

## Ch. 1 Drilling Geology

### Origins of Rocks

- **Igneous rock**- (basement rock) formed by molten rock cooling and solidifying
  - o Basalt
  - o Granite
- **Sedimentary rock** (basement rock)
  - o **Digenesis**- Process of forming new rock by chemical changes to sediments
  - o **Cementation**- Small grains of mineral become bonded together by minerals growing where the grains touch
    - Sandstone
- Metamorphic rock
  - o **Metamorphosis**- existing rocks can be physically changed by high pressure and temperature

### ROCK CYCLE PAGE

### Plate Tectonics

- African, Pacific, Indian-Australian, North and South American, Eurasian, Antarctica
- Rock is compressed = thrust fault
- Rock is stretched = normal fault
- **Unconformity**- Surface rocks are eroded away and sediments are deposited

### **Lithology**- Physical character of the rock

- **Shales**- Consist of layers of clay minerals (originates in sedimentary rocks)
  - o **Drilling muds**- shale that is stable in the presence of water
  - o 75% of sedimentary rock
  - o Cause most drilling problems
  - o Porous but impermeable
- Sandstones
  - o Particles of sand
  - o 11% of sedimentary rock
  - o For a sandstone to be a reservoir:
    - **Porosity**- measure of the percentage of the volume of that rock that is occupied by fluid
    - **Permeability**- measure of the ability of fluids to flow through the rock
- Carbonates
  - o Fossilized skeletons and mineral grains of calcite
  - o Fractured carbonates are good reservoir rocks (oil and gas collect in fractures)

- o 13% of sedimentary rock
- Evaporites (salts)
  - o Salt domes are suitable for reservoirs in the Gulf of Mexico

#### Rock strengths and stresses

- Compressive strength
  - o Harder to drill
  - o More stable
- Tensile strength
  - o Rock has little and pulls apart easily
- Shear strength
- Principal stresses
  - o Compressive and tensile
  - o Deviated wells are greatly affected by these stresses
  - o **Fracture pressure**- Ability of the rock to withstand pressure inside a hole drilled in it

#### Hydrostatic pressure imposed by a fluid

- Overpressured:
  - o Pressure-tight barrier above the overpressured formation
  - o Mechanism that created the higher pressure
- If formation pressure is higher than hydrostatic of mud, mud is pushed up the well (kick). A BOP will seal the top and kill the well

#### Geological input to drilling wells

- **Pore pressure**- pressure of fluid within rock pores
- **Fracture pressure**- pressure inside the well that would fracture the hold  
Normally both increase with depth
- Casing point- depth at which drilling stops to run casing (steel pipe cemented in hole)