfield Development Project»	CNPC-AMG	231 000 000	2018

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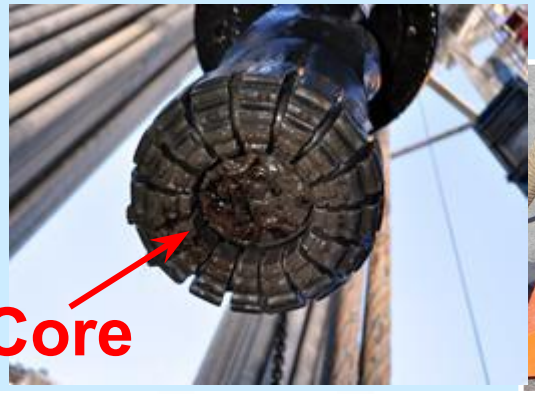
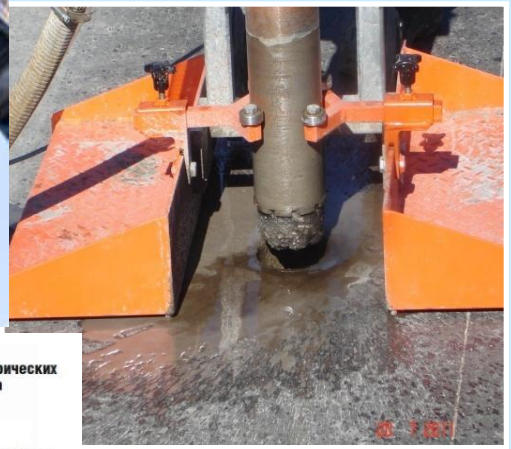
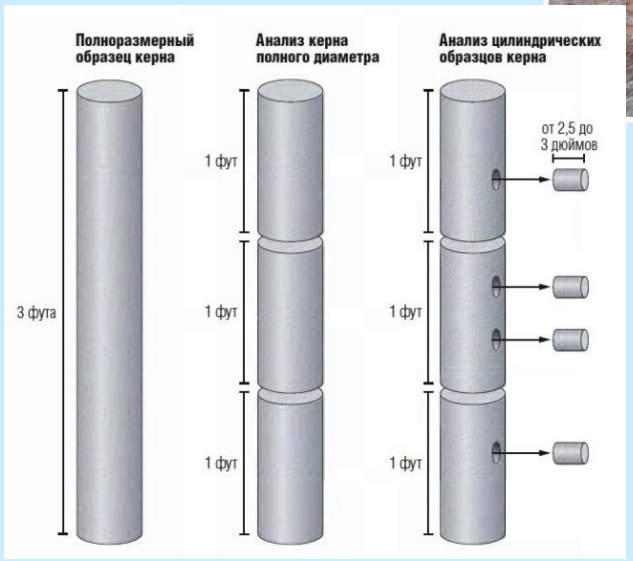
Core is a sample of rock extracted from a well by means of a specially designed drilling type. It often represents a cylindrical column (column) of rock that is strong enough to maintain solidity.

It is a primary source of information on the geological structure of subsoil, sedimentation conditions and the material composition of rocks.





In most cases, the core is sampled when drilling a rock with a hollow steel pipe, called a core pipe, and the core drilling itself is core drilling. Inside the core pipe is the core receiver (sampler). The core receiver consists mainly of a head, a core-receiving tube and a core cutter.



The core diameter is usually from 4.45 to 13.3 cm (1.75 to 5.25 inches), they are drilled in fragments of 10 m (30 ft).

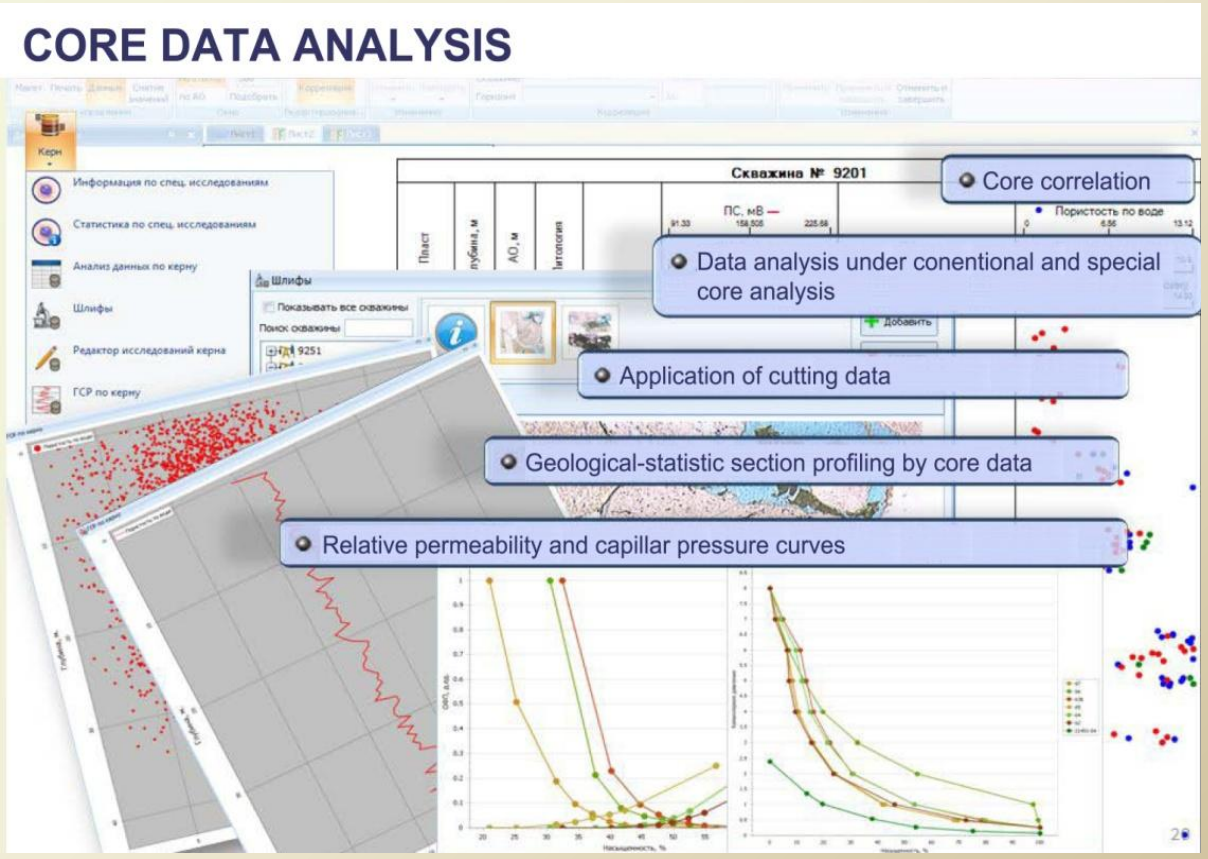
Core Analysis:

Core is jammed, torn from the bottomCore is jammed, torn from the bottom and raised to the surface. After removing the core from the pipe, it is decomposed into core boxes in a strict sequence of finding it in the geological section of the well.

The entire raised core is described in detail and transferred to storage in a core storage facility.

Further, the core is examined and analyzed (chemical, spectral, petrographic and other analyzes) **in the laboratory using various methods and on different equipment, depending on what data should be obtained.**

Core analysis allows to obtain the data necessary to perform an analysis of those properties that can not be estimated only by well logging measurements.



Core Analysis:

Routine Core Analysis laboratories perform a number of services, such as gamma core logging, **to correlate the depth** of core sampling with the depth of logging measurements in the well, computed tomography of **core to study heterogeneity, and photograph cores for documentation and description.**

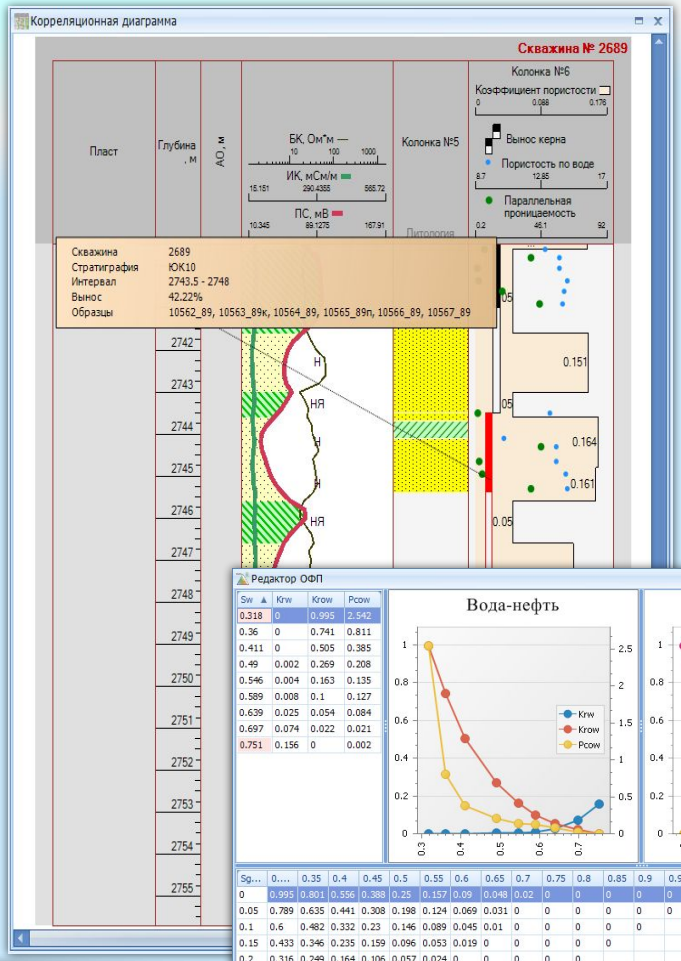
For a more detailed study of some characteristics of the reservoir, special core analyzes are carried out.

Special Core Analysis Labs (SCAL) are equipped with measuring instruments for determining capillary pressure, phase permeability, electrical characteristics, the degree of deterioration of reservoir properties, NMR relaxation time, oil recovery factor, and other parameters used to calibrate logs.

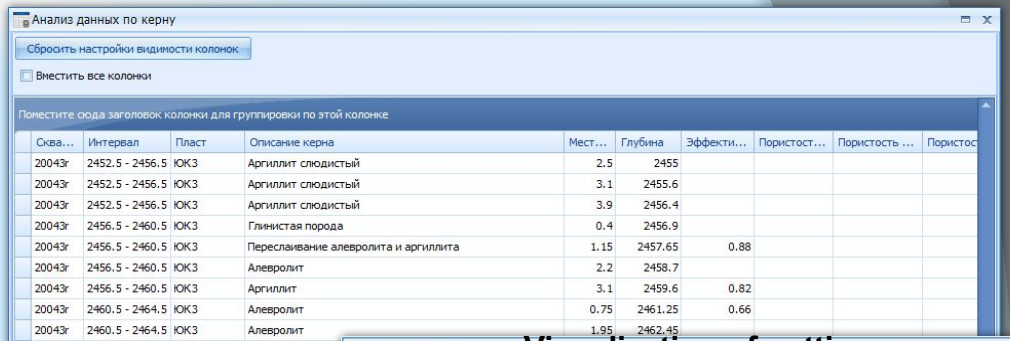
Core Analysis

The results of standard and special studies.
Correlation of core to Wireline logging data, statistical analysis

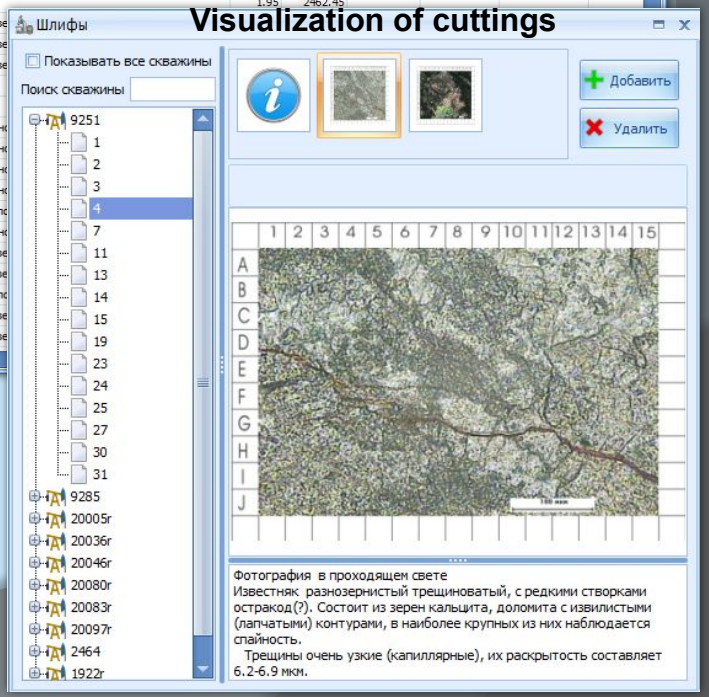
Correlation Curve

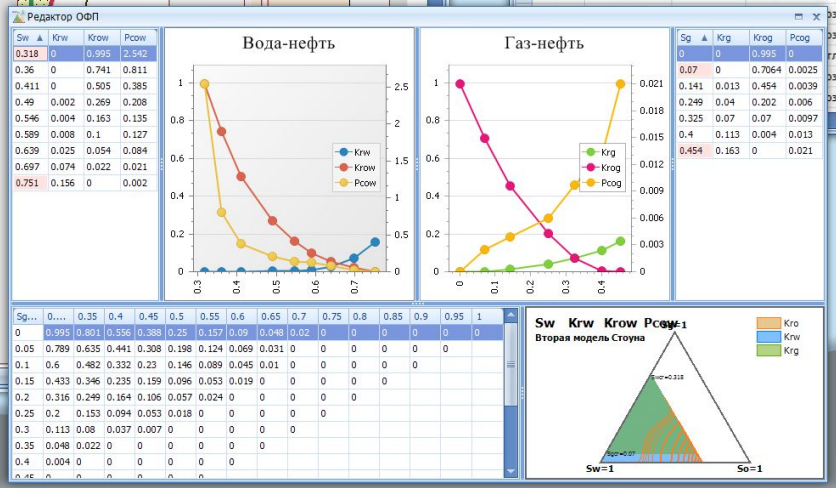


Statistical Data

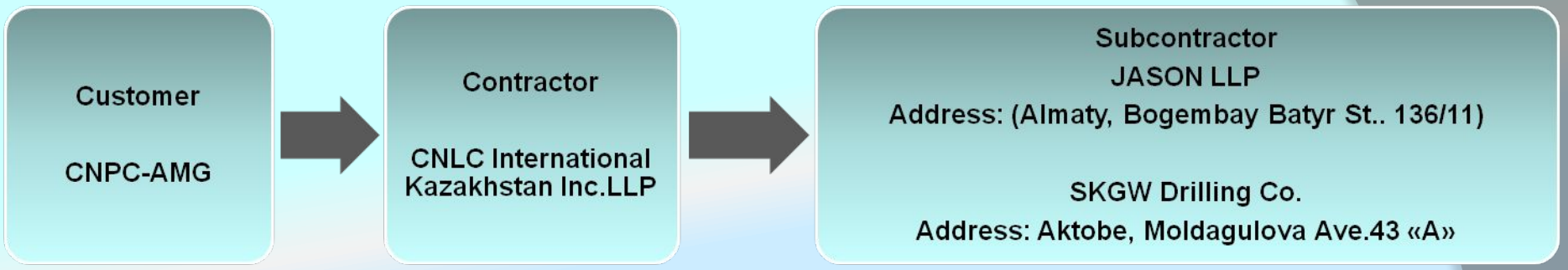


Visualization of cuttings





Core Analysis



To carry out these works, it is necessary to posses:

1) A license for activities related to trafficking in precursors.
2) The license for the design (technological) and (or) operation of mining (exploration, mining, petrochemical production, operation of gas mains, oil pipelines, oil product pipelines in oil and gas)
3) Permits for the use of equipment (for working with a core).
4) Accreditation certificate for the Testing Laboratory accredited by the National Accreditation Center of the Republic of Kazakhstan (issued by the Committee for Technical Regulation and Metrology of the Ministry of Industry and New Technologies of the Republic of Kazakhstan).

Core Analysis

The Contracts concluded in 2015 - 2019:

Names of Projects	Customer	Price in KZT, exclude VAT	Completion Terms (year)
Core analysis and complex evaluation of wells on North Truva and on the Central territory of the eastern part of the Caspian basin	CNPC-AMG	86 997 202	2015
Core analysis and complex evaluation of wells on North Truva and on the Central territory of the eastern part of the Caspian basin	KMK Munai	62 779 000	2016
Core analysis and complex evaluation of wells on North Truva and on the Central territory of the eastern part of the Caspian basin	CNPC-AMG	302 082 110	2017
Core analysis and complex evaluation of wells on North Truva and on the Central territory of the eastern part of the Caspian basin	CNPC-AMG	222 030 375	2018
Core analysis and complex evaluation of wells on North Truva and on the Central territory of the eastern part of the Caspian basin	CNPC-AMG	148 020 300	2018
Core analysis and complex evaluation of wells on North Truva and on the Central territory of the eastern part of the Caspian basin	CNPC-AMG	222 030 375	2019

Presentation Topic:

- R&D;
- Core Analysis;
- Reservoir evaluation;
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- CBL and borehole gauging;
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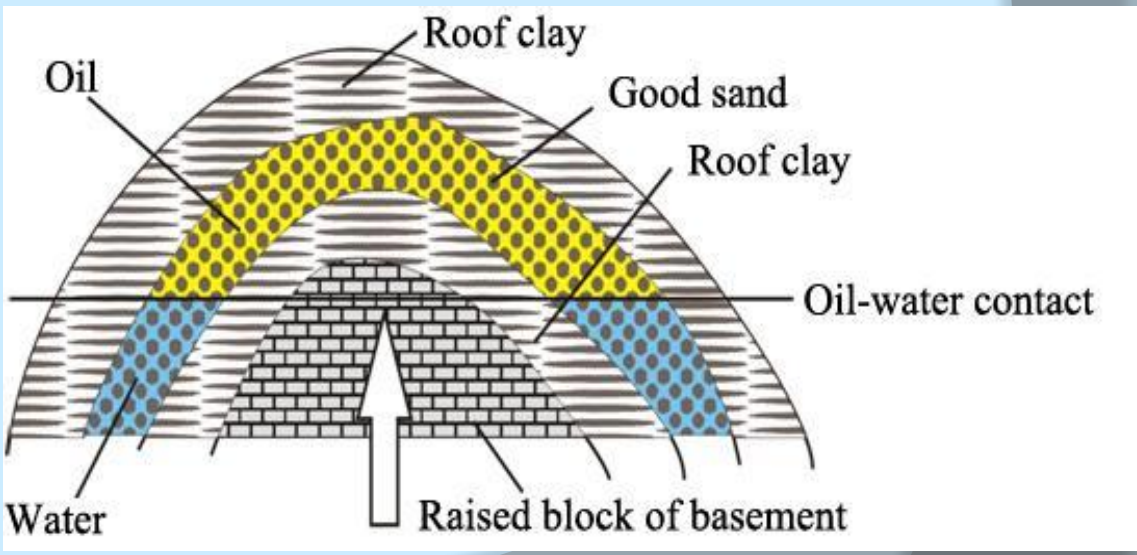
- Fishing Operations.

FORMATION EVALUATION

Stratum is a layer of rock of relatively constant thickness, located between similar formations. A geological body composed of a homogeneous rock, bounded by two more or less parallel bedding surfaces, having the same thickness (thickness) and occupying a considerable area. Usually the name of the layers is given depending on the constituent rocks.

A hydrocarbon reservoir is a rock A hydrocarbon reservoir is a rock containing voids (pores, caverns A hydrocarbon reservoir is a rock containing voids (pores, caverns or cracks) and capable of containing and filtering fluidsA hydrocarbon reservoir is a rock containing voids (pores, caverns or cracks) and capable of containing and filtering fluids (oil, gas, waterA hydrocarbon reservoir is a rock containing voids (pores, caverns or cracks) and capable of containing and filtering fluids (oil, gas, water). The majority of reservoir rocks are of sedimentaryA hydrocarbon reservoir is a rock



❑ Formation Evaluation

COLLECTORS OF OIL AND GAS

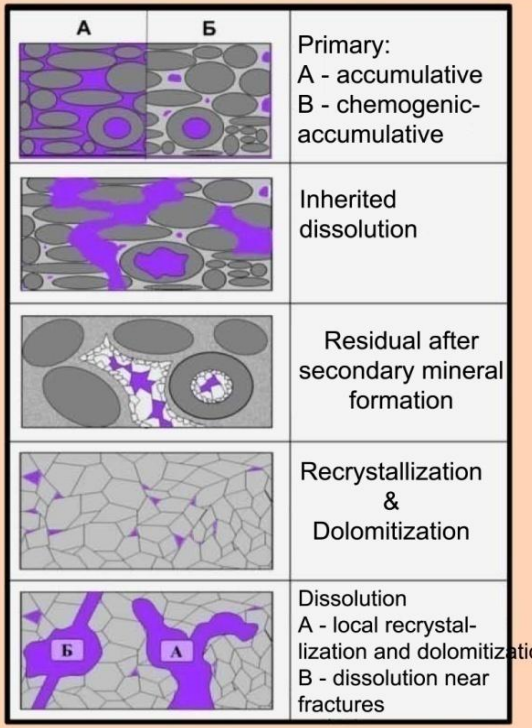
«Oil soaks rocks like water soake sponge»

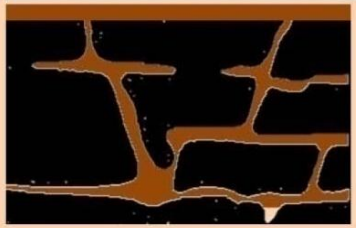
Dmitriy MENDELEYEV

Collectors mean rocks that have the ability to contain oil and gas and output them during development.

TYPE OF COLLECTORS

Porous | **Cavernous** | **Fractural** | **Combined**



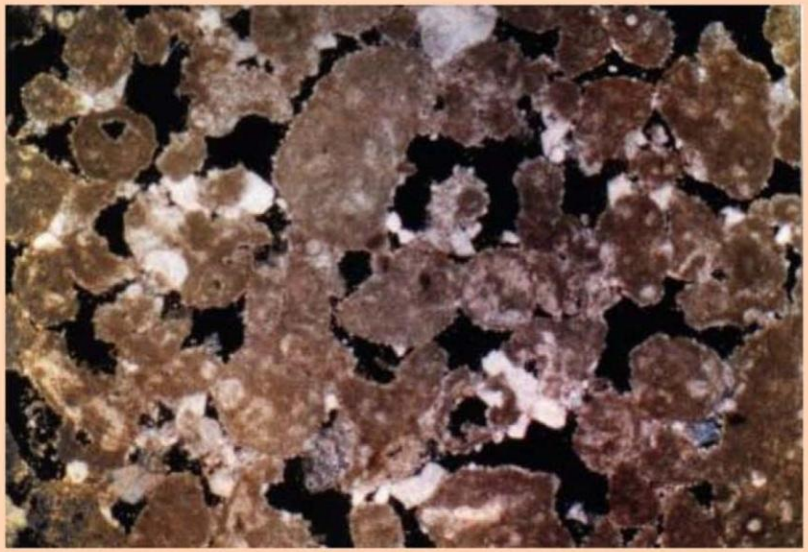


Cavities differ from pores only in size, the size of which allows the fluid to flow out of the rock under the influence of its own weight

Typical collectors:
Sand, siltstone, limestone

Formation Evaluation

Collectors of Oil and Gas

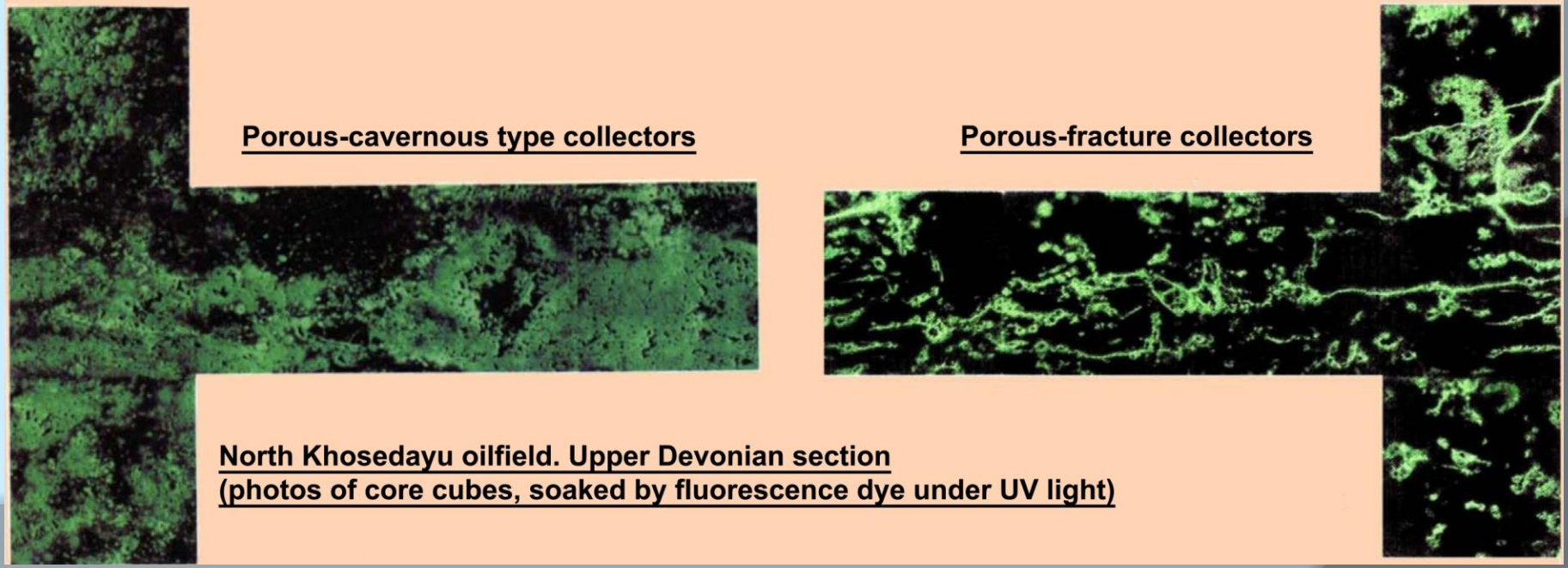


Example of porouse type collector

Ardalinskoye oilfield.
Upper Devonian-Tournaisian stage
Oil bearing complex
(photo of cutting, nicol)

Porous-cavernous type collectors

Porous-fracture collectors



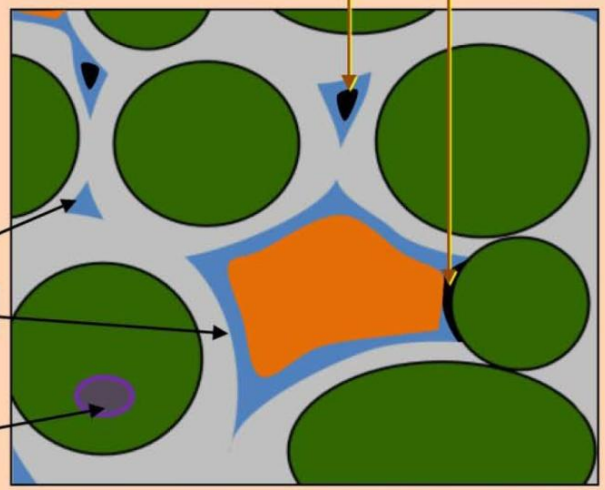
North Khosedayu oilfield. Upper Devonian section
(photos of core cubes, soaked by fluorescence dye under UV light)

Formation Evaluation

Reservoir Features:

Porosity

- **Dynamic** — The volume of communicated pores, not filled by residual water and oil / Rock volume
- **Effective** — The volume of communicated pores, not filled by residual water / Rock volume
- **Open** — The volume of communicated pores / Rock volume
- **Total** — The volume of all pores / Rock volume

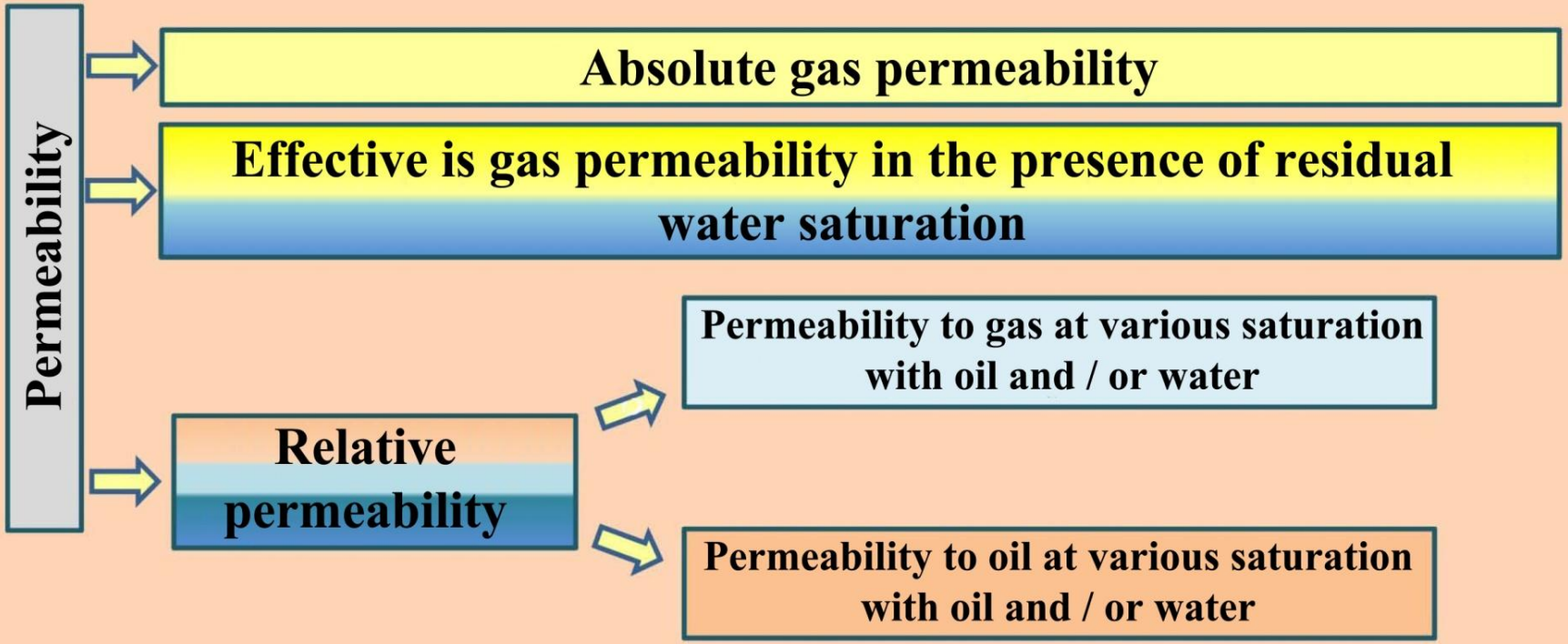


Residual water saturation is total content of capillary-trapped and physically bound water in rocks

The volume of residual water saturation / Rock volume

❑ Formation Evaluation

Reservoir Features:



Permeability is the ability of a rock to flow liquid and gas

Initially, permeability is measured in darcy. For darcy, this permeability is accepted, in which through a rock with a cross section of 1 cm^2 and at a pressure drop of 1 atm for 1 cm passes 1 cm^3 of a liquid with viscosity of 1 cp.

$$\text{Permeability coefficient} = \frac{(\text{fluid volume} * \text{fluid viscosity})}{(\text{sample cross-section area} * \text{pressure gradient})} \quad M^2$$

❑ Reservoir evaluation

Isolation of reservoirs is carried out at lithological dissection of the section. The characteristics by which the reservoirs are allocated are determined by the nature of the cut, the type of reservoir, and the conditions of drilling the well.

Reservoirs are considered as rocks that can contain oil, gas or water and give them back during development. Under the conditions of formation, the oil and gas reservoirs are mainly sedimentary deposits. In terms of material composition, terrigenous, carbonate and mixed types are distinguished. According to the morphology of the porous space, the collectors are divided into pore (intergranular, granular), fissured, cavernous and mixed (pore-cracked-cavernous).

Resevoirs differ from the enclosing rocks with permeability, porosity and clayiness, which is a prerequisite for their separation according to geophysical methods.

Identification of reservoirs is carried out at lithological dissection of the section. Lithological dismemberment of the section of wells within the perspective intervals provides for the allocation of strata that differ in geophysical properties, the determination of their boundaries and the depth of occurrence.

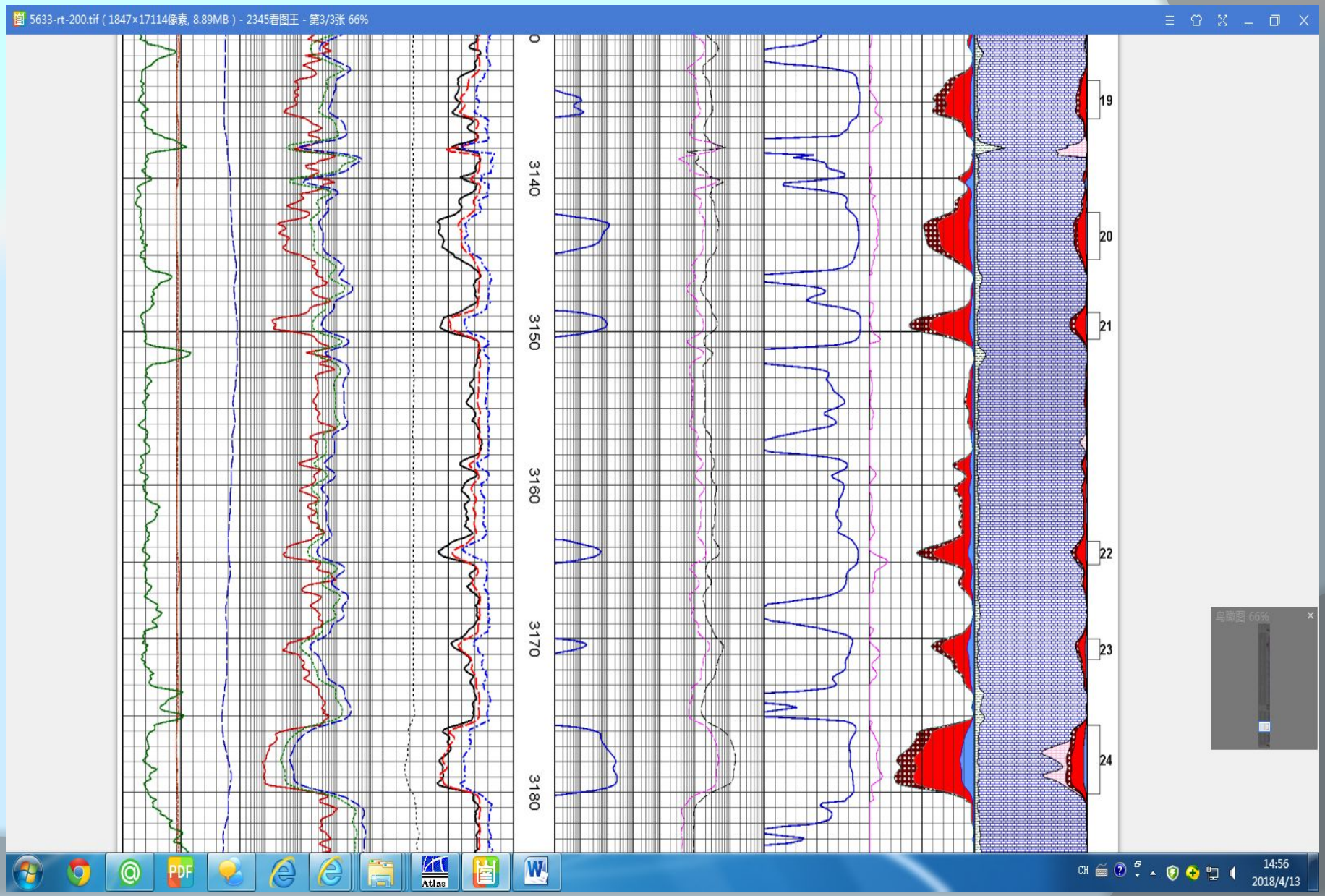
The first group combines direct qualitative characteristics based on a higher permeability of the reservoir compared to the host rocks and on the penetration of the clay solution filtrate reservoir.

The second group includes indirect quantitative criteria of the reservoir, based on the difference between the reservoir and the host rock in terms of porosity, permeability and clay: this allows reservoirs to be isolated in intervals with increased porosity, permeability and reduced clayness according to the diagrams of the corresponding geophysical methods.

The belonging of the allocated seams to a specific lithological type is determined by the totality of the characteristics in the diagrams of the various Wireline logging techniques.

❑ Formation Evaluation

Collectors of Oil and Gas



Presentation Topic:

- R&D;
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❑ Coiled Tubing Operations, well stimulation and relevant engineering services

Coiled Tubing Operations, well stimulation and relevant engineering services

Coiled tubing is an another technology that has been known for decades and has had limited application until recently, when interest in it has increased dramatically due to significant technical achievements.

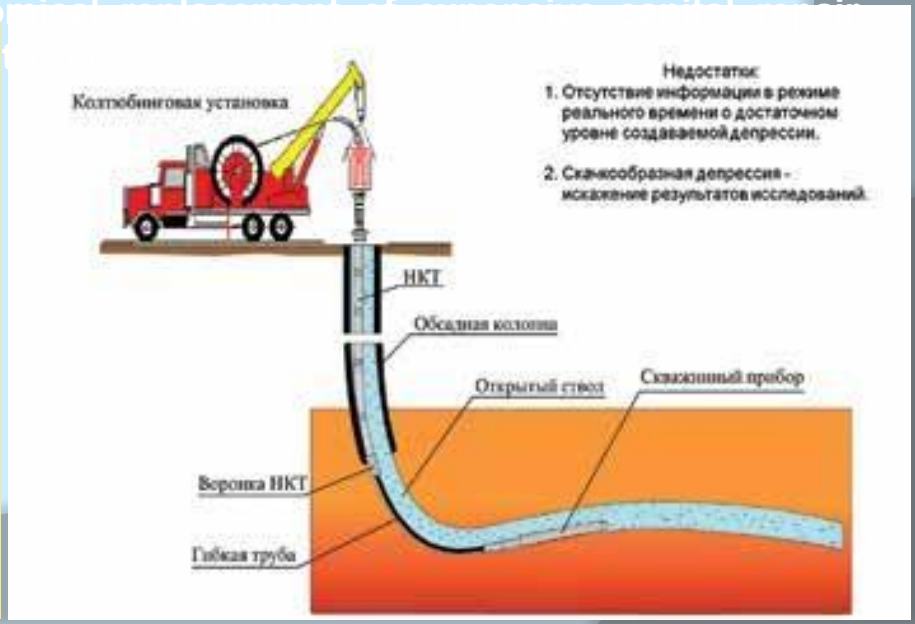
Coiled tubing system is a self-contained, easily transportable, hydraulically driven unit for repair work in the well, which allows the introduction (and extraction) of a continuous column of pipes into a tubing or casing of a larger diameter (Fig.).

The system can be used on land or at sea and does not require a special repair tower. The unit can be used in working wells, it allows continuous injection of liquid or nitrogen with continued movement of the pipe.

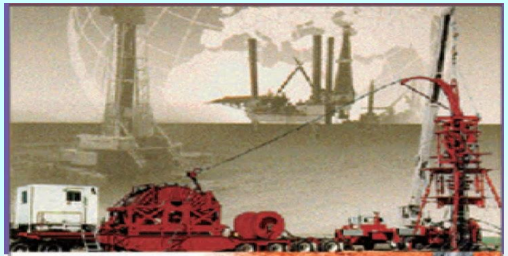
The main advantage of the technology of flexible pipes is that in many cases it is an econom[illegible] works using auxiliary t[illegible]

Coiled tubing operations are used in such areas as:

- drilling;
- repair cementing;
- electrical wiring and perforating;
- fluid displacement;
- Sand binding;
- cleaning of the wellbore;
- setting and removal of plug-packers;
- fishing, testing, completion of wells;
- well control;
- intensification of production;
- use of a collapsible tubing as a discharge pipeline;
- Provide flow control when the horizontal or curved wellbore is completed.



- **Coiled Tubing Operations, well stimulation and relevant engineering services**



Coiled tubing operations include:

- Acid treatment
- Nitrogen gaslift
- Borehole cleaning
- Horizontal well operations
- Chemical injection
- Rinsing works
- Wash and fill sand
- Fishing using coiled tubing
- Secondary cementation
- Drilling of cement bridges
- Wireline logging using coiled tubing
- Perforation using coiled tubing

❑ Coiled Tubing Operations, well stimulation and relevant engineering services

In order to increase the economic efficiency of field development, reduce direct capital investments and maximize the possible use of reinvestment, the entire period of field development is divided into three main stages:

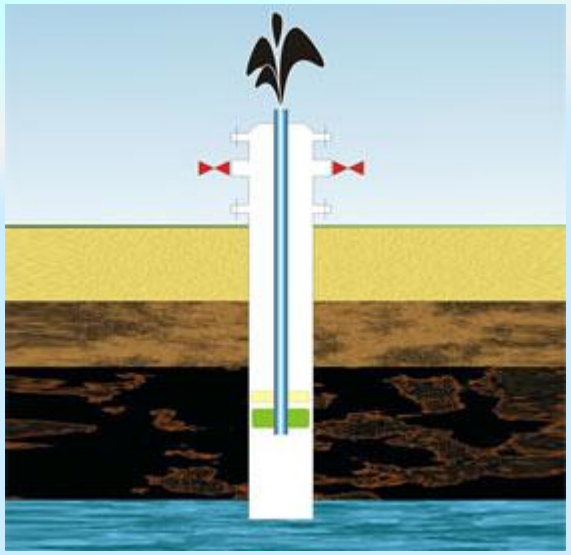


Fig.2. The natural energy of the reservoir

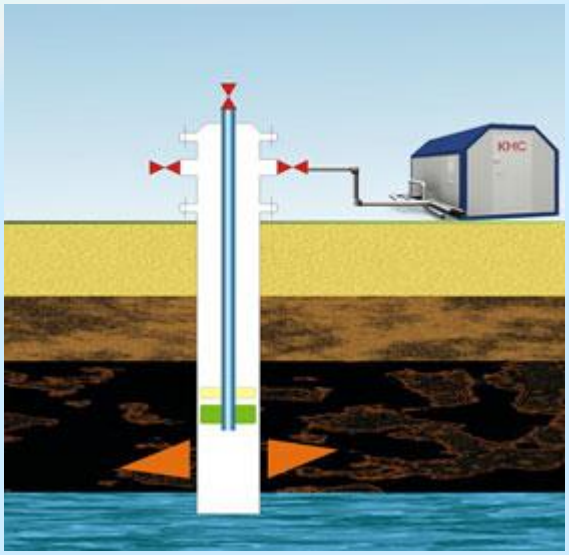


Fig. 3. Water / gas injection

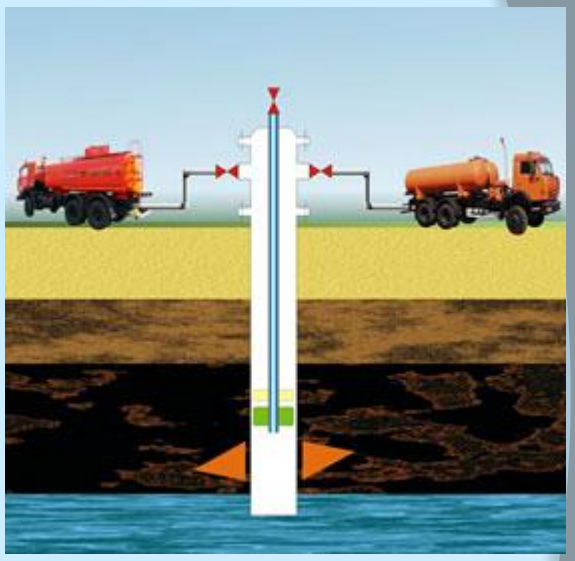


Fig. 4. Application of enhanced oil recovery (EOR)

At the first stage, the natural energy of the reservoir (elastic energy, dissolved gas energy, the energy of the law water, the gas cap, the potential energy of the gravitational forces) is used as much as possible for the extraction of oil (Fig. 2).

At the second stage, methods are implemented to maintain reservoir pressure by pumping water or gas. These methods are usually called secondary (Fig 3).

In the third stage, enhanced oil recovery (EOR) methods are used to increase the efficiency of field development (Fig.4).

- Coiled Tubing Operations, well stimulation and relevant engineering services

METHODS

Oil recovery can only increase through the use of new modern techniques and technologies. Moreover, for each interlayer or operational grade, experts recommend using a specific method.

Among the most popular, it is necessary to name such methods:

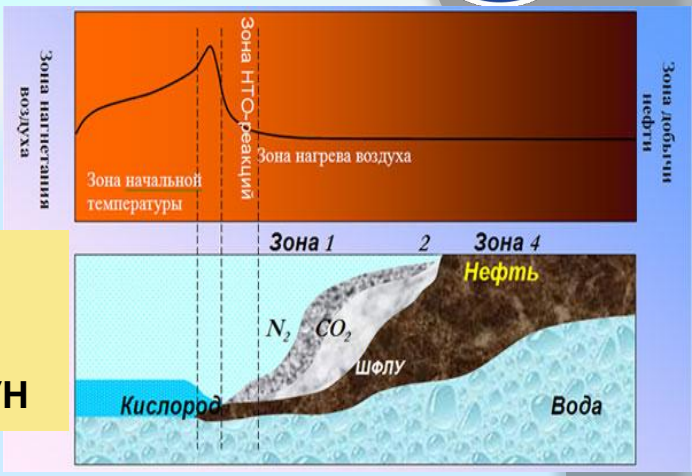
- **Thermal methods** – is the use of high temperature (as a result of combustion, temperature, hot water under pressure, etc.), which increases the flow;

- **Gas Methods** – injection of nitrogen, carbon dioxide, air or a wide fraction of light hydrocarbons;

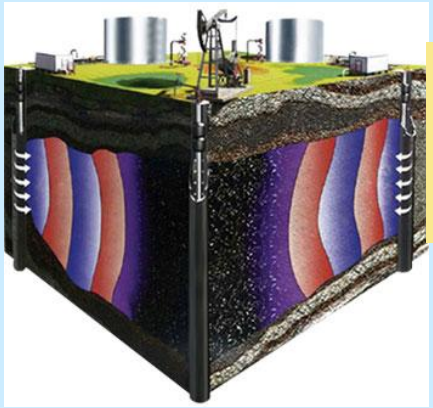
- **Chemical Methods** – application of foam systems, polymers, various types of acids;

- **Hydrodynamical Methods** – use of modern technologies and techniques;

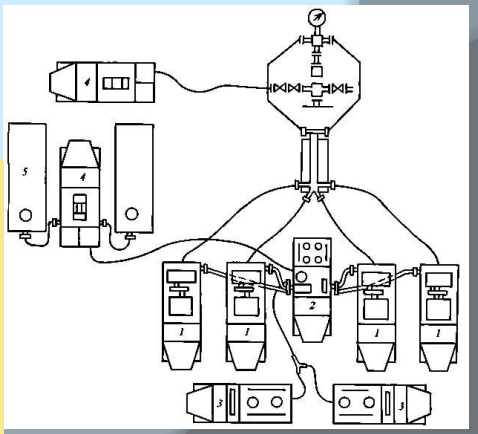
- **Physical** – hydraulic explosion of rock, drilling of vertical boreholes, application of electromagnetic waves.



Механизм вытеснения нефти при тепловых МУН



Применение химических методов для вытеснения нефти



Пример. Обвязка оборудования устья скважины для проведения гидравлического разрыва пласта

❑ Coiled Tubing Operations, well stimulation and relevant engineering services

Engineering maintenance:

Specialists conduct technological engineering, which is necessary for successful work at the stages of drilling, development, operation of wells and transportation of oil.

Stimulation of oil production:

Treatment of carbonate reservoirs. Allows to conduct with the application of adapted acid systems an effective intensification of the treated interval and obtain a drainage area of the required geometry.

Treatment of terrigenous reservoirs. Increase the productivity of wells that exploit terrigenous reservoirs or reservoirs that have reduced their productivity due to secondary technogenic contamination of the wellbore zone (penetration of clay mud).

Acid packets. Taking into account the peculiarities of the geological structure, the Company's specialists propose a solution to intensify the flow rate to achieve the full potential of a particular well. Acid packs are used to eliminate individual problems (sludge, emulsion, iron control), as well as for a complex solution (optimally balanced acid systems).

Enhanced oil recovery:

Waterproofing systems. Minimizing the causes of waterlogging of wells that arise as a result of the breakthrough of water from the injection well zone, the approach of natural formation water from other horizons.

Deflection of the fluid flow. Increase the efficiency of the development of heterogeneous reservoirs with high water cut (more than 80%). Blocking of permeable zones is carried out with the help of viscous gel-like emulsion systems of the reverse type.

Conformance control

Increase in oil displacement ratio.

Recovering. Optimization of well operation due to advanced chemical technologies. Intraquired oilfield chemistry, aimed at reducing the cost of oil production operations.

- **Processing of asphaltenes. * Paraffin treatment. * Treatment of salt deposits.**
- **Chemical technologies for hard-to-recover reserves. A wide range of technologies and chemical compositions for extraction of hard-to-recover oil reserves** (high viscosity heavy oils, heterogeneous carbonate reservoirs, undrained oil reserves) using specialized laboratory studies.

Engineering solutions for mature fields. Technologies that allow to reduce costs on long-running fields by reducing water cut**, involvement in development of non-draining and residual oil reserves.**

Presentation Topic:

- R&D;
- Core Analysis;
- Reservoir evaluation;
- Coiled Tubing Operations, well stimulation and relevant engineering services;
- CBL and borehole gauging;
- Bridge plug setting;
- Fishing Operations.

- CBL and borehole gauging services
- borehole gauging services

Wellbore preparation

• Borehole gauging

After selective drifting of the borehole, will be checked the passage ability of the casing by patterning the borehole. For this, a section of casing about 25 m in length on the drill string is lowered to the bottom. The well is washed until the circulation fluid properties are completely equalized (at least two cycles of circulation). At the end of the washing, the pancreas is treated with a lubricating additive to facilitate the descent of the casing.

• Monitoring the length of the wellbore by measuring the total length of the drilling tool extracted from the well.

Gauging of production and tubing columns is carried out in order to ensure trouble-free descent of equipment, especially the packer, instruments and tools. Its body is made whole without chamfers on the lower and upper ends. The gauge has a through longitudinal hole for washing and preventing the accumulation of mechanical impurities during the launching and lifting operations.

Gauging allows to exclude the possibility of loss of the device.

The diameter of the gauging is determined by the size of the production column and the installation.

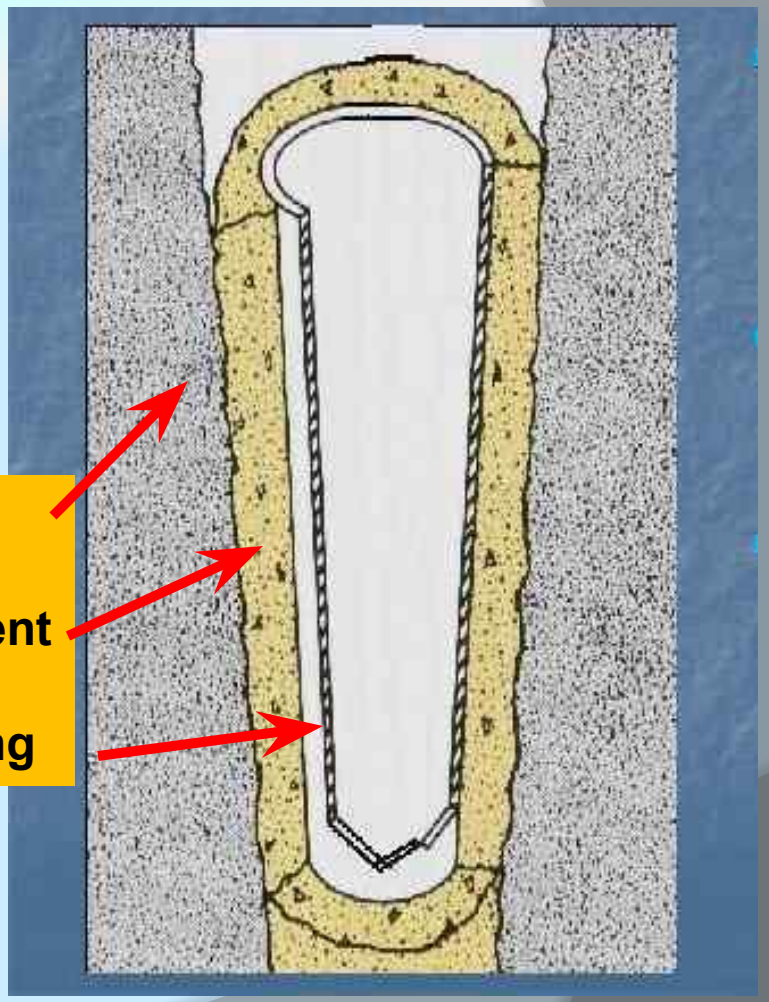
Gauging the production column to a depth of 100-200 m below the location of the cement ring behind the casing.

❑ CBL and borehole gauging services

Cement Bond Logging (CBL) refers to the main research, is carried out in each exploratory well, in a column, along the entire section.
Determined the presence of cement and the nature of its joining to the column and rock.

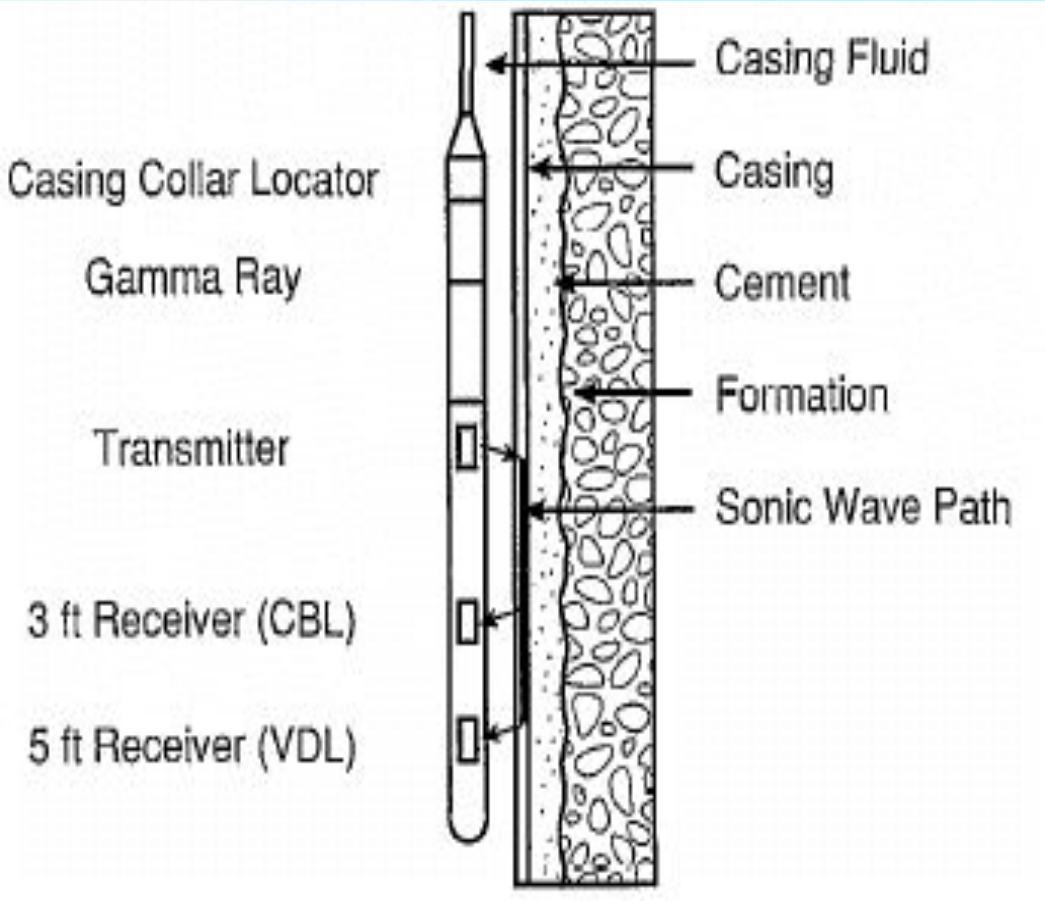
Good Quality cementing of wells is an indispensable condition for their long-term trouble-free operation, the absence of flows between formations and water and gas showings along the annular space.

In most cases, it is impossible to evaluate the quality of cementation immediately after WOC.



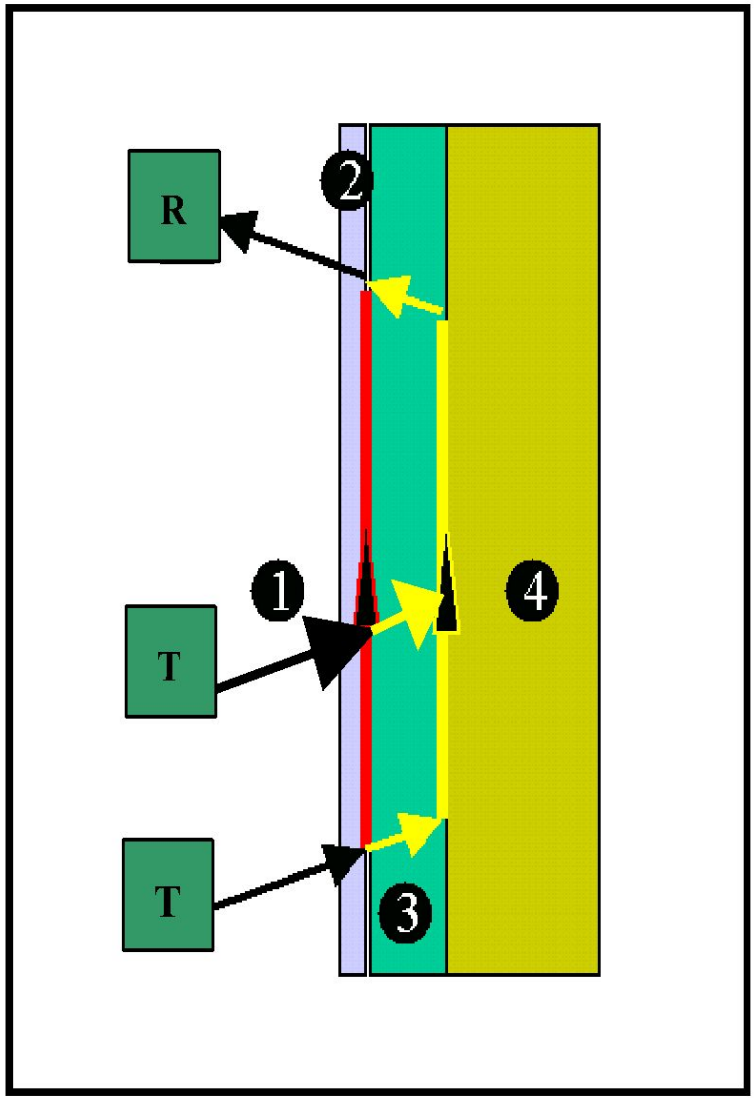
Cement Bond Logging (CBL)

CBL method, based on the use of the laws of propagation of ultrasonic waves in various media, makes it possible to detect a solid cement ring behind the column, provides information about serious defects in the oil well ring itself, qualitatively characterizes the state of the contacts of the column-cement ring-rock.



Cement Bond Logging (CBL)

The amplitudes of the longitudinal wave in the column Ak and in the rock Arock and the propagation time of the longitudinal wave in the rock are recorded. In case of good cement bond with the column and the rock, the minimum amplitudes and maximum attenuation of the signal are observed. In the absence of cement behind the casing, a reverse pattern is observed. The average values are the areas with partial filling or with insufficiently strong adhesion of cement to the rock and column;



The amplitudes of the near (shallow) (3ft) -ACC, long (deep) (5ft) -VDL receivers on the diagram are presented together.
At the same time, the GR-CCL curves recorded with CBL give additional information on the state of the column and the lithology of the section.

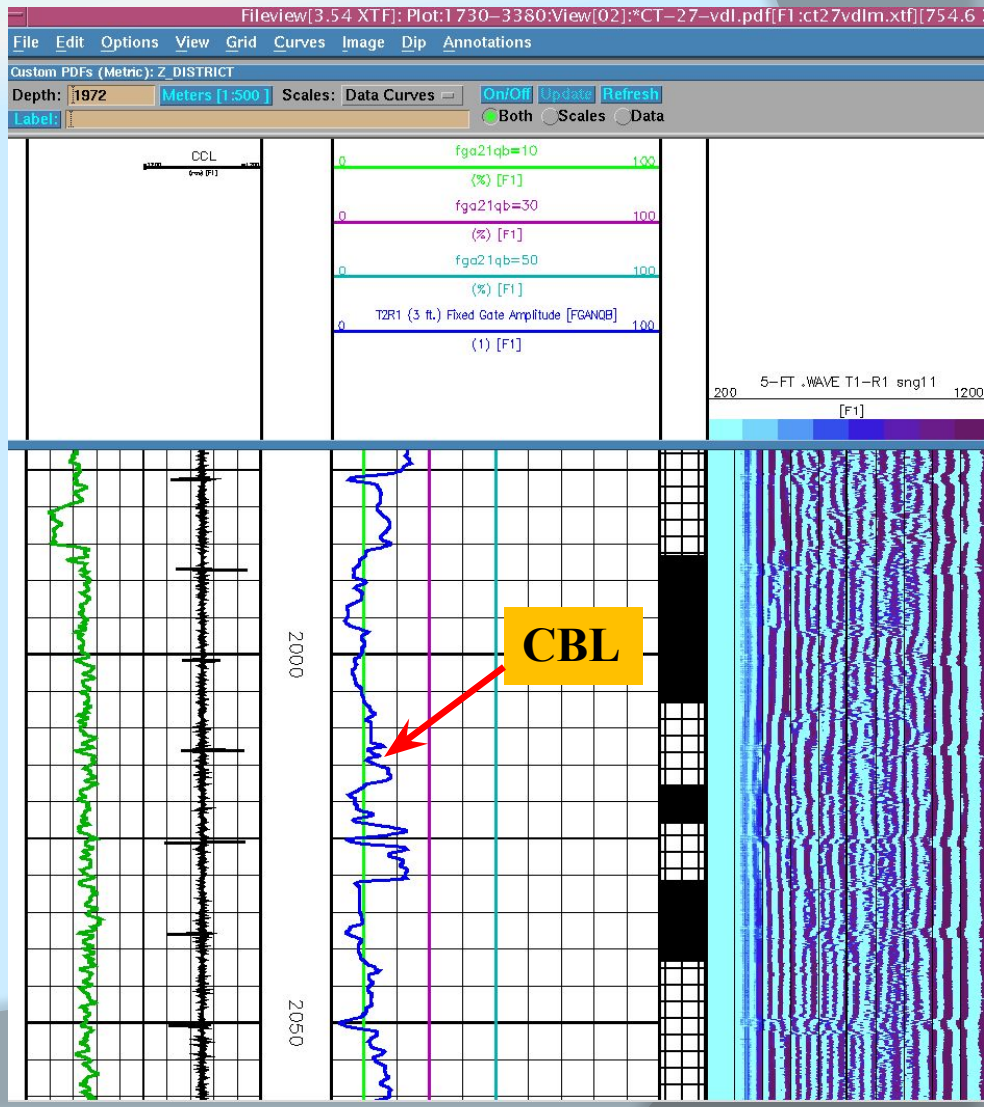
red line - wave along the column,
yellow - on the rock,
green - on the cement stone.
In the case of rigid adhesion of the column to the cement, elastic vibrations, spreading along the column, excite oscillations in the cement rock.

Cement Bond Logging (CBL)

Processing and interpretation of CBL data allows to solve the following tasks:

- determine the top of cement;
- identify the presence or absence of cement outside of the column;
- evaluate the degree of cement bond between column and rock.

CBL data and the results of their processing are presented in the summary diagram.



Evaluation principle:

The maximum wave amplitude in a free column in a well without cement is -100%, the ratio of the amplitude in the processing intervals to this maximum amplitude is the relative amplitude. Method for determining the quality of CBL in the following:

The following standards have been approved for assessing the quality of the well bracing:

Af = A/A0

Af≤10%, bond quality - Good,

10% <Af≤30%, bond quality - Partial,

Af> 30%, bond quality - Poor,

Af> 50%, bond quality - Absence

where, Af - is the amplitude of the CBL,
A - is the amplitude in a given interval,
A0 -is the amplitude in the free column.

Presentation Topic:

- R&D;
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- CBL and borehole gauging;
- Bridge plug setting;
- Fishing Operations.

❑ Bridge plug setting

One of the types of packer equipment used in the oil industry is represented by so-called bridge plugs - devices designed to separate the formations. The use of such devices is mainly related to the work on the conservation of wells, their repair and directly in the course of operation.

Bridge plugs include a number of common structural elements, characteristic for almost any device of this class. Such elements include a lock assembly (whose function is to hold the rest of the elements during transportation and packing), a sealing unit (which provides a sealed separation of volumes) and an anchor assembly (which secures the device in the well).

The drillable bridge plugs are packers of lightly drillable materials. In addition to such devices, there are also recoverable bridge plugs that imply the possibility of creating a temporary or switching to permanent insulation. The installation and lifting of the extracted bridge plugs is carried out using a flexible pipe and a set of hydraulic equipment.

❑ Bridge plugs settings:

Application area

- ❑ For installation of bridges and temporary disconnection of seams;
- ❑ For the liquidation of wells or conservation of deposits;
- ❑ For use as a support for a wedge-deflector;
- ❑ For carrying out repair and insulation work using a plugging material under pressure (elimination of casing circulation, leakage of the casing string).

Distinctive features:

setting of the packer is carried out with the help of the hydraulic installation string of the corresponding design, by creating excess pressure in standard tubing;
It is designed for uninterrupted operation at a differential pressure up to 35 MPa;
the integral design of the slips eliminates the risk of premature installation during descent;
is manufactured in accordance with strict technical conditions for materials and with strict quality control of products, due to which the best combination of high strength characteristics and good drillability.

Benefits:

simplicity, low metal consumption compared to similar structures and good packer drillability;
Packing in inclined, horizontal, deep wells;
the use of a bridge plug during repair and insulation works significantly reduces the time of carrying out technological operations, reduces the cost of work, increases their reliability.

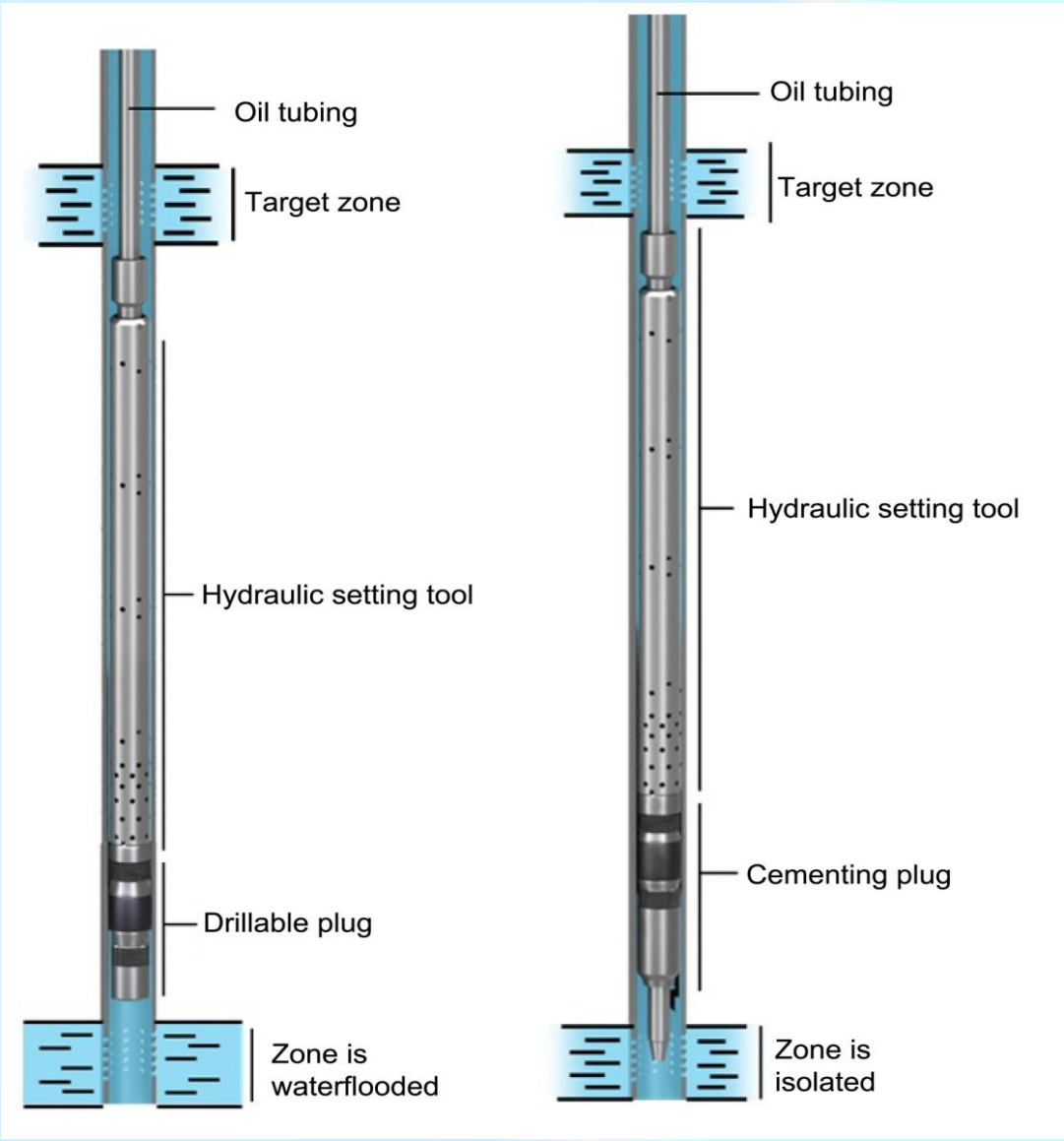
❑ Bridge plug setting

There are 2 certain types of bridge plugs:

- Bridge plug is used to overlap the insulation interval at producing casing.

- Cementing plug is for filling in the sub-packer zone.

They are produced in designs with a pressure difference of 35 MPa and 100 MPa.



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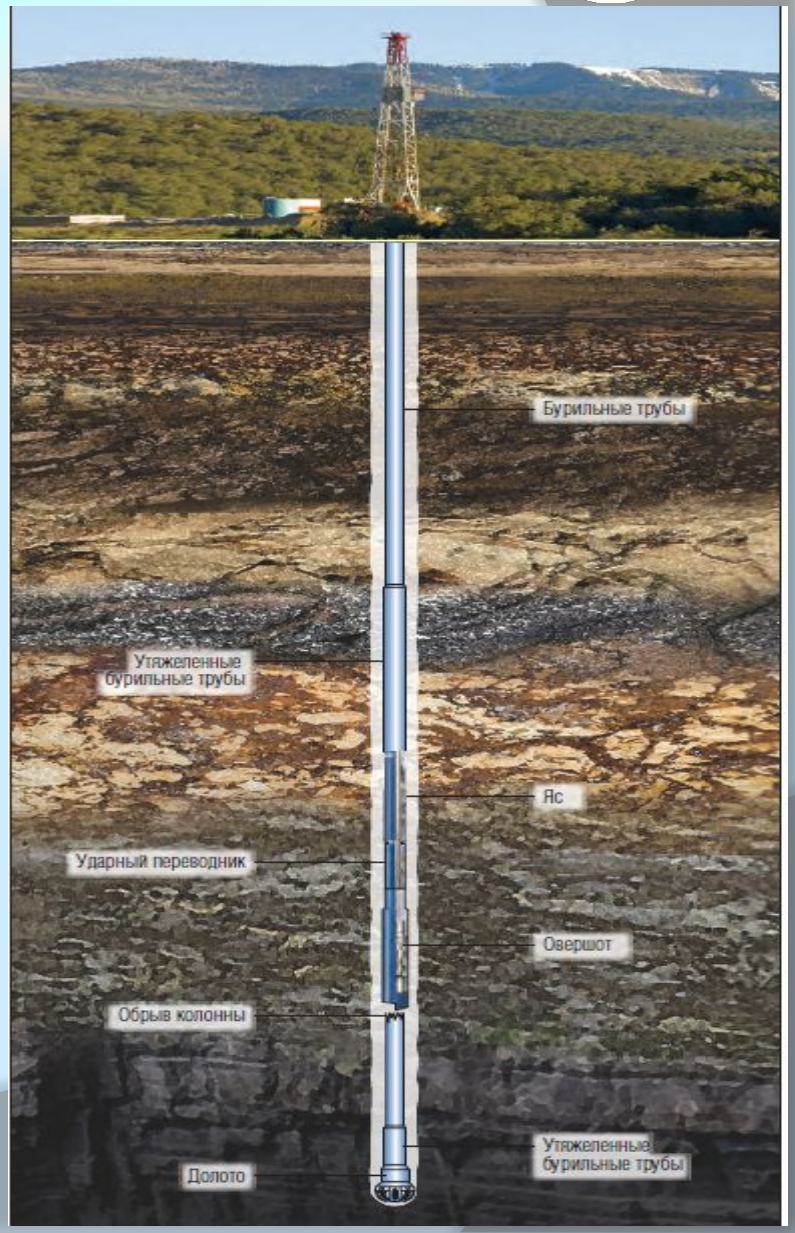
❑ Fishing operations and their purposes.

Any matters left in the borehole that interfere further work at the oilfield are called emergency tool. This definition covers the entire variety of drilling, logging and operating equipment, including bits, pipes, wireline logging tools, hand tools and other foreign matters that could be lost, damaged, stuck or left in the borehole. The left tools and equipment serve as an obstacle to the performance of work, they must be extracted from the well by fishing operations.



Reasons for fishing operations:

1) Human factor
2) Equipment malfunction
3) Wellbore instability

❑ Fishing operations and their purposes:

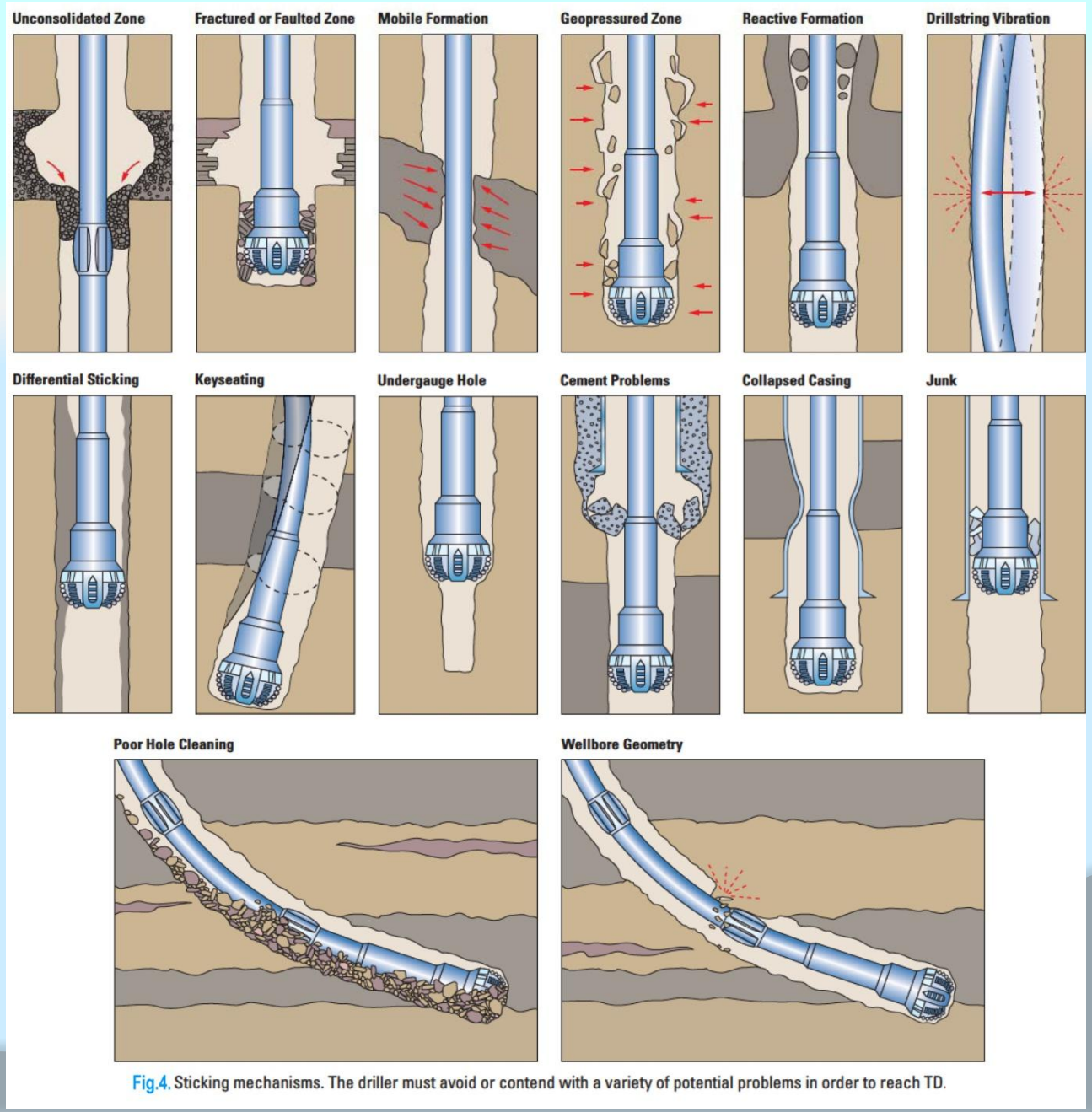


Fig.4. Sticking mechanisms. The driller must avoid or contend with a variety of potential problems in order to reach TD.

❑ Fishing operations and their purposes.

Fig.7. Junk magnet. This type of magnet is used to retrieve small pieces of ferrous material from the hole. Some junk magnets have circulating ports that enable cuttings to be washed away from the junk.

Fig.8. Junk mill. A slight concavity to the face of the mill helps to center the junk beneath the cutting surface so it can be ground into smaller pieces.

Fig.10. Box tap. This device is designed to externally engage and retrieve tubulars that cannot be rotated. It uses a tapered wicker thread sized to fit over the top of the fish.

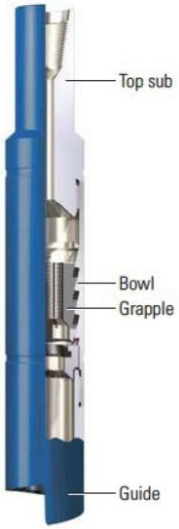


Fig.11. Overshot. The overshot is divided into three segments. The top sub connects the overshot to the workstring. The bowl has a tapered helical design to accommodate a grapple, which holds the fish in place. The guide helps position the overshot onto the fish.

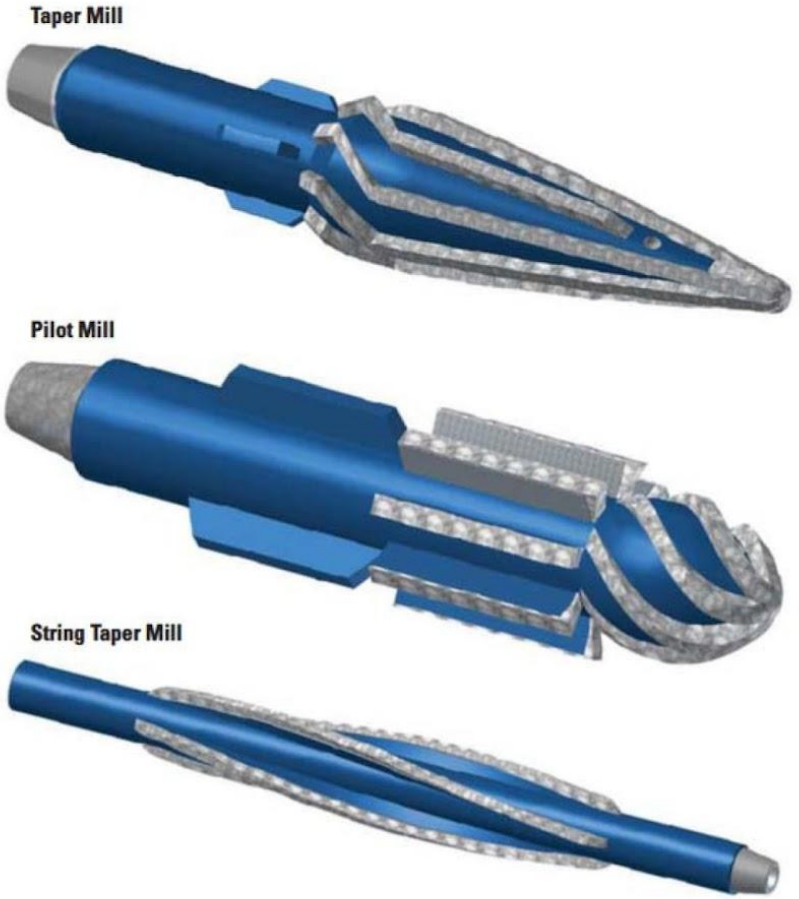


Fig.9. Downhole milling tools. Mills come in a variety of sizes and configurations. The taper mill (*top*) is designed for milling through tight spots and cleaning out collapsed or deformed tubulars. A pilot mill (*center*) may be employed to mill sections of tubular junk or to dress casing prior to installing a casing patch. The larger milling blades are guided by the small central pilot at the front of the tool. The string taper mill (*bottom*) may be used for cleaning out damaged tubulars and is also recommended for removing keyseats in open hole. Tapering at the top and the bottom of this mill allows it to ream in both directions.

❑ Fishing operations and their purposes.

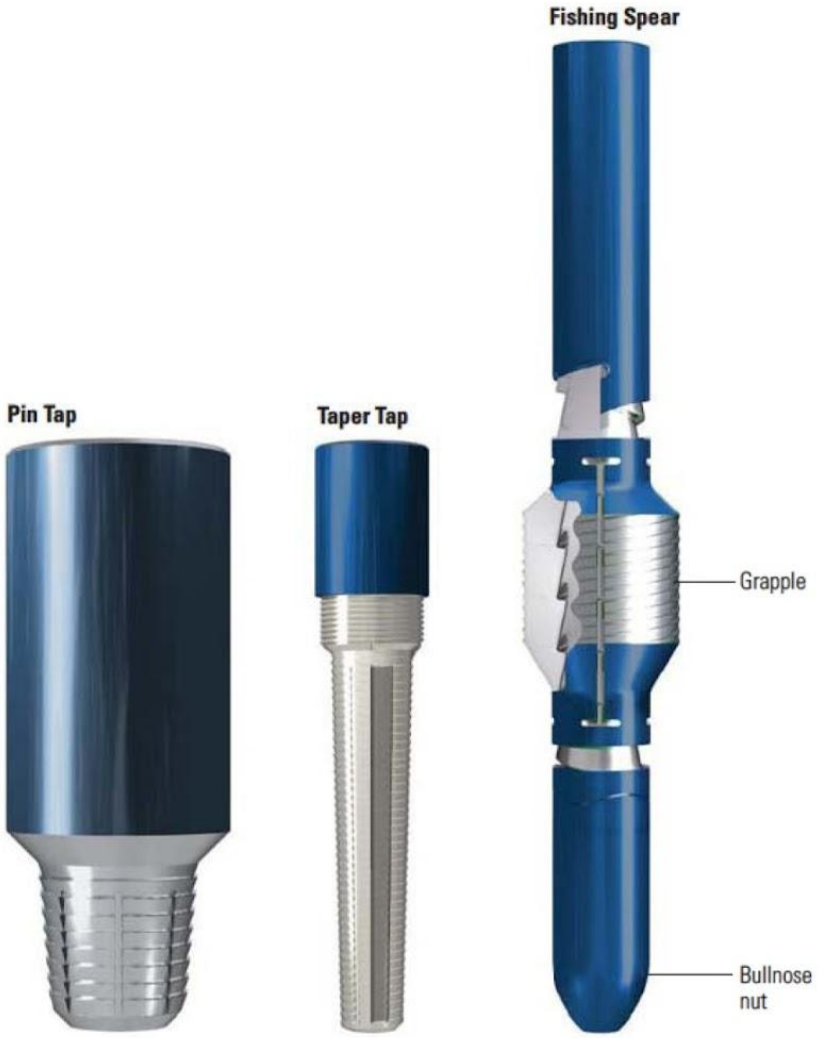


Fig.14. Internal catch devices. Pin taps (*left*) are used to make up to a box tool joint when retrieving a tubular fish that is restrained from rotation. One-piece taper taps (*center*) are constructed with a fine thread form that enables the tap to work as a threading tool. Flutes in its threading give it a cutting edge to assist in tapping into the fish. The fishing spear (*right*) provides engagement over a large area of pipe to minimize distortion of the fish.

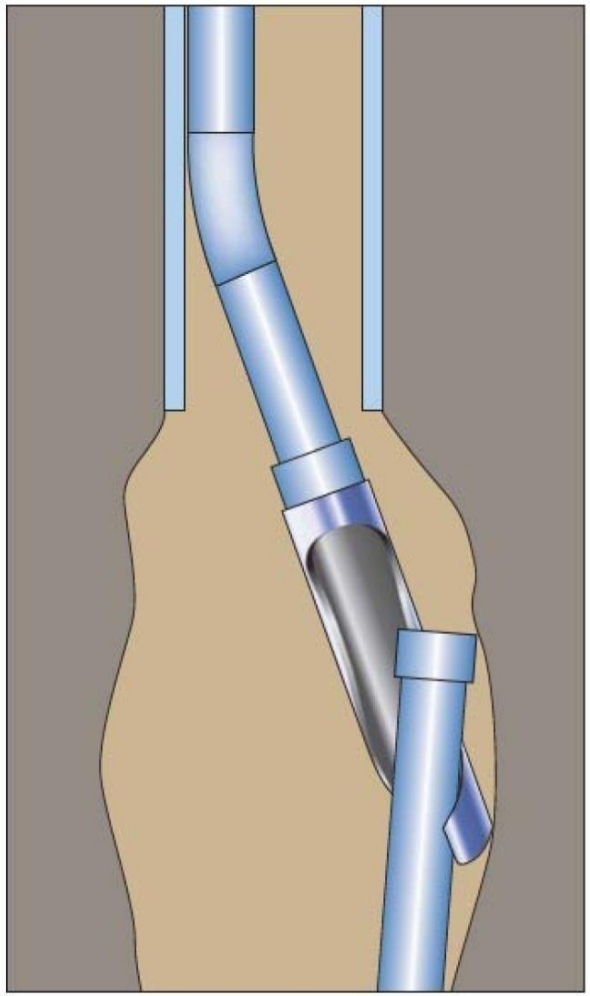


Fig.8. Wall hook guide. If the hole size is much greater than the fish diameter, the overshot may pass alongside the fish, rather than engaging it. This condition forces the fishing specialist to install a wall hook guide to ensure alignment of the fish with the overshot.

Спасибо за внимание!

Thank you for paying attention!