



جامعة البصرة
كلية الهندسة - قسم هندسة النفط



PeE3321 ***Petroleum Drilling Eng. 1***

2019-2020

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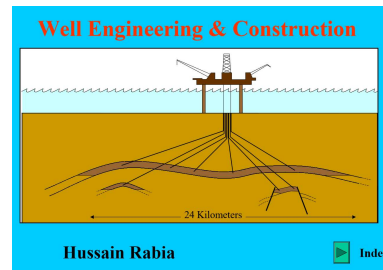
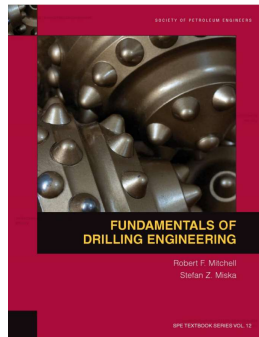
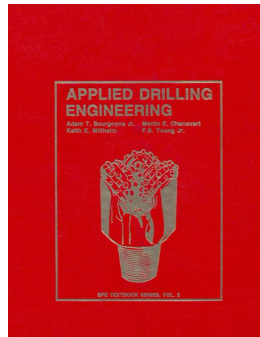
Syllabus

- Introduction to drilling
- classification of drilling operations
- properties and functions of drilling fluid
- types and properties of clay in water
- types of drilling fluids, drilling hazards dependent on mud control, drilling mud calculations
- drilling methods (cable tool drilling, rotary drilling)
- basic component of rotary drilling equipment, drilling string and accessories
- types of bits

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References

Books:



OnePetro: 

Petrowiki: 

3

Instructor

- Ethar H. Khalil
- Ph.D. in Petroleum Eng. (Drilling Automation) from Missouri University of Science and Technology, USA, 2018
- M.Sc. in Petroleum Eng. (Drilling Automation) from Missouri University of Science and Technology, USA, 2016



- M.Sc. in Mechatronics Eng. (Automation) from Baghdad University, 2008.
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Lecture # 1 PeE 3321

Overview of the Drilling
Process

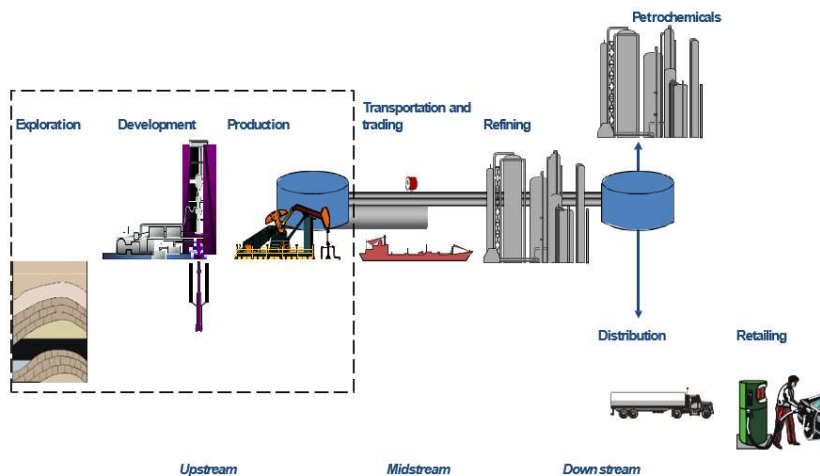
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Lecture overview

- Topics covered
 - Petroleum System
 - Rig types
 - Drilling process
 - Making a hole
 - Drill String Components
 - Making a connection
 - Rig Systems

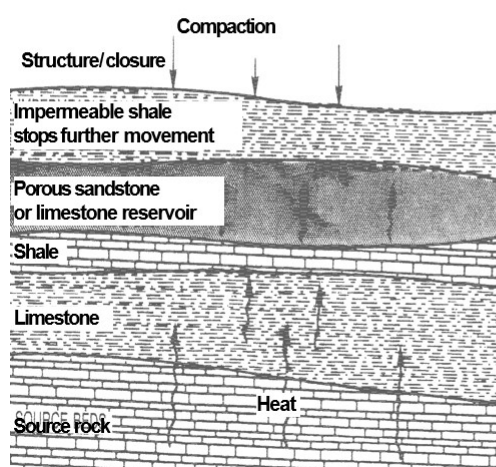
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E&P In The Petroleum Business System



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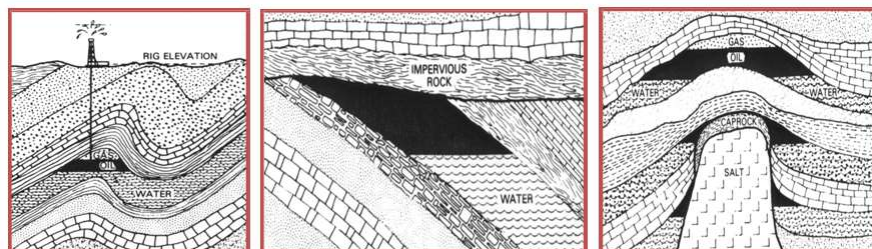
For oil and gas reservoirs to exist, all six ingredients must be present



- 1. Source rock:** Shales rich in organic carbon
- 2. Heat and pressure:** At depth and over long periods to generate oil/ gas from the source rock
- 3. Migration:** The flow of oil/ gas from source rocks to reservoirs over millions of years
- 4. Reservoir rock:** Porous and permeable rock where oil and gas accumulate
- 5. Seal:** Impermeable rock that serves as a barrier to oil and gas, preventing it from migrating out of reservoir rock
- 6. Structure:** A geometric structure that prevents upward migration

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Geological traps



Structural trap

Stratigraphic trap

Salt dome and anticline

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Petroleum field life cycle

Exploration	Development	Production	Abandonment
Review existing geological/geophysical data	Land owner permits	Operate oil field	Abandon field and reinstate property
Shoot seismic	Complete development plan	Monitor reservoir performance	
Drill exploratory wells	Facilities and well design	Develop prod. maintenance and improvement plans	
Log and core well and sample fluids	Set performance targets	Evaluate ongoing economic viability of well/field	
Well test	Final facilities engineering design	Review scope for additional investment	
Evaluate data	Drill production wells		
	Construct, install, and commission production and export facilities	e.g., Service well/ perform workovers Stimulate wells, new wells, satellite fields, Enhance oil recovery	

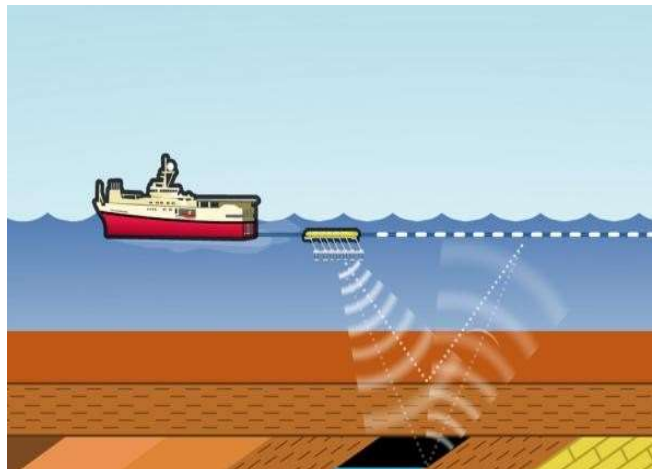
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Shoot seismic



Seismic exploration is the search for commercially economic subsurface deposits of crude oil, natural gas and minerals by the recording, processing, and interpretation of artificially induced shock waves in the earth. ... Acquire, process and interpret new 2D

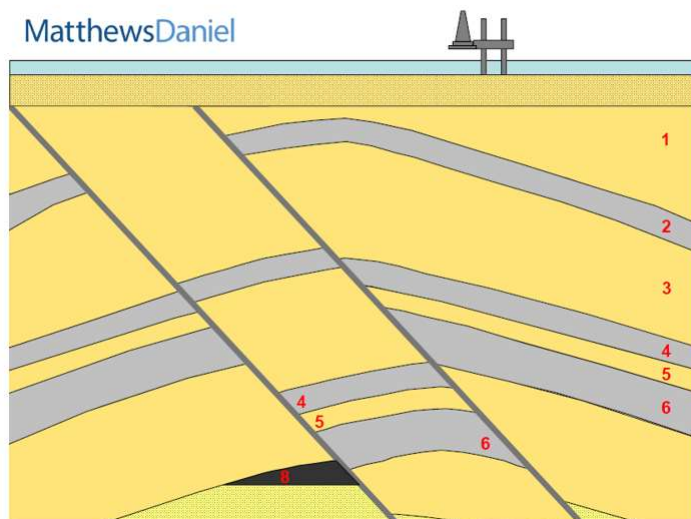
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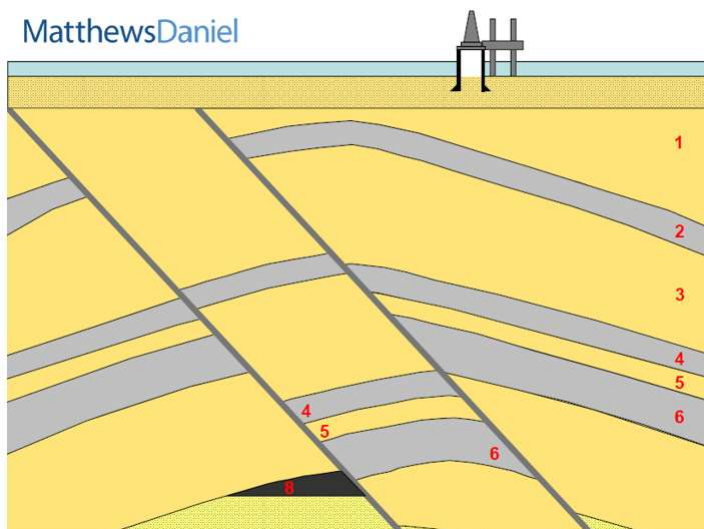
Here is a Drilling Example

MatthewsDaniel

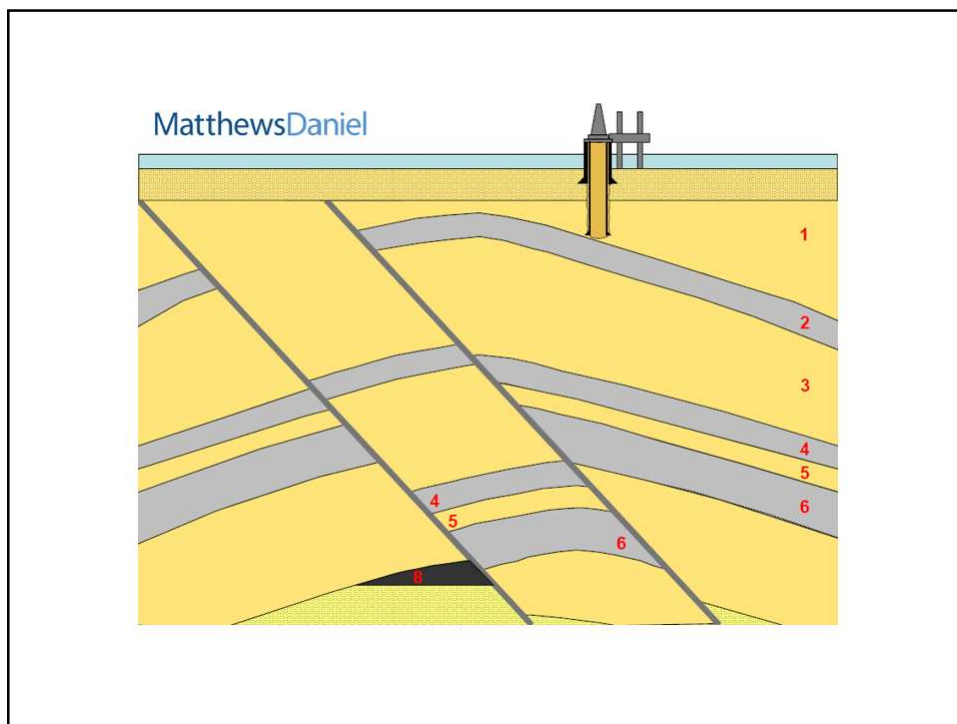


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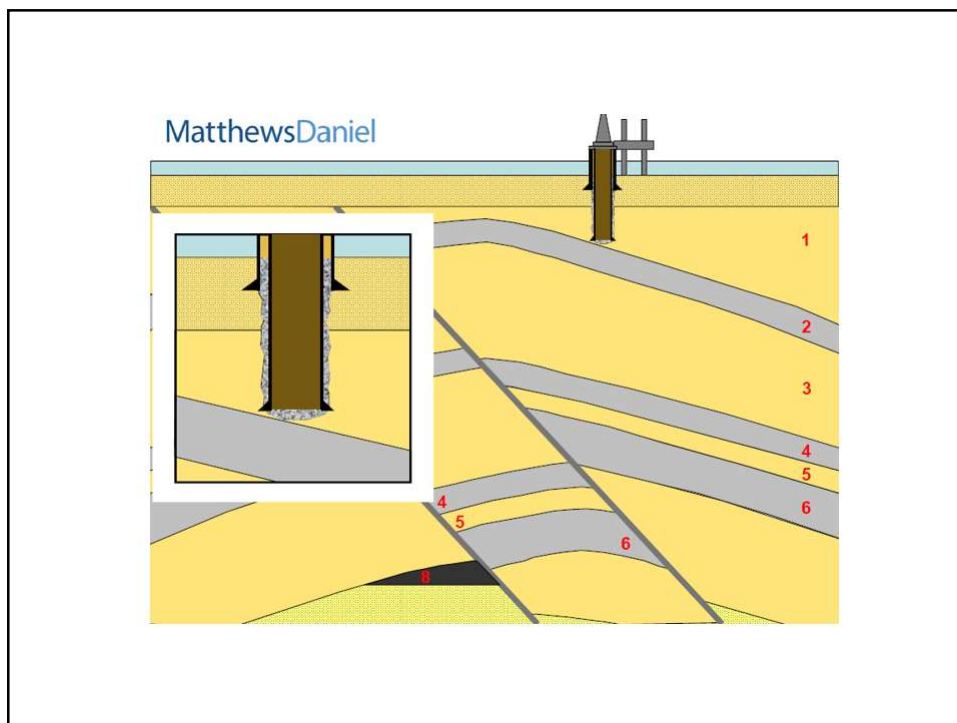
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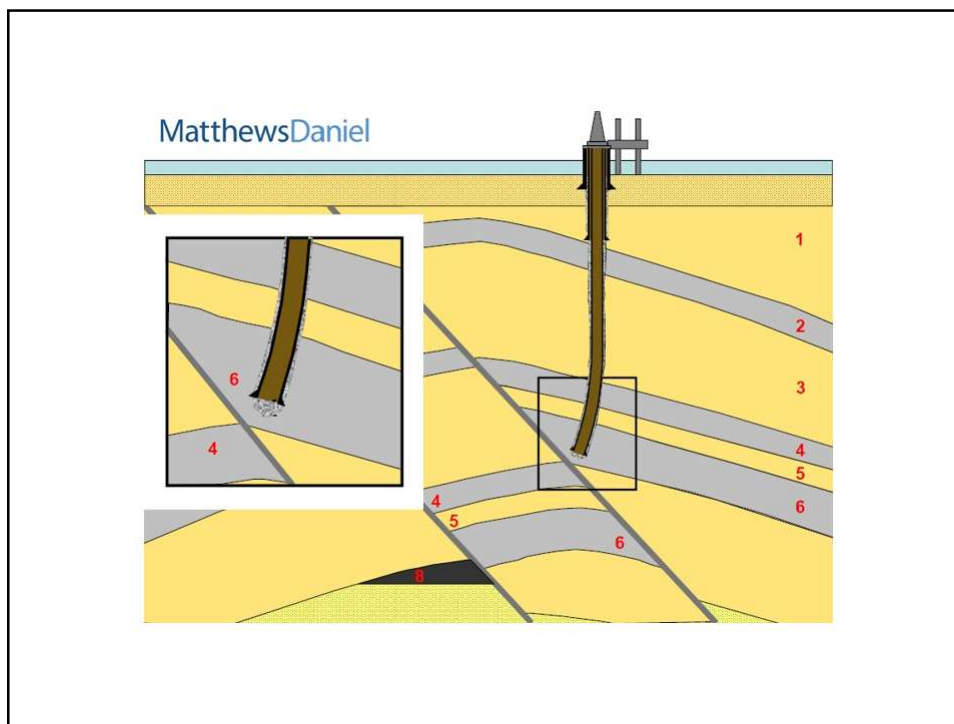
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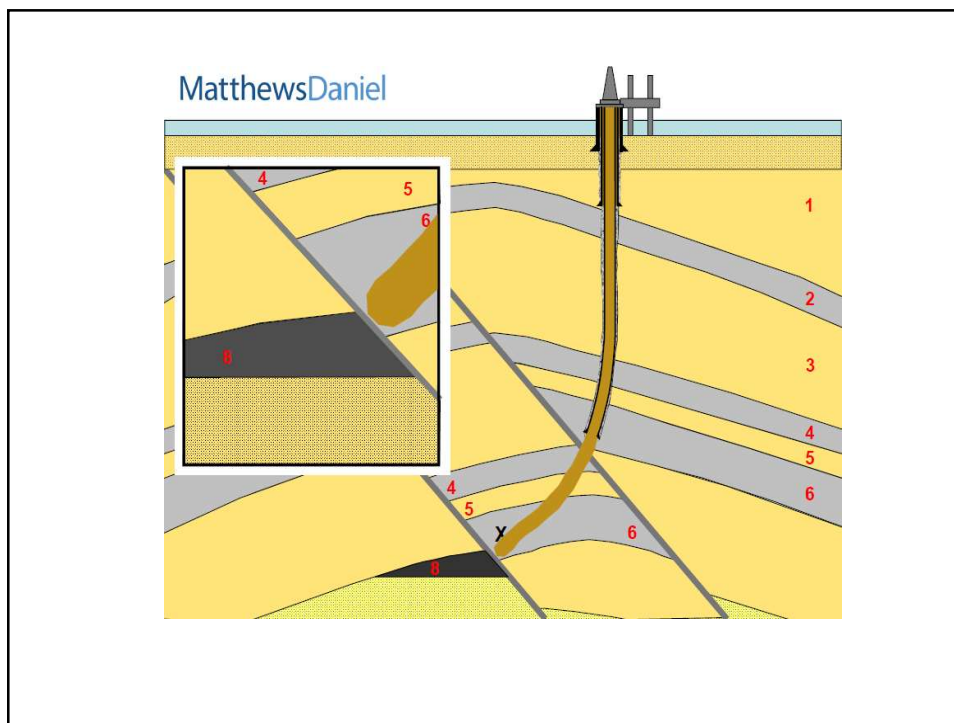
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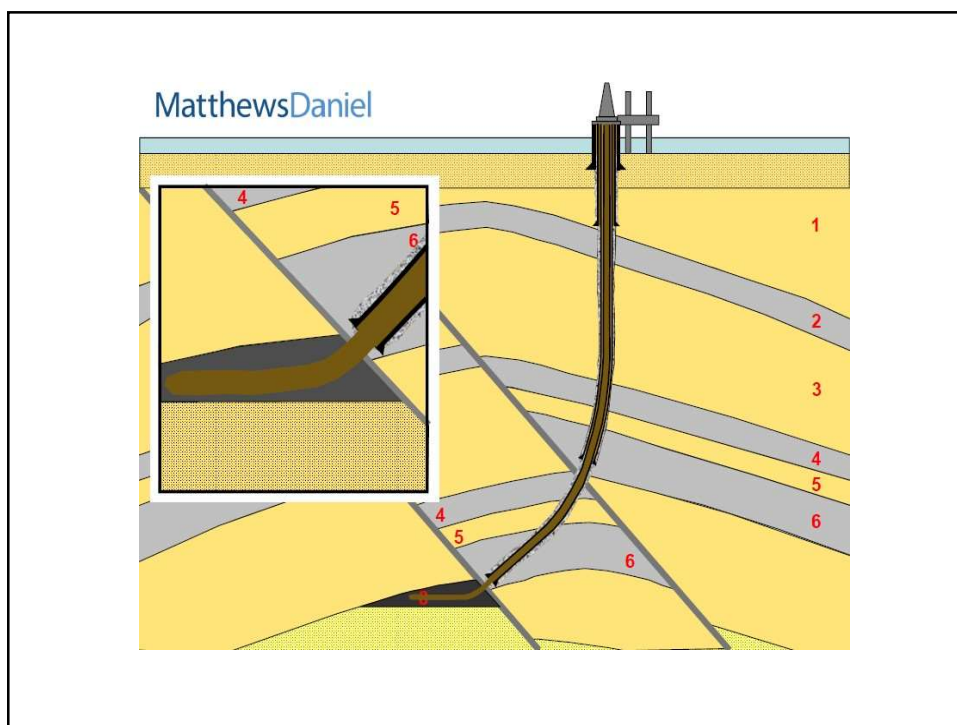
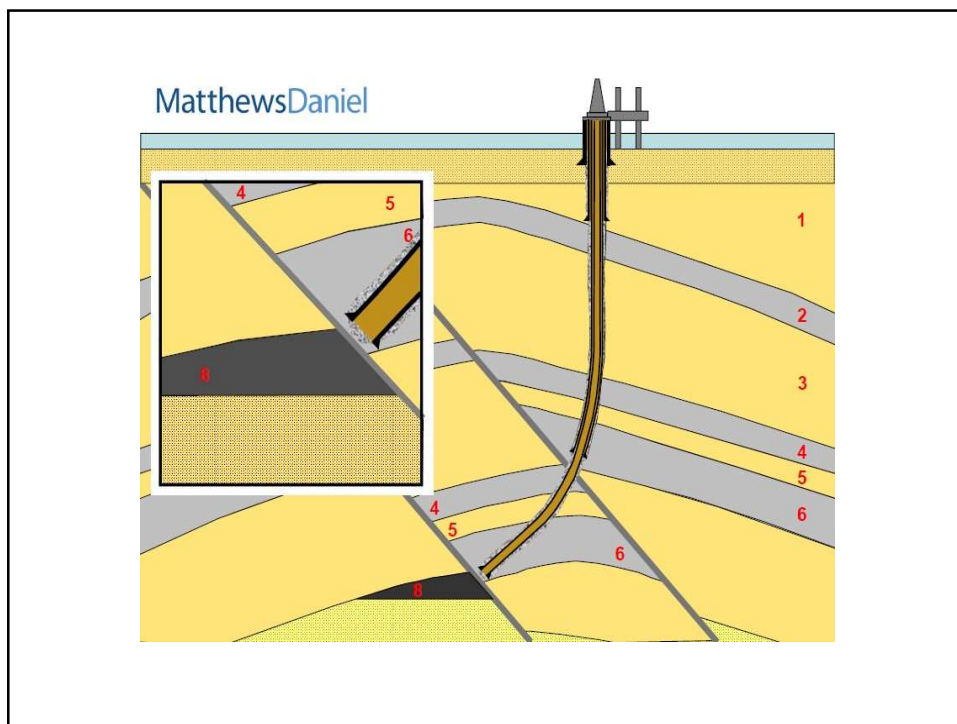
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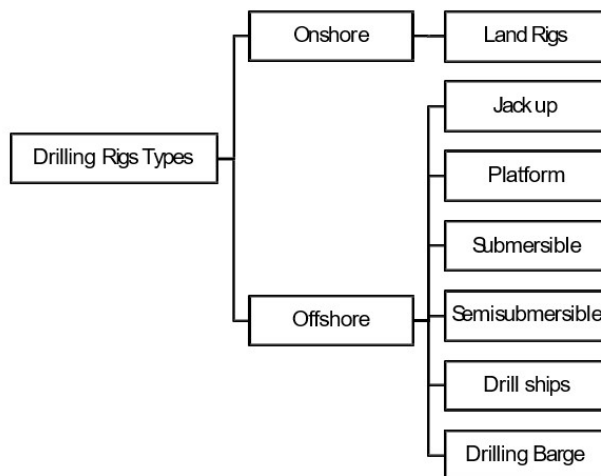
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Types of Drilling Rigs



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Land rigs “ Portable hole factories”

Land Rigs Classified by Drilling Depths

Rig Size	Max. Drilling Depth(ft)
Light Duty	3,000 – 5000
Medium Duty	4,000 – 10,000
Heavy Duty	12,000 – 16,000
Very Heavy Duty	18,000 – 25,000+

A primer of Oil well Drilling 6th edition



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Jack up rigs



- ✓ Shallow water
- ✓ Typically less than 400 ft water depth
- ✓ Can drill up to 30,000 ft
- ✓ Bottom Supported Unit



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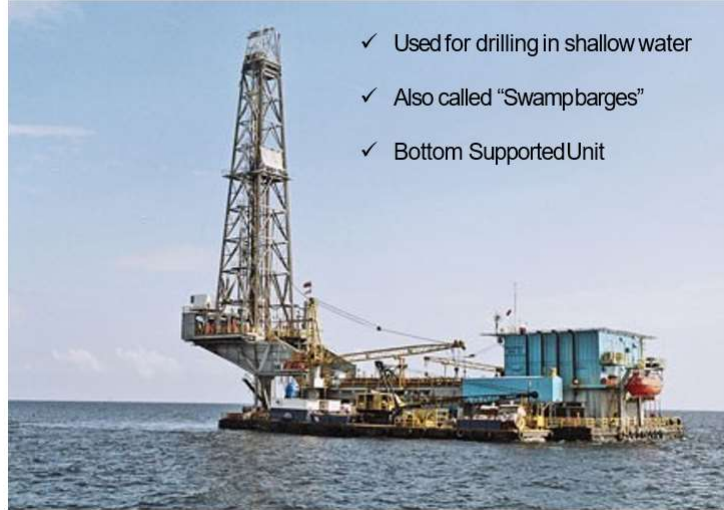
Submersible rigs

- ✓ The first mobile offshore drilling unit was a submersible (1949 in the Gulf Coast of Louisiana)
- ✓ Bottom Supported Unit
- ✓ Shallow water



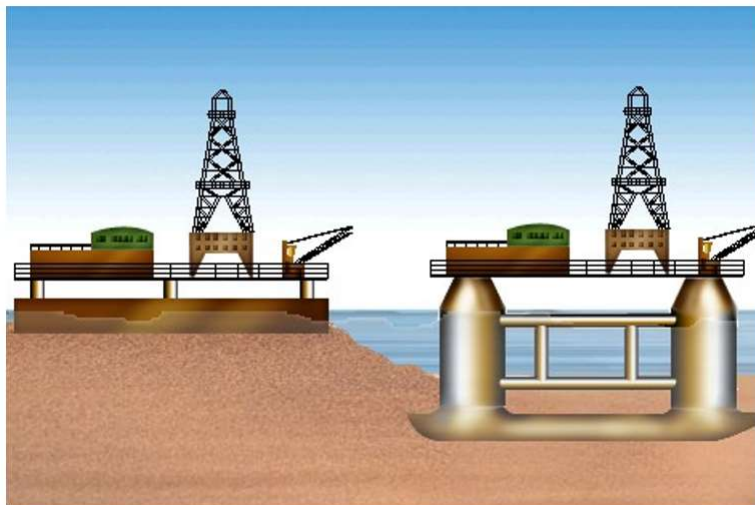
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Drilling Barge



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Drilling barge vs. submersible



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Semi-Submersible rigs

- ✓ Used for deep water drilling
- ✓ Anchored to the seafloor or uses dynamic positioning systems to remain in location
- ✓ More stable than drill ships
- ✓ Floating Unit
- ✓ Water depths up to 8000 ft
- ✓ Can drill up to 30,000 ft



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Transportation of a semi-sub



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Drill ships

- ✓ Used for deep water drilling
- ✓ Good for remote location
- ✓ Can drill up to 30,000 ft
- ✓ Water depth ranges from 1000-3000 ft and some can go up to 10,000 ft



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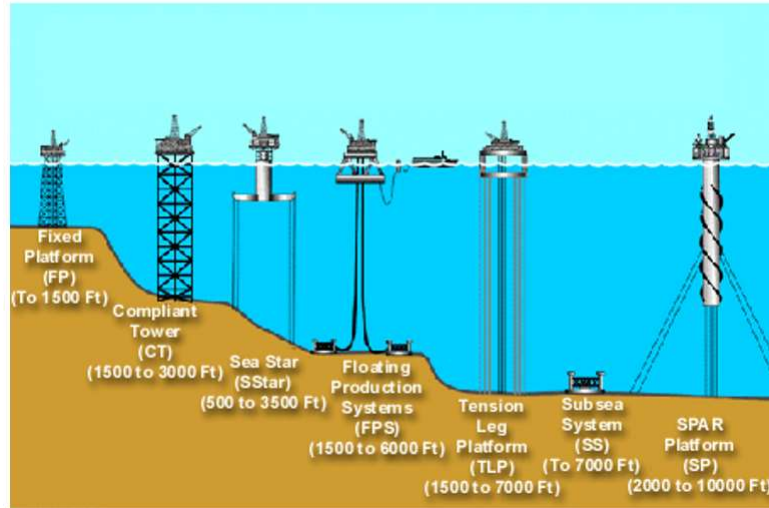
Platform rigs

- Different Types of platforms
- Built of steel or concrete
- Fixed to the ocean floor



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Platform rigs



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Drilling process

Types of Drilling Wells

- Wildcat: New well in area unknown for production
 - Exploration: New well in area known for production
 - Production: Well drilled in area or field with known production
-
- Obtain drilling and production rights
 - Decide on Target and TD and reservoir section length, production method
 - Design well and plan drilling
 - Secure drilling appropriate rig and contractor, secure tools, equipment and service companies
 - Onsite drilling preparation

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