Introduction of well drilling technology

Prepared by:

Kanat Suleimen, Senior-lector

Life of field

The life of an oil or gas field can be sub-divided into the following phases:

- Exploration
- Appraisal
- Development
- Maintenance
- Abandonment

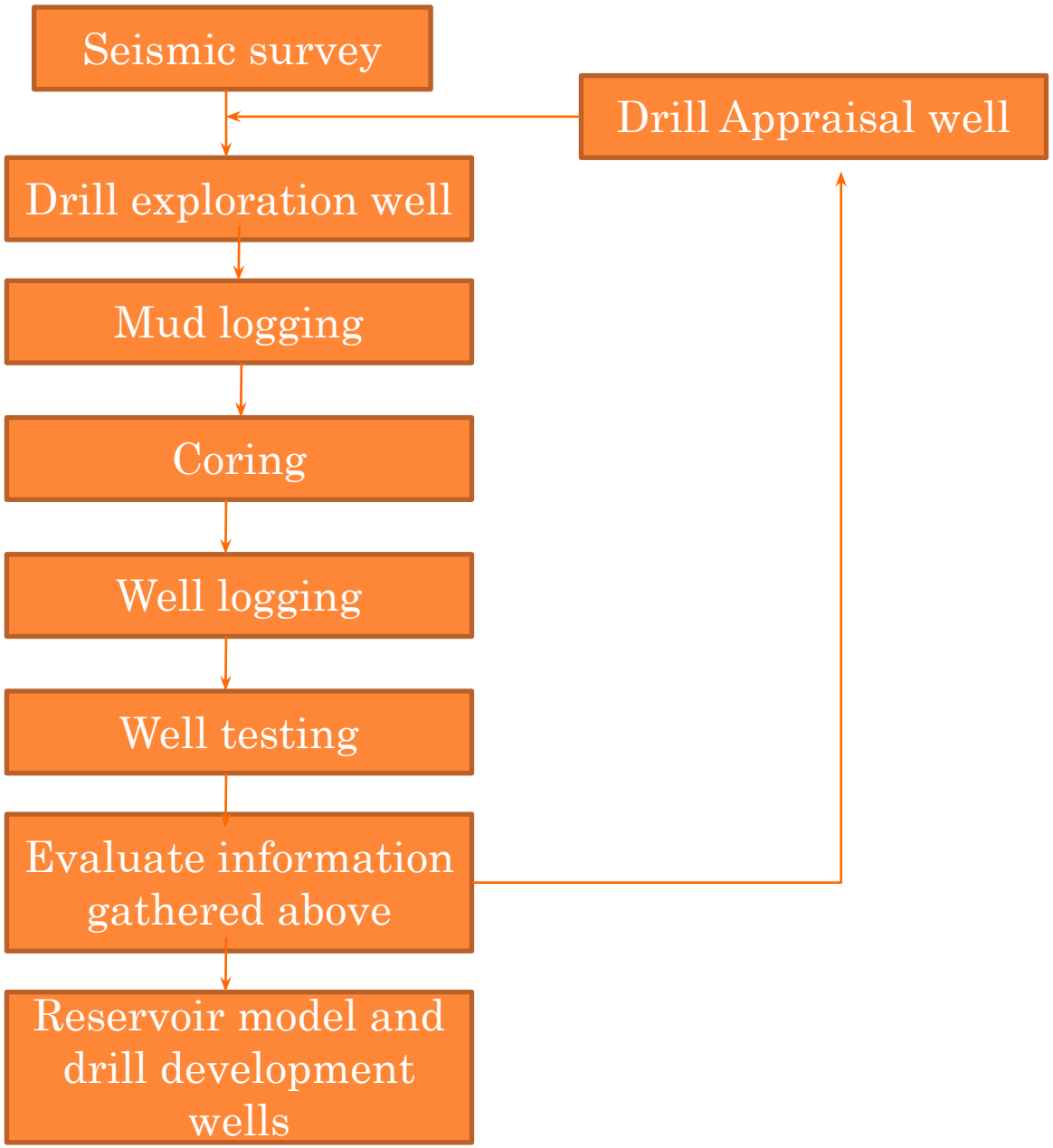
Exploration well

Exploration wells are drilled for data collection in new regions

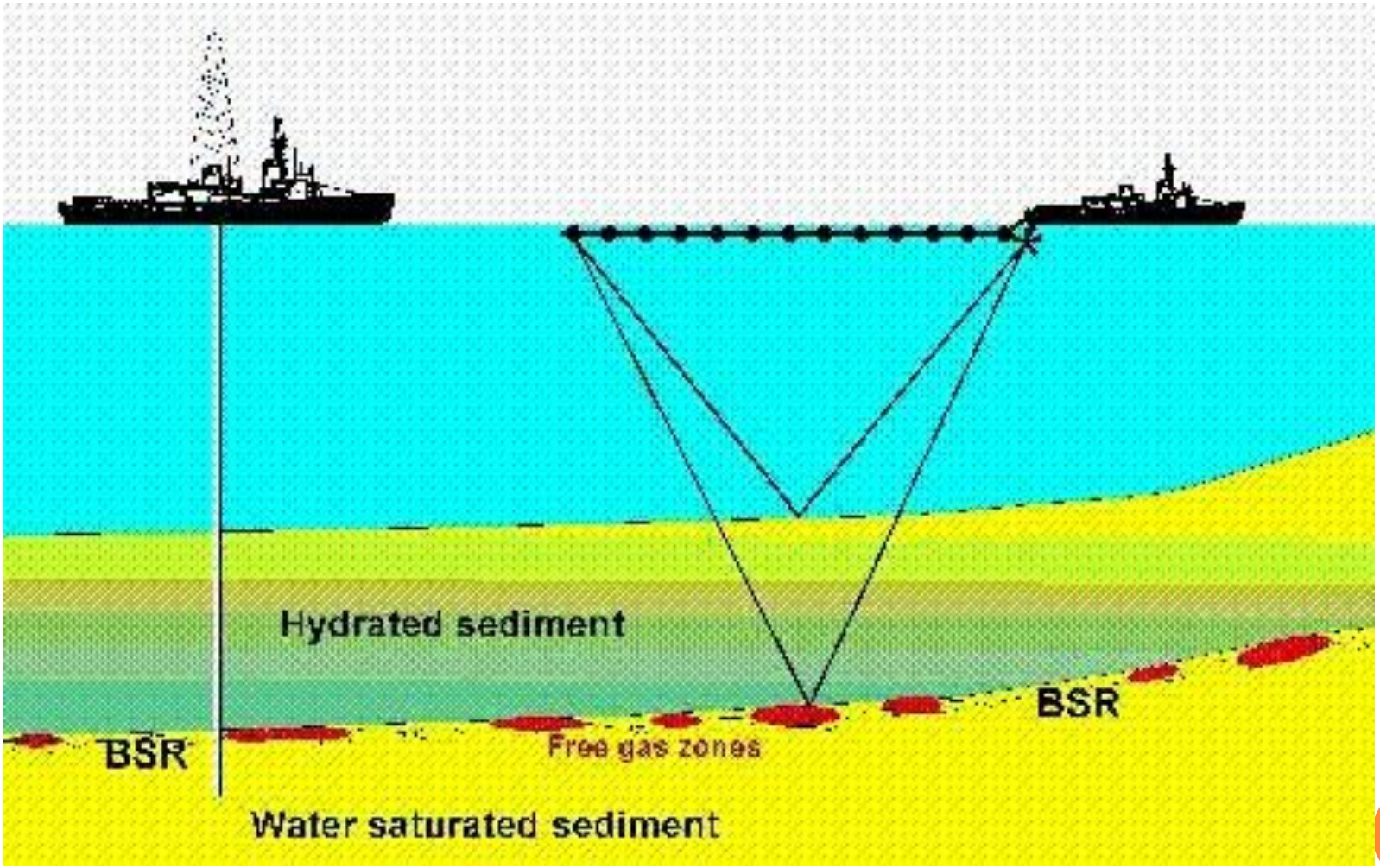
Information is mainly represented by drilled rock, core samples, well test and well logging data

Exploration phase

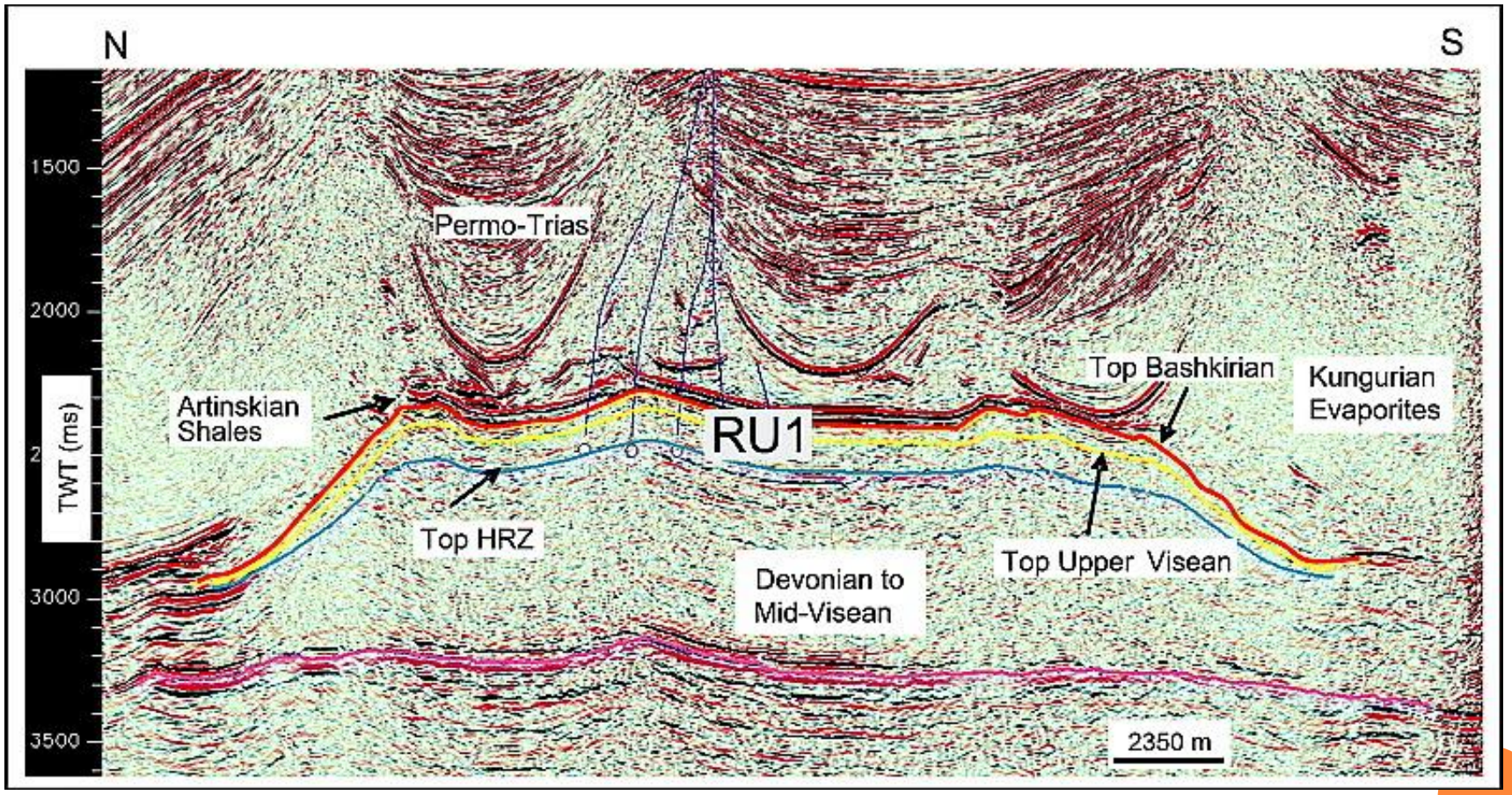
The length of the exploration phase will depend on the success or otherwise of the exploration wells. There may be a single exploration well or many exploration wells drilled on a prospect.


Seismic survey
Drill Appraisal well
Drill exploration well
Mud logging
Coring
Well logging
Well testing
Evaluate information gathered above
Reservoir model and drill development wells

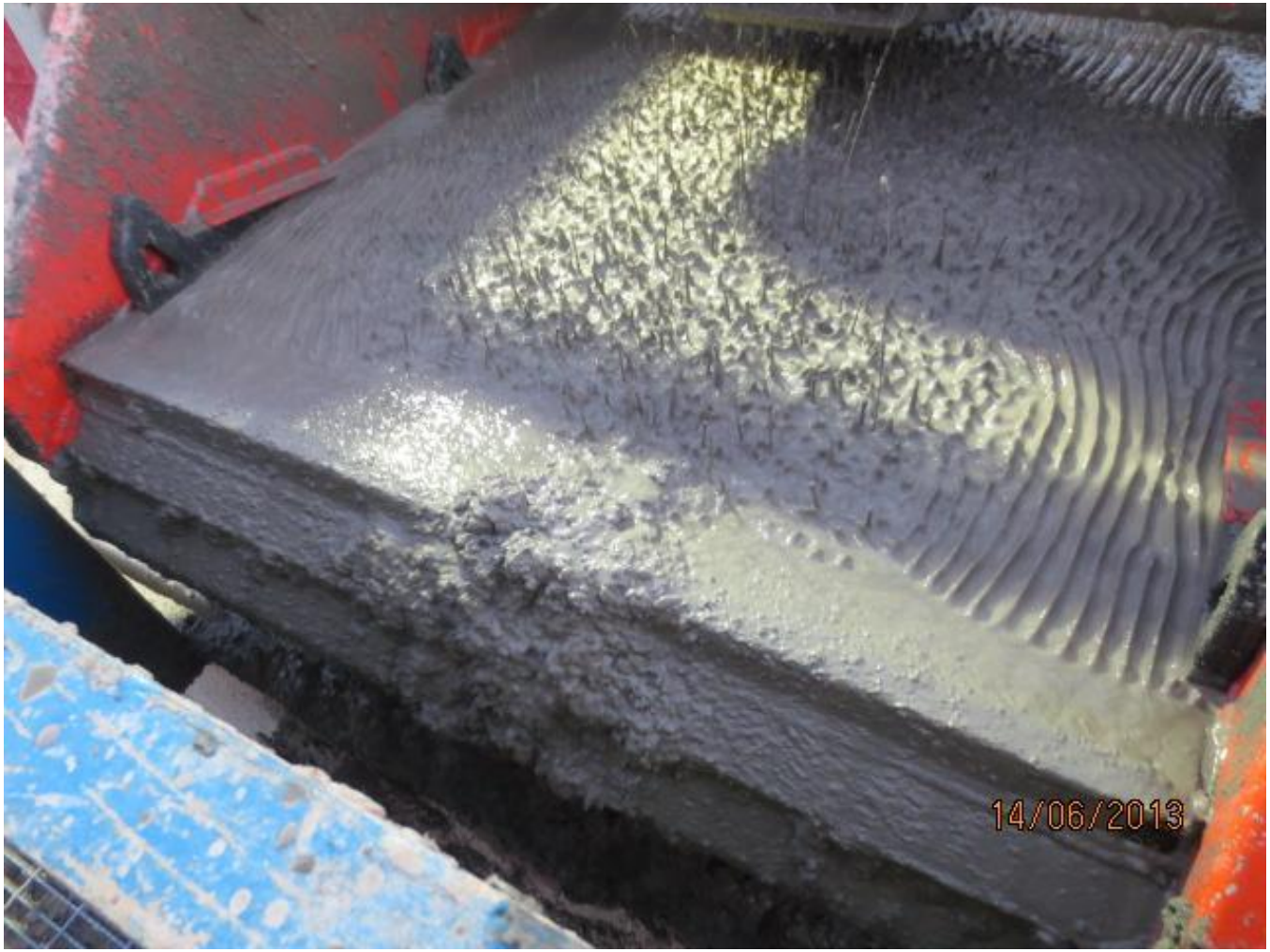
Seismic survey



Seismic survey



Drilled rock samples and Mud logging data



Drilled rock samples and Mud logging data

Core/core barrel

- Essentially three different types of coring methods are used to recover formation samples from petroleum reservoirs

1. **Rotary Coring**
2. **Sidewall Coring**

Conventional methods

3. **High Pressure Coring**

Rotary Coring Method

- In this method, cores are obtained by a coring bit that has a hole in the center with a combination of barrel and catcher.

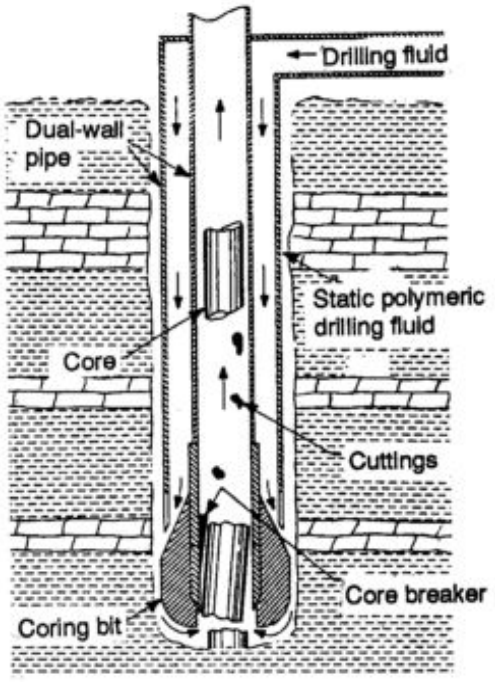
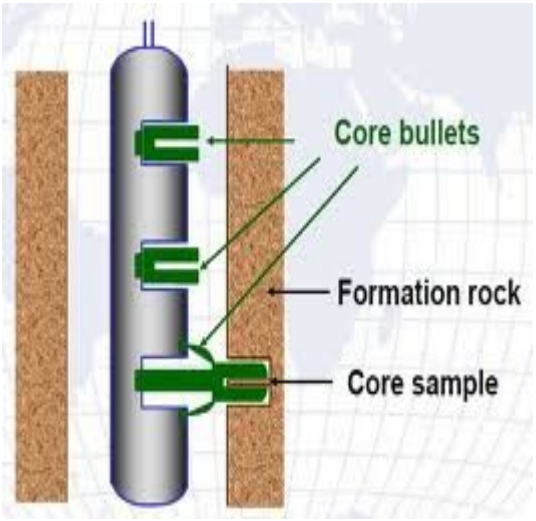


Figure 11-1. Core-drilling equipment

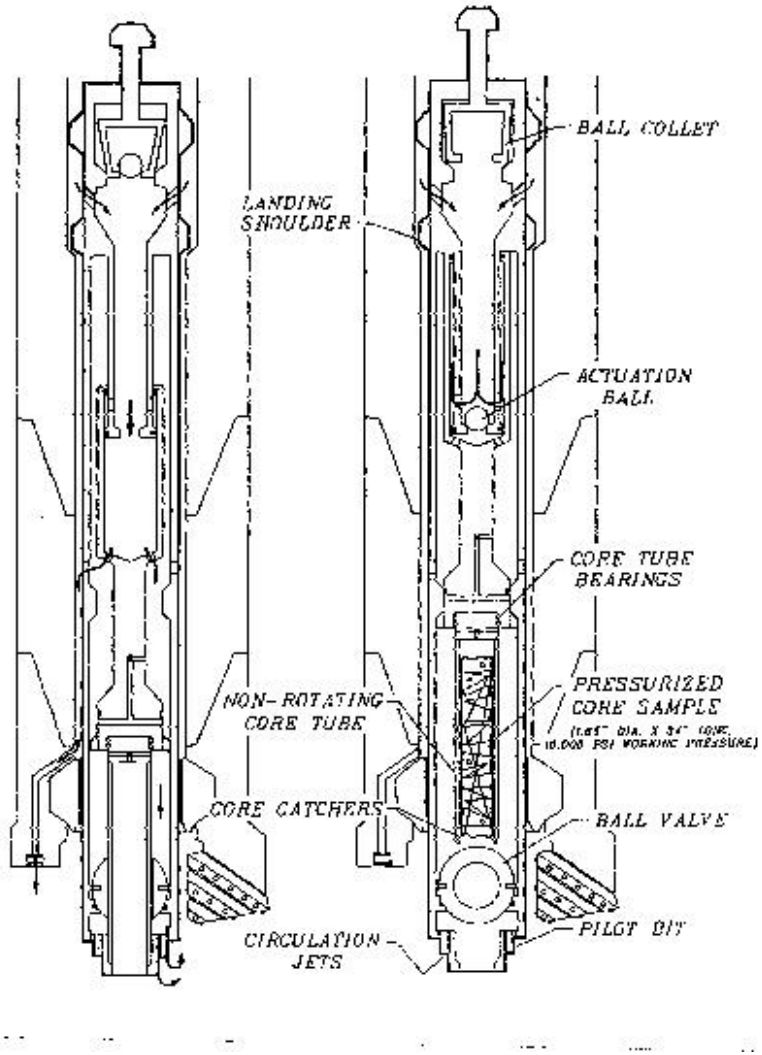
Sidewall Coring

- This type of coring method obtains smaller core samples. It employs hollow cylindrical core barrels that can shot in sequence from the gun into the formation.

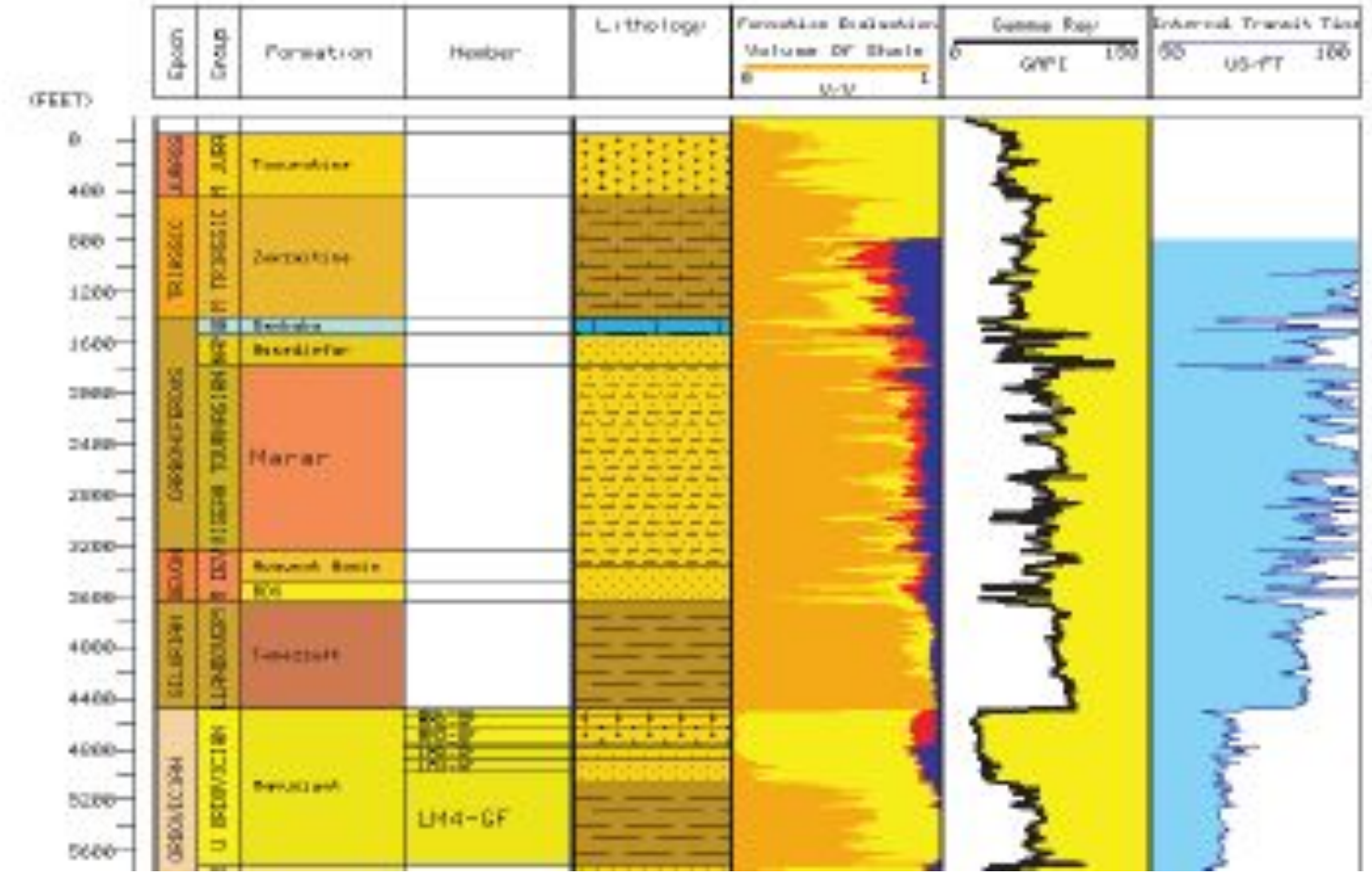


High Pressure Coring

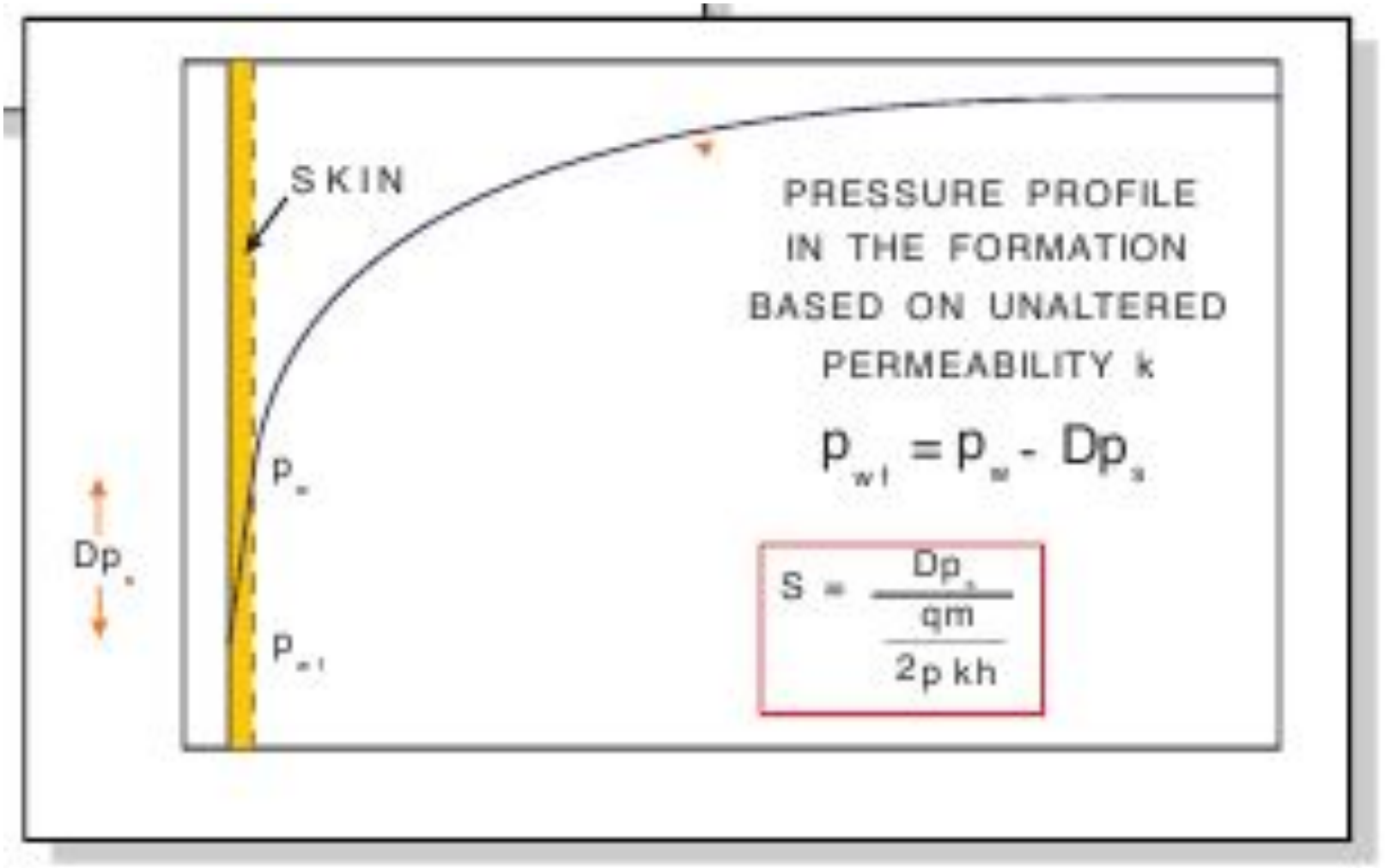
- Pressurized Coring
  - Used high pressure to get the core samples in its original conditions to avoid any loss of the fluids
  - Freezing the core to immobilize the fluids then the core can be depressurize



Well logging



Well testing



Appraisal well

If an economically attractive discovery is made on the prospect then the company enters the Appraisal phase of the life of the field.

During this phase more seismic lines may be shot and more wells will be drilled to establish the lateral and vertical extent of (to delineate) the reservoir. These appraisal wells will yield further information, on the basis of which future plans will be based.

Company announcement example

SAGW-1 Discovery well: 27m net pay (21m oil / 6m gas) in Triassic over 114m interval between 1,177–1,291m. Good porosity between 18-25%

- SAGW-2 appraisal well result limited the eastern flank of the Field
- SAGW-3 appraisal well logged 15 M of net pay

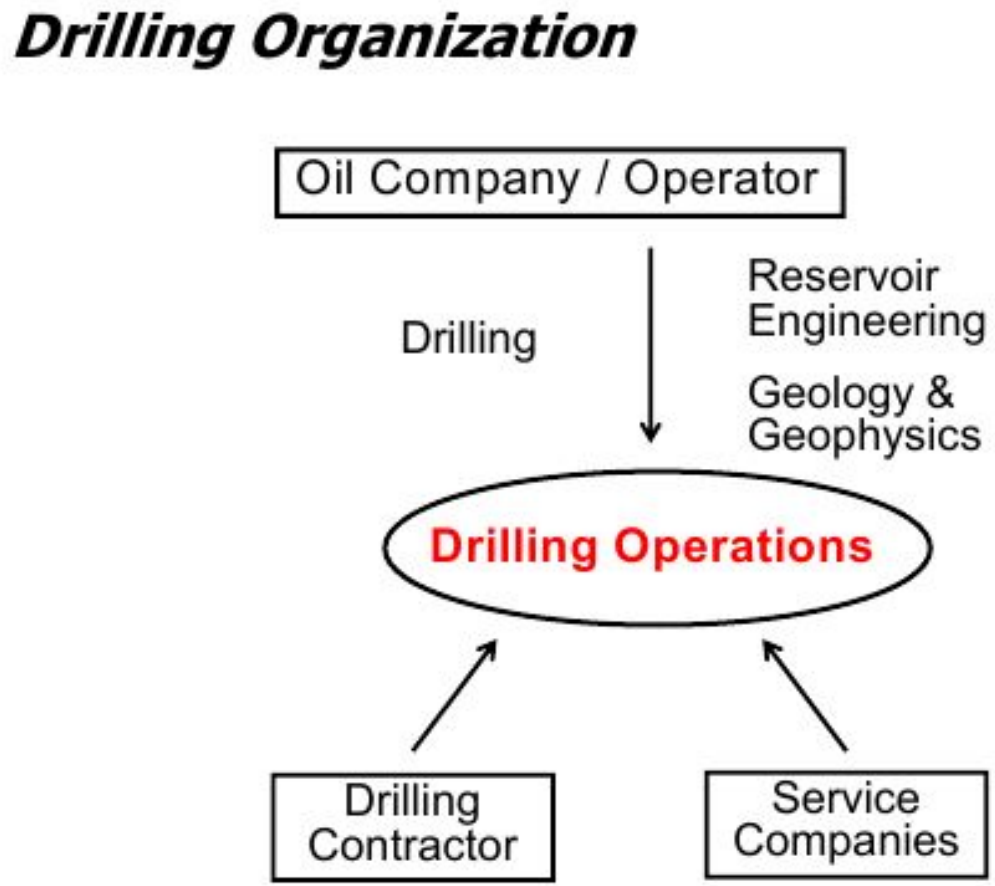
Company announcement example

SAGW-4 appraisal well logged 20 meters of gas condensate and oil pay with porosities ranging from 15% to 25%. Additional 17m of potential oil pay with lower oil saturation

- Appraisal drilling programm to commence after integration of new 3D high-fold seismic data and SAGW-4 wells results

Source: www.maxpetroleum.com

Drilling organization



Author: Zolotukhin A

Operator

The oil company who manages the drilling and/or production operations is known as the operator. In joint ventures one company acts as operator on behalf of the other partners.

The operator will generally have a representative on the rig (sometimes called the "**company man**") to ensure drilling operations go ahead as planned, make decisions affecting progress of the well, and organize supplies of equipment. He will be in daily contact with his drilling superintendent who will be based in the head office of the operator. There may also be an oil company drilling engineer and/or a geologist on the rig.

Drilling Contractor

There are many different management strategies for drilling a well but in virtually all cases the oil company will employ a drilling contractor to actually drill the well. The drilling contractor owns and maintains the drilling rig and employs and trains the personnel required to operate the rig.

The toolpusher

The drilling contractor will employ a toolpusher to be in overall charge of the rig. He is responsible for all rig floor activities and liaises with the company man to ensure progress is satisfactory. The manual activities associated with drilling the well are conducted by the drilling crew.

Drilling Proposal

The proposal for drilling the well is prepared by the geologists and reservoir engineers in the operating company and provides the information upon which the well will be designed and the drilling program will be prepared. The proposal contains the

following information:

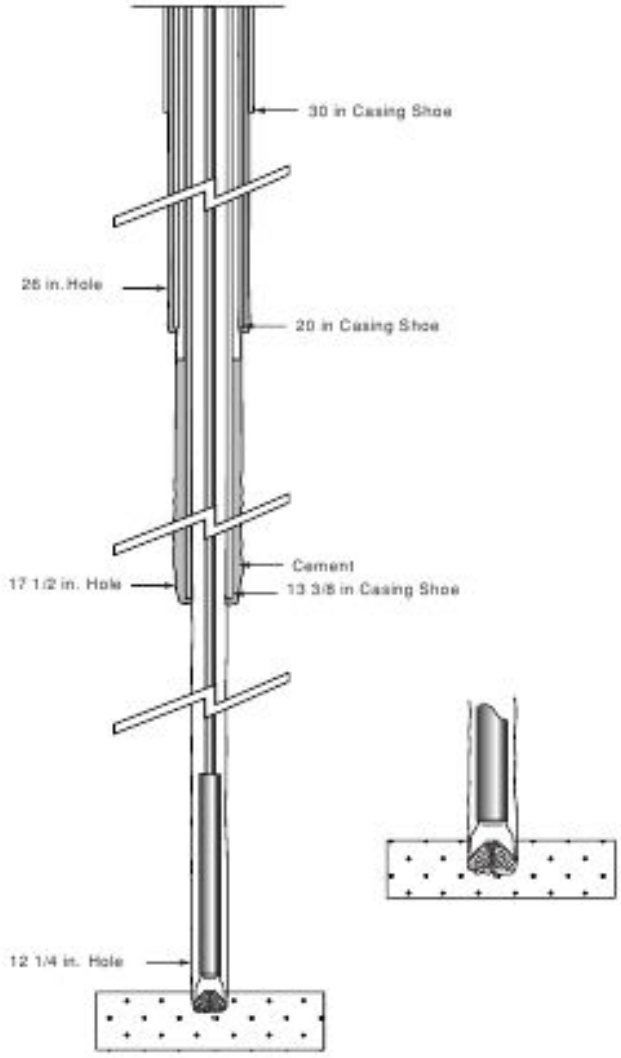
- Objective of the Well
- Depth (m/ft Subsea), and Location (Longitude and Latitude) of Target
- Geological Cross section
- Pore Pressure Profile Prediction

Drilling program

The drilling program is prepared by the Drilling Engineer and contains the following:

- Drilling Rig to be used for the well
- Proposed Location for the Drilling Rig
- Hole Sizes and Depths
- Casing Sizes and Depths
- Drilling Fluid Specification
- Directional Drilling Information
- Well Control Equipment and Procedures
- Bits and Hydraulics Program

THE DRILLING PROCESS



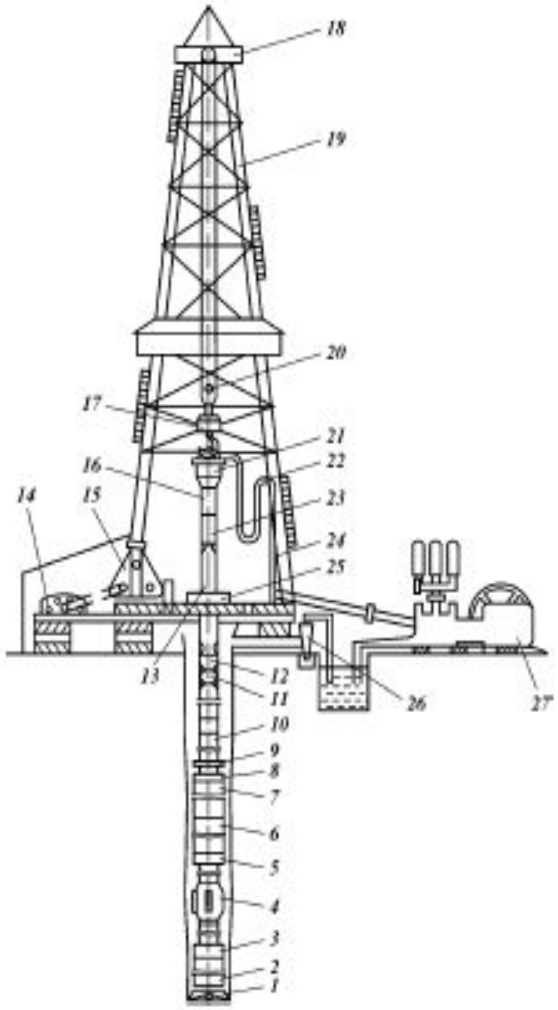
Типы профилей скважин

- Относительно точки входа в заданный горизонт профиль скважины бывает:
- Вертикальным. Зенитный угол меньше 3 градусов
- Наклонно-направленным. Зенитный угол в пределах от 3 до 55 градусов
- Пологим. Зенитный угол а пределах более 55 до 85 градусов
- Горизонтальным. Зенитный угол более 85 градусов

Способы бурения

ВРАЩАТЕЛЬНОЕ БУРЕНИЕ

- - роторное
- - турбинное
- - комбинированное или роторно-
- турбинное



Методы бурения

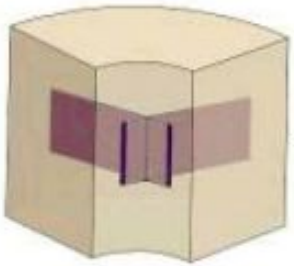
Роторно-турбинный. Наиболее распространенный в настоящее время. Позволяет управлять траекторией

ствола скважины без подъема КНБК на

поверхность.

Изменении траектории осуществляется при помощи винтовых забойных двигателей PowerPak Motor и управляемых роторных систем Rotary Steerable Systems

Mud Weight vs Failure



Shear Failure Wide Breakout (Swbo)

Tensile Failure Vertical (Tver)

Shear failure

Occurs when the Shear STRESS exceeds the Formation Shear STRENGTH

Tensile failure

Occurs when the Tensile STRESS exceeds the formation Tensile STRENGTH

Thank you a lot for listening to my talk!