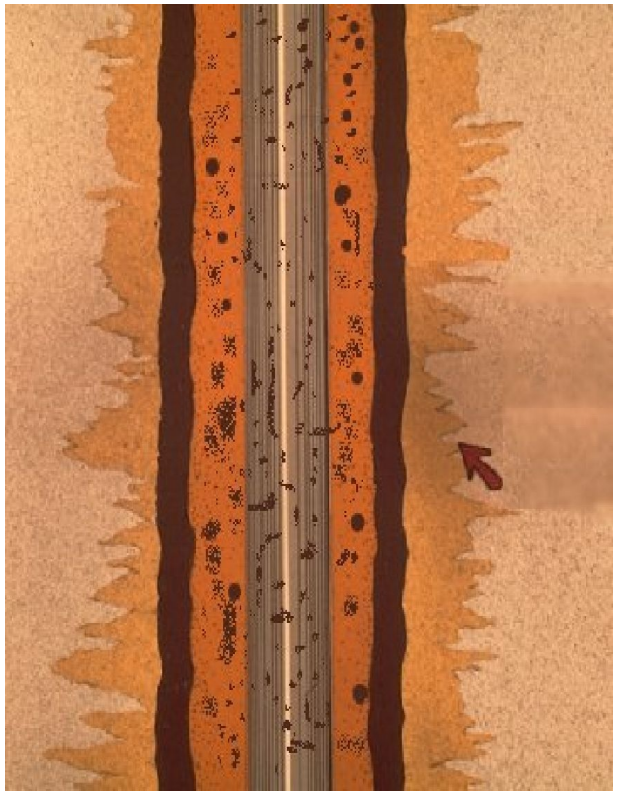
Contents

Drilling Fluid Function

1.Transport cutting and dispose to surface - The drilling fluid brings the drilled

material to the ground surface

either by mud rheology and velocity



Drilling Fluid Function

2. Clean drill bits – As drilling fluid exits the bit jets, fluid velocity removes cutting from the bit teeth and bit body.

This prevents bit

ball up situation.

Drilling Fluid Function

3. Provide hydrostatic pressure to control well while drilling
   –Hydrostatic pressure provided from drilling fluid is the primary well control. Mud weight should be high enough

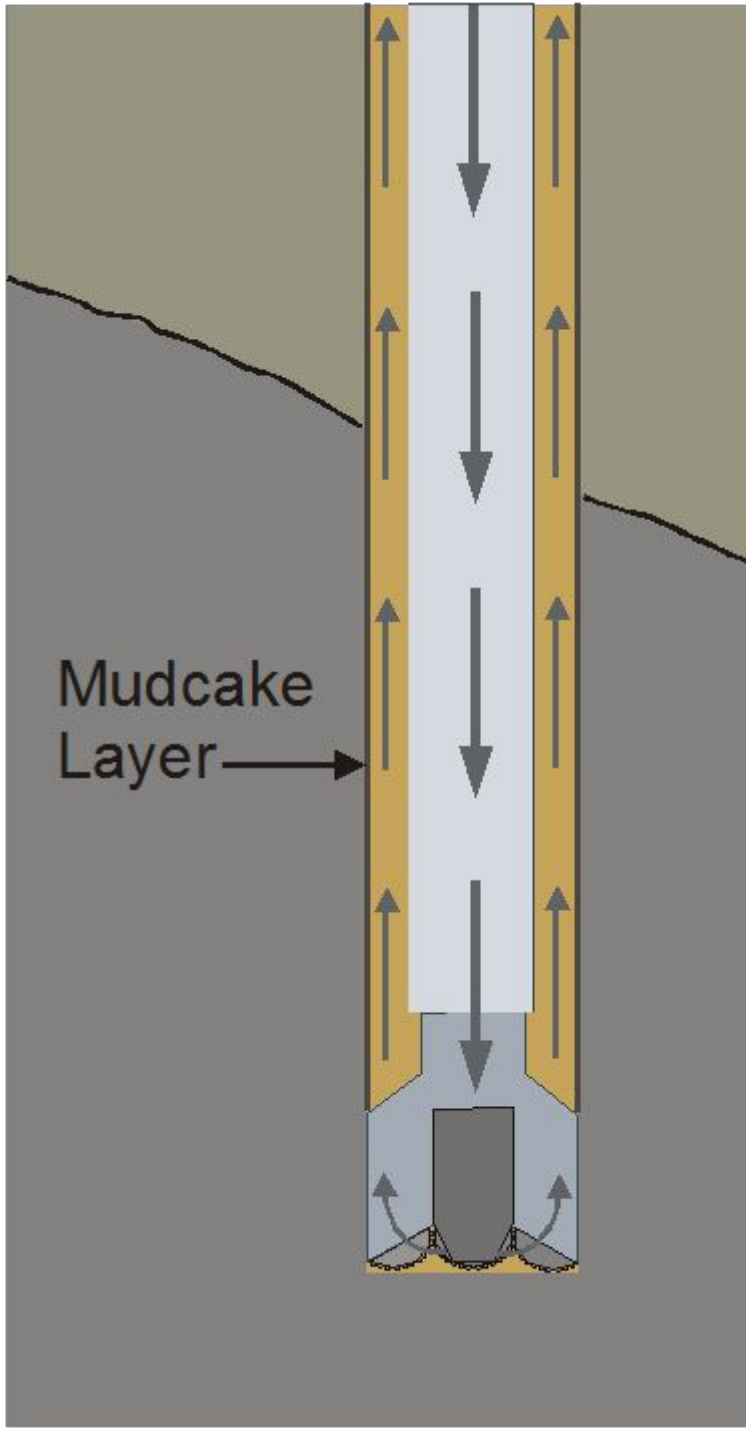
   to control formation pressure while drilling.

P=0.052*MW*TVD

Psi=0.052*ppg*ft

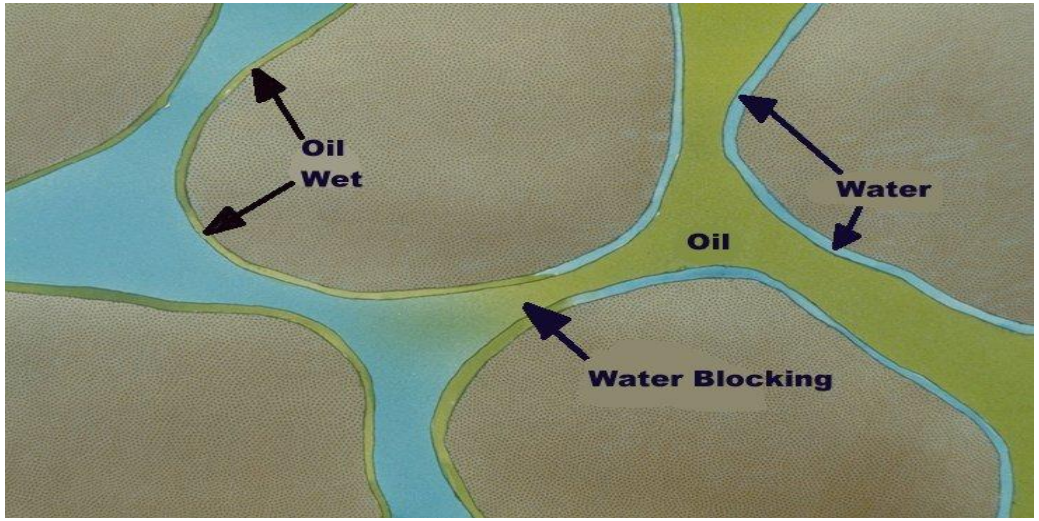
Drilling Fluid Function

4. Prevent excessive mud loss - While drilling, clay particle will form a thin layer over porous zones called “mud cake” or “filter cake”. Mud cake acts as barrier to prevent excessive drilling fluid loss into formation and provides wellbore stability..



Drilling Fluid Function

5. Prevent formation damage by using reservoir drill-in fluid – While drilling long reach zone in horizontal wells, the special drilling fluid will be utilized in order to prevent formation damage.



Drilling Fluid Function

6. Provide hydraulic pressure to down hole assembly (BHA)- as mud motor, measuring

while drilling (MWD),

logging while drilling (LWD), etc

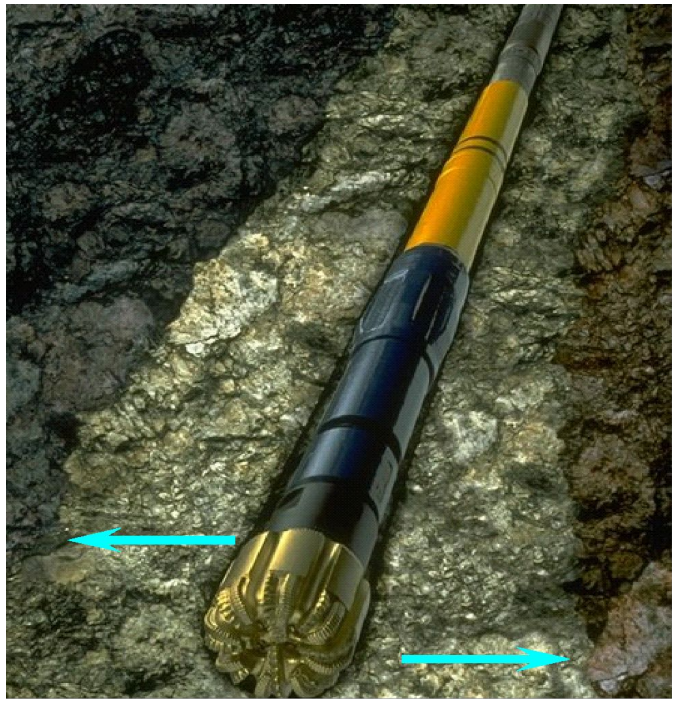
– Without enough hydraulic power,

down hole tool will not be properly

operated, hence, drilling fluid plays

essential role to provide power to

sophisticated down hole tool.



Drilling Fluid Additives

There are many drilling fluid additives which are used to either change the mudweight(density) or change its chemical properties .

1.Weighting Materials:

Weighting materials (densifiers) are compounds that are dissolved or suspended in drilling fluid to increase its density. They are used to control formation pressures and to help combat the effects of sloughing or heaving shales that may be encountered in stressed areas.

Any substance that is denser than water and that does not adversely

affect other properties of the drilling fluid can

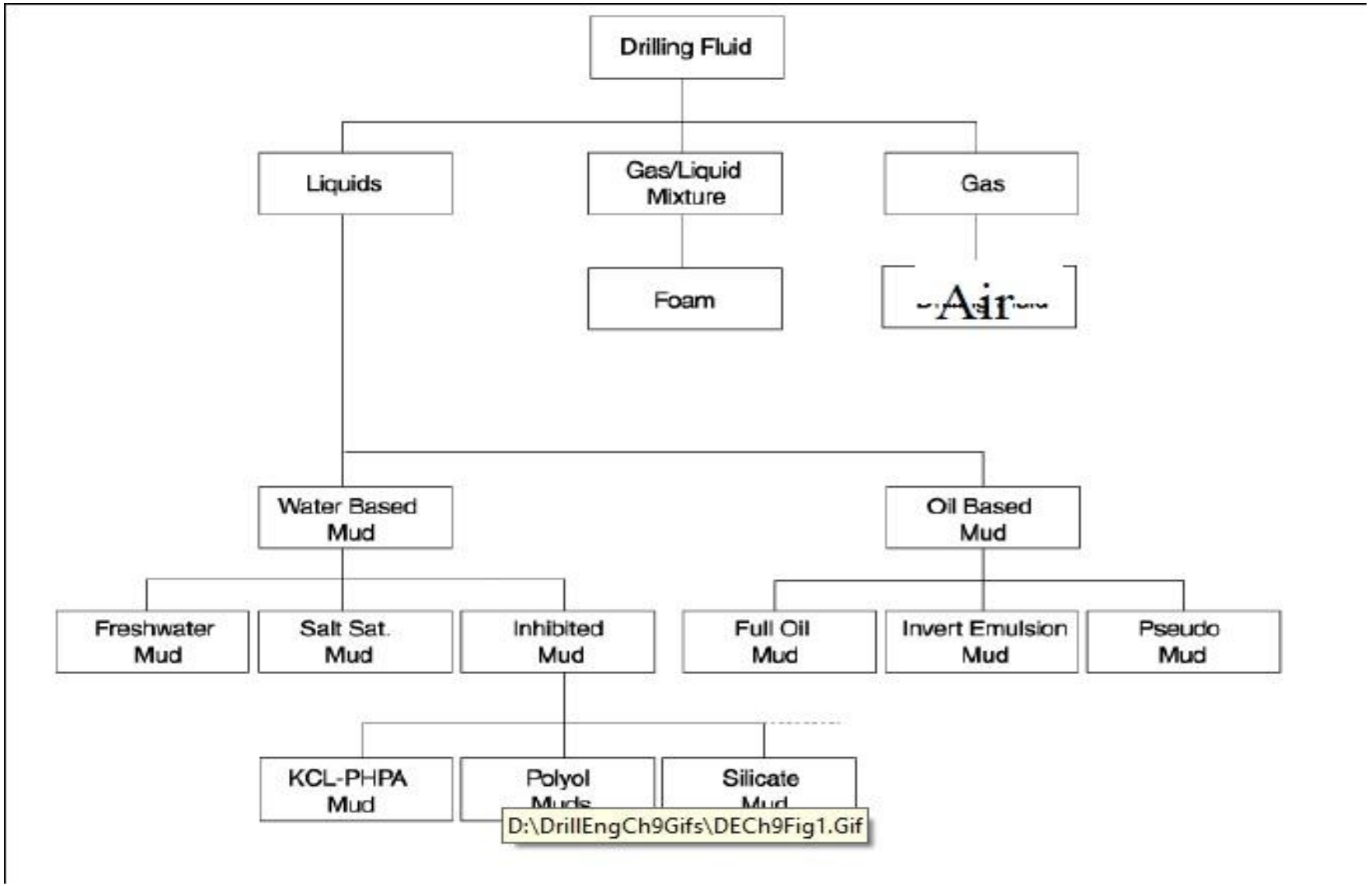
be used as a weighting material

Drilling Fluid Additives

Mud weights higher than water (8.3 ppg) are required to control formation pressures and to help combat the effects of sloughing or heaving shales that may be encountered in stressed areas.

Material	Principal Component	Specific Gravity	Hardness (Moh's Scale)
Galena	PbS	7.4-7.7	2.5-2.7
Hematite	Fe_2O_3	4.9-5.3	5.5-6.5
Magnetite	Fe_3O_4	5.0-5.2	5.5-6.5
Iron Oxide (manufactured)	Fe_2O_3	4.7	---
Ilmenite	$FeO \cdot TiO_2$	4.5-5.1	5.0-6.0
Barite	$BaSO_4$	4.2-4.5	2.5-3.5
Siderite	$FeCO_3$	3.7-3.9	3.5-4.0
Celesite	$SrSO_4$	3.7-3.9	3.0-3.5
Dolomite	$CaCO_3 \cdot MgCO_3$	2.8-2.9	3.5-4.0
Calcite	$CaCO_3$	2.6-2.8	3.0

Types of Drilling Fluid



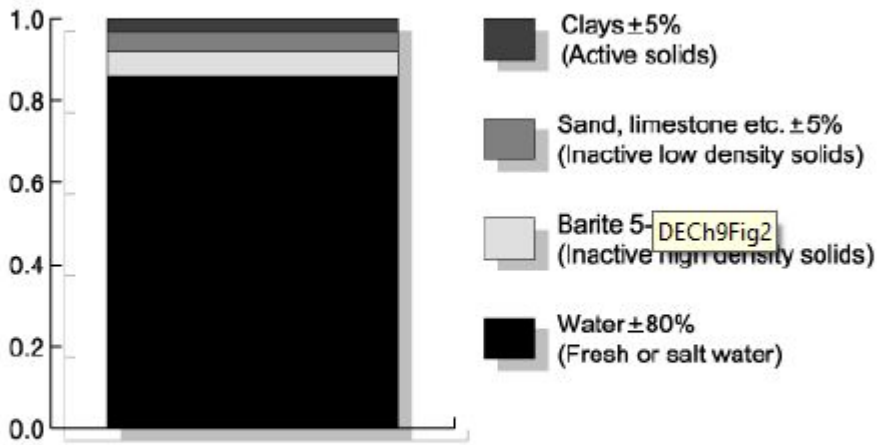
Air drilling

- Advantages:
  - Higher penetration rates
  - Better hole cleaning
  - Less formation damage
- Disadvantages:
  - Air cannot support the wellbore stability
  - Doesn’t provide enough pressure

Types of drilling Fluid

Three types of drilling mud are in common use:

- **water-base mud**
- **oil-base mud**
- **Gas based fluids**



Water Base Mud

This fluid is the mud in which water is the continuous phase. This is the most common drilling mud used in oil drilling.

The following designations are normally used to define the classifications of water base drilling fluid

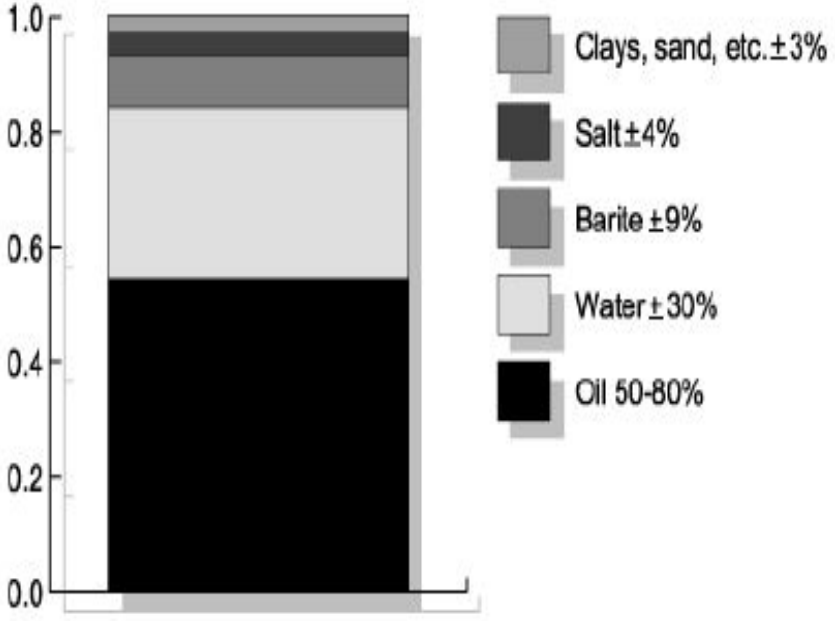
Oil base mud

This drilling mud is made up of oil as the continuous phase. Diesel oil is widely used to provide the oil phase.

This type of mud is commonly used in swelling shale formation.

There are two types of oil-based muds:

- **Invert Emulsion Oil Muds.**
- **Pseudo Oil Based Mud .**



Advantages of Oil Based Mud

- The oil base mud is good for high temperature environment because the base fluid is oil.
- It is good for drilling into shale formation because it does not react with formation clay causing shale instability.
- It typically creates thin mud cake. This is really good because you can reduce risk for pipe stuck situation.
- It can be treated and reused. Using this mud for long run can reduce overall drilling mud cost.
- Oil base as external phase is good lubricant so it greatly reduce drilling torque.

Disadvantages of OBM

- Environmental concern – Oil base mud is considered as toxic waste therefore it cannot be disposed directly into land, river, or ocean
- People Heath – This mud has hazardous vapors which will cause health problem to personnel who working with it in both short and long term.
- Cost – Mud cost of this system is higher than water base mud in terms of cost per barrel.
- Gas kick detection – Gas kick is very difficult to identify because gas is soluble in oil. You may take kick but you will be able to see pit gain or flow increase at the first time.
- Equipment – Rubber parts is easily deteriorated by oil base.

Density

((Any accepted terminology that indicates the weight per unit volume of drilling fluid))

- -Pounds per gallon (ppg).
- -Pounds per cubic feet (pcf).
- -Gram per cubic centimeter (g/cc).
- -Kilogram per liter (kg/l).

Density

Mud weight is measured in the field using a mud balance, as shown in Fig..

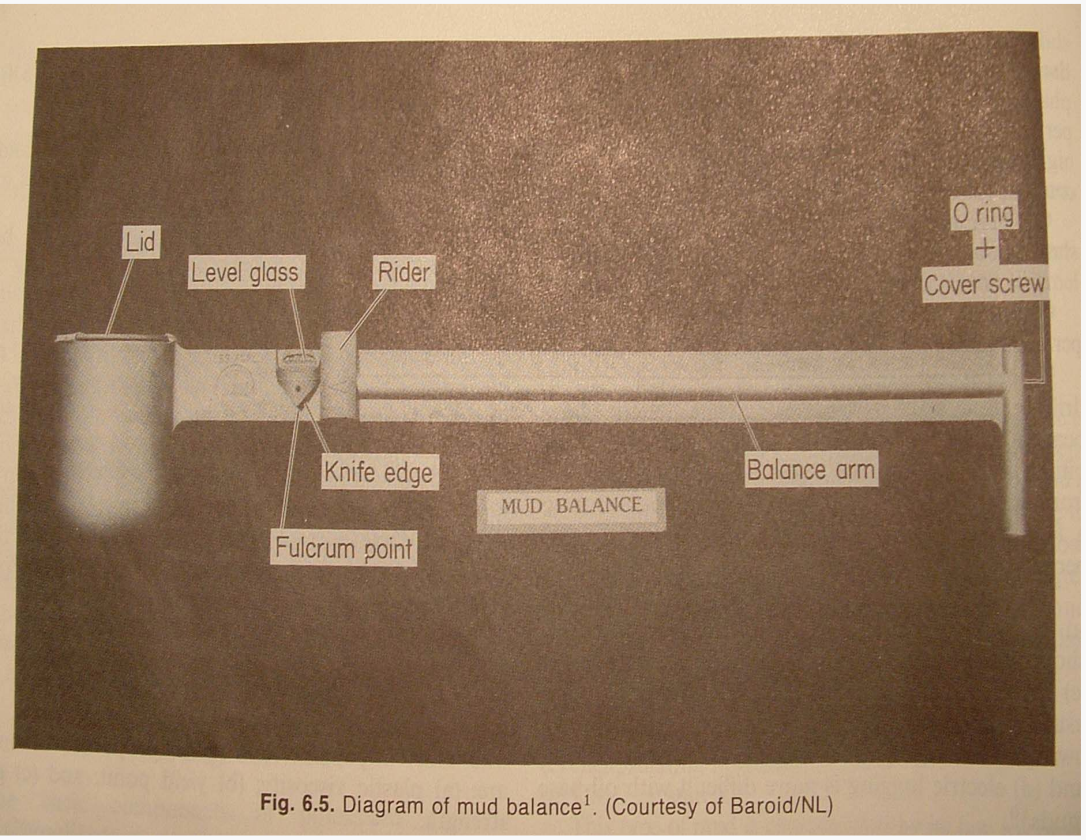
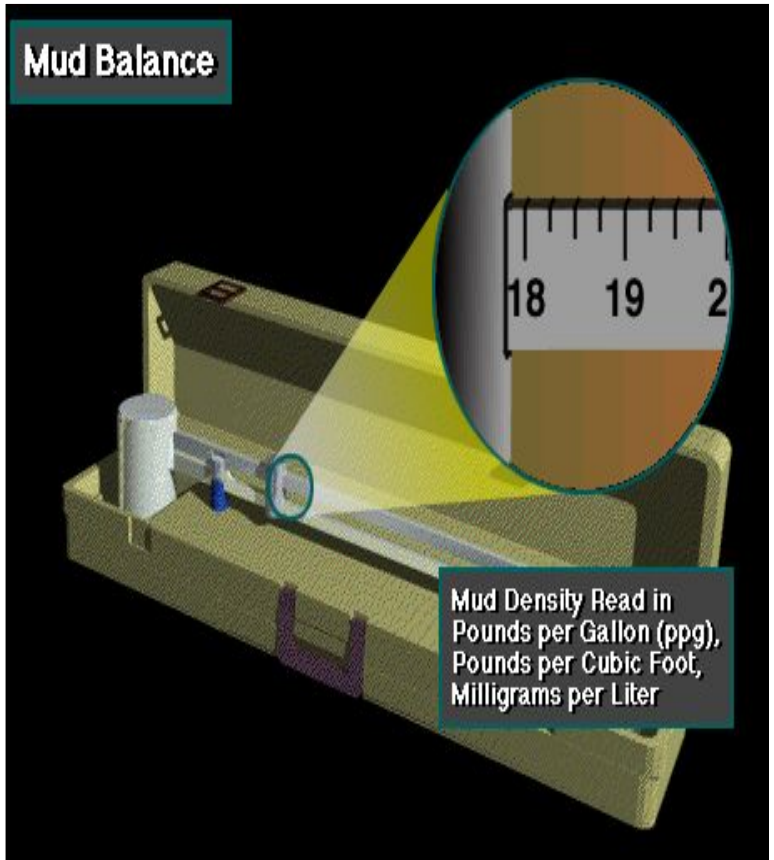


Fig. 6.5. Diagram of mud balance[1]. (Courtesy of Baroid/NL)

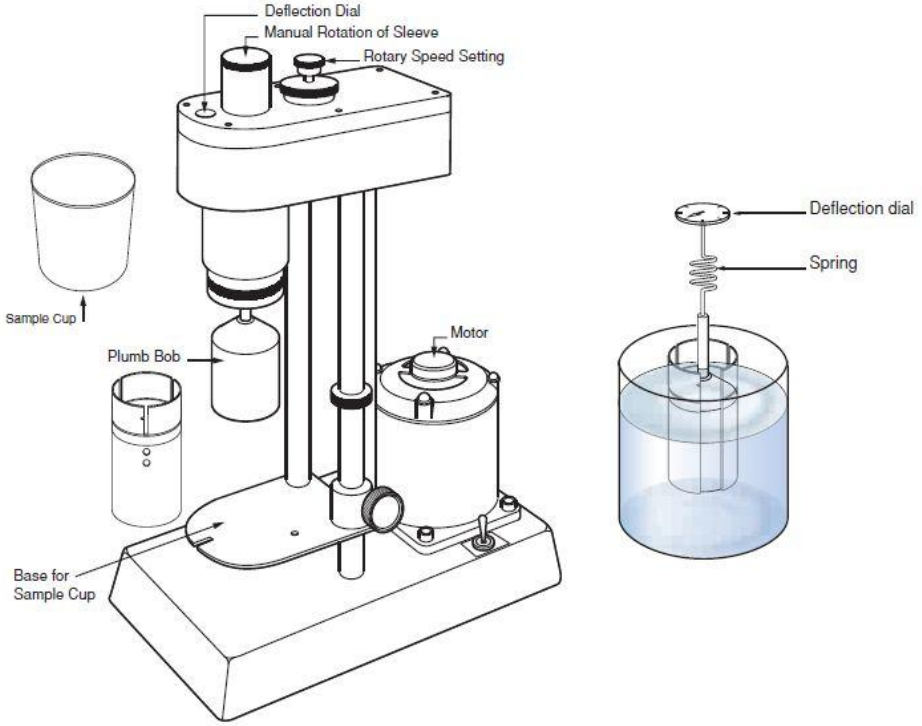


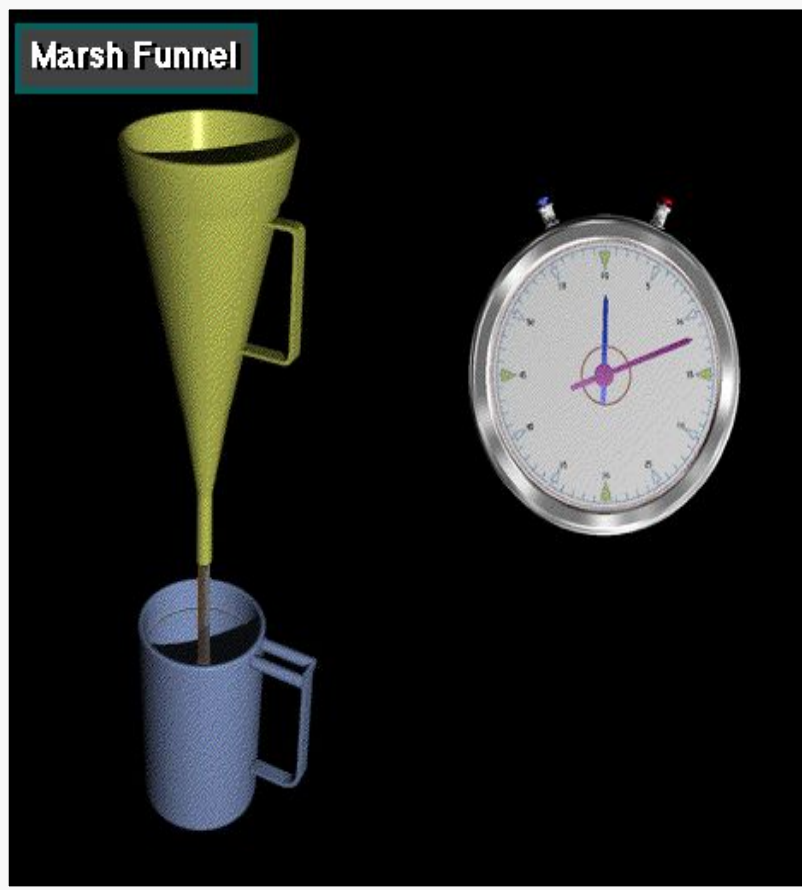
viscosity

Viscosity is a measure of the internal resistance of a fluid to flow

1- Funnel Viscosity

Apparent Viscosity (vis) is the measured times it takes for one quart of mud to gravity feed through a hole of a specific diameter.

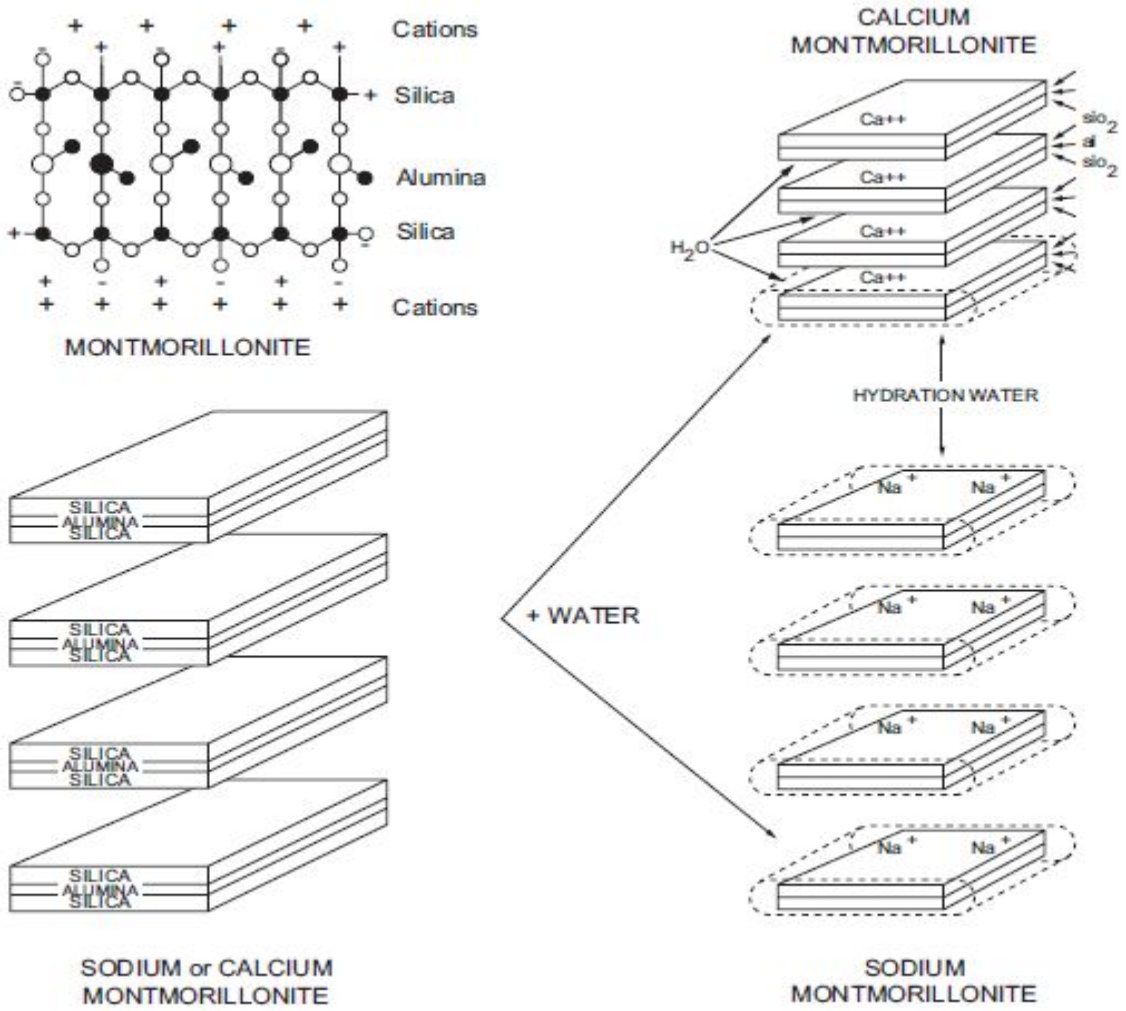




Clay Chemistry

- Expandable Clays which absorb water so that they are called **hydrophilic**. (such as montmorillonite clays)
- Non-expandable Clays, they will not absorb water so they are called **hydrophobic** (such as illite)

Sodium & Calcium montmorillonite



Viscosity Control additives to WBM

- Native clays
- Wyoming Bentonite

To reduce the viscosity of the mud:

- Reduce the solids content
- Reduce the number of particles per unit volume
- Neutralize the attractive forces between the particles. (Using thinners)

Density control additives to WBM

- Barite
- Calcium Carbonate
- Galena