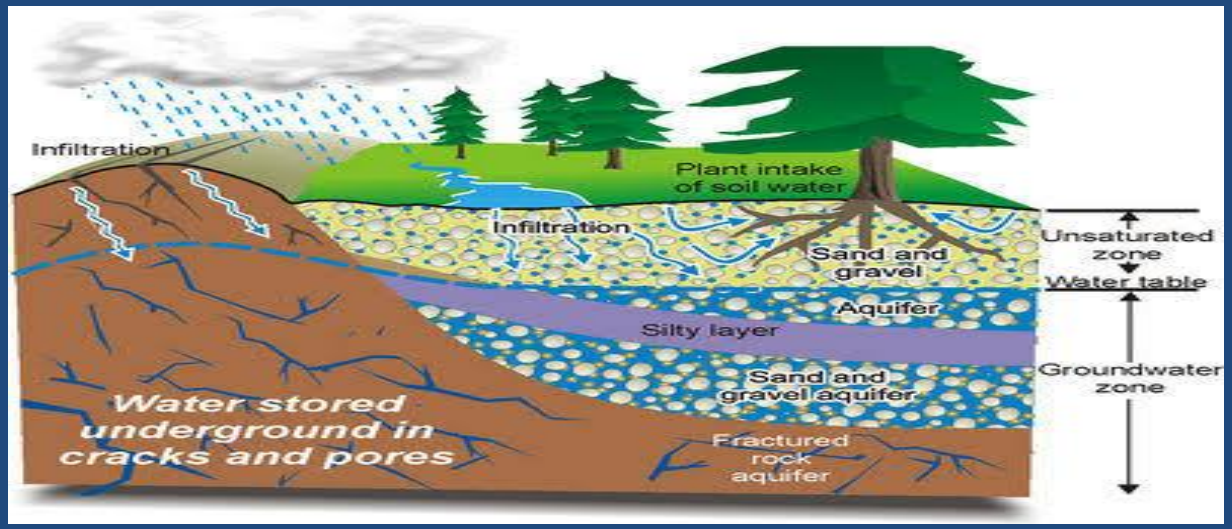
Geologic Formations as Aquifer

Dr. Anil Kumar
Professor
Department of Geology
Patna Science College
Patna University , Patna

- An water bearing Geological Formation is known as Aquifer. Such formation may transmit water to well , spring ,River etc.



- There are four types of water storing geologic formations :

1. Aquifer
2. Aquifuse
3. Aquiclude
4. Aquitard

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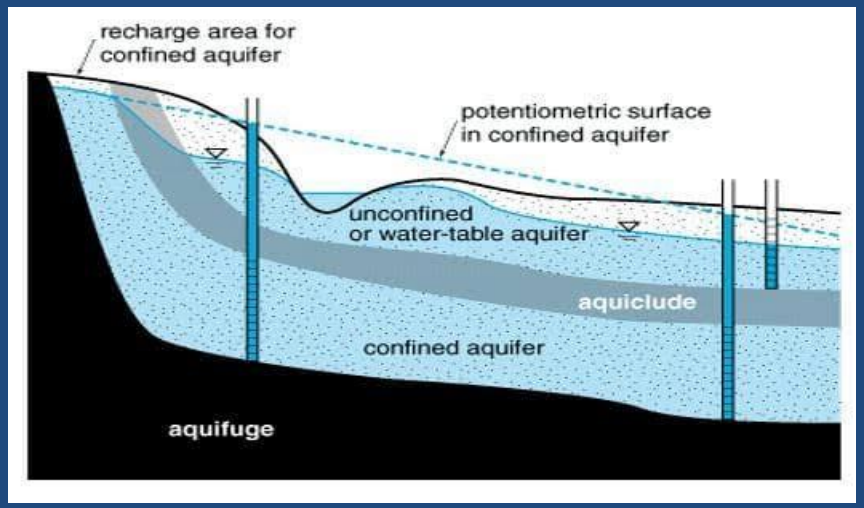
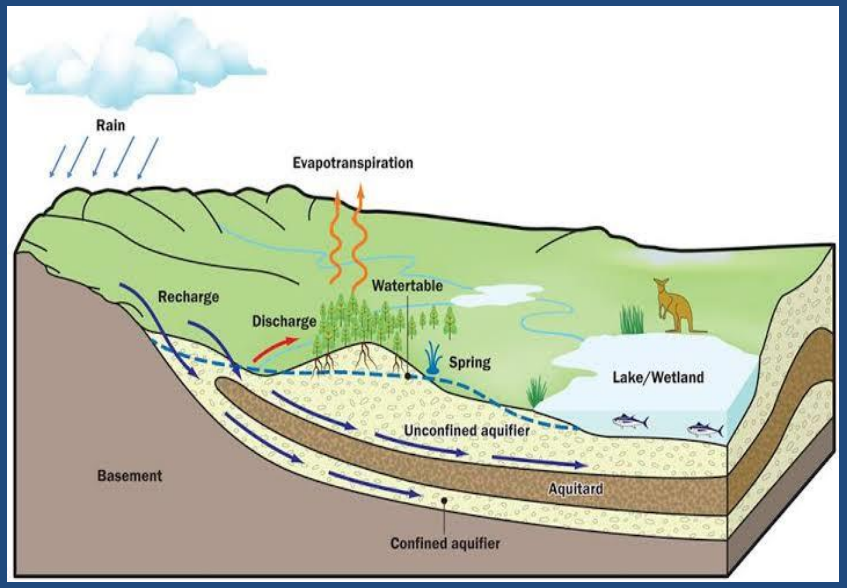
- An **AQUIFER** is a permeable geologic formation that stores and transmits water.
- An **AQUIFUGE** is rock formation containing no interconnected openings and therefore neither transmits nor stores water. (eg.Massive granites)
- An **AQUICLUDE** is formation of rocks which can store water and cannot transmit water.(eg. Clay & shale)
- An **AQUITARD** is an impervious and semiconfined geologic formation that transmits water very slowly.(eg. Shale or clay lenses interbedded with sand)





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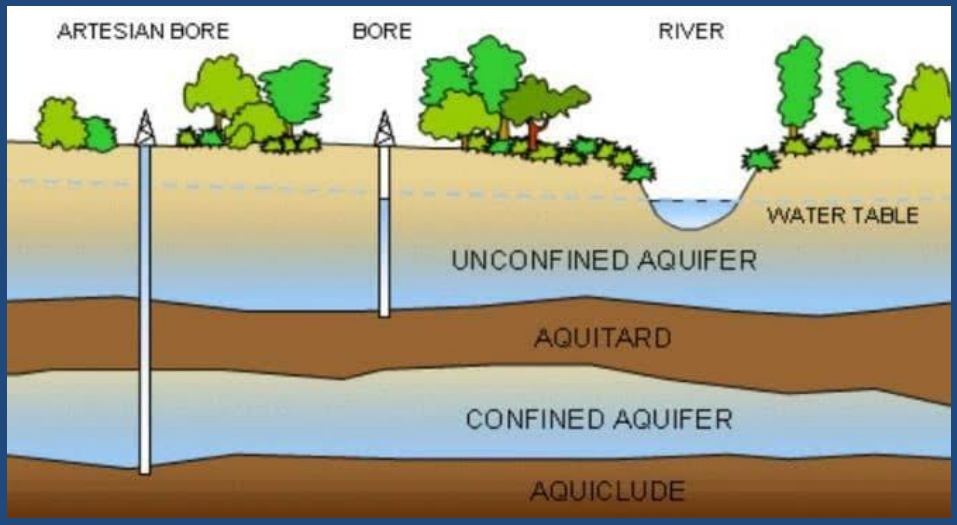
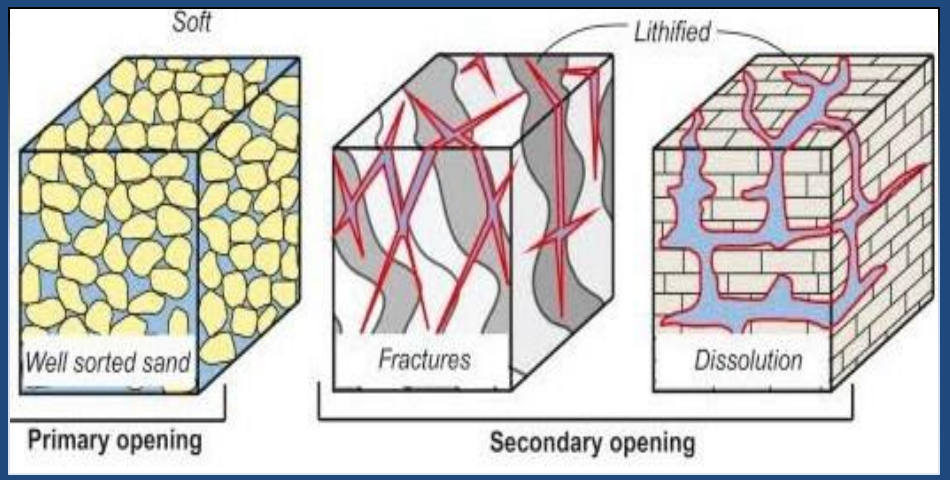
- Most geologic strata are classified as either aquifers or aquitards ; very few formations fit the classical definition of aquitard.



- The ability to store water in the rock pores is depending on the porosity of the rock.

- **Porosity** of the rock formation may be derived from intergranular spaces or from fractures.



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Depending on pores and fractures aquifers are described in the following subsection :

- Alluvial Deposits
- Limestone
- Volcanic rock
- Sandstone
- Igneous & Metamorphic rocks

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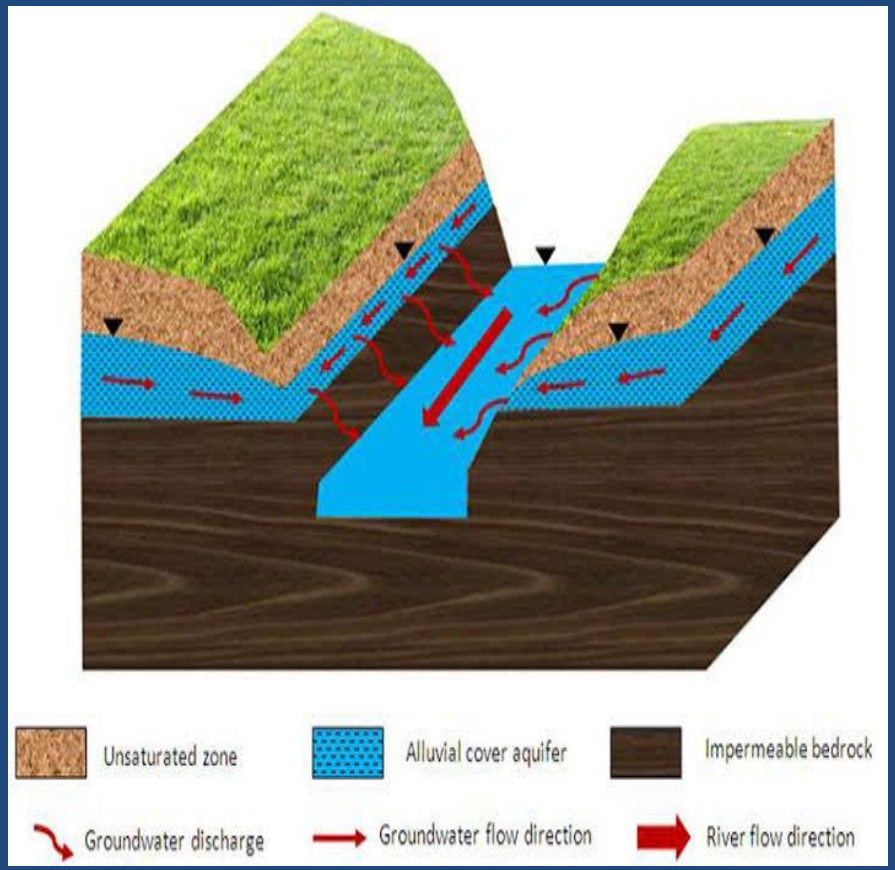
- **Alluvial Deposits** :

  Probably 90% of all developed aquifers consist of unconsolidated rocks. These consist of alluvial sediments of river basins,costal and deltaic tracts.

  These aquifers may be divided into four categories based on manner of occurance. They are water courses , abandoned or burried valleys , plains and intermontane vallyes.



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Water Courses –

Water courses consists of alluvium that forms and underlies stream channels as well as forming the adjacent floodplains.

Well located in highly permeable strata boardering stream produce large quantity of water as infiltration from the streams adds groundwater supplies.

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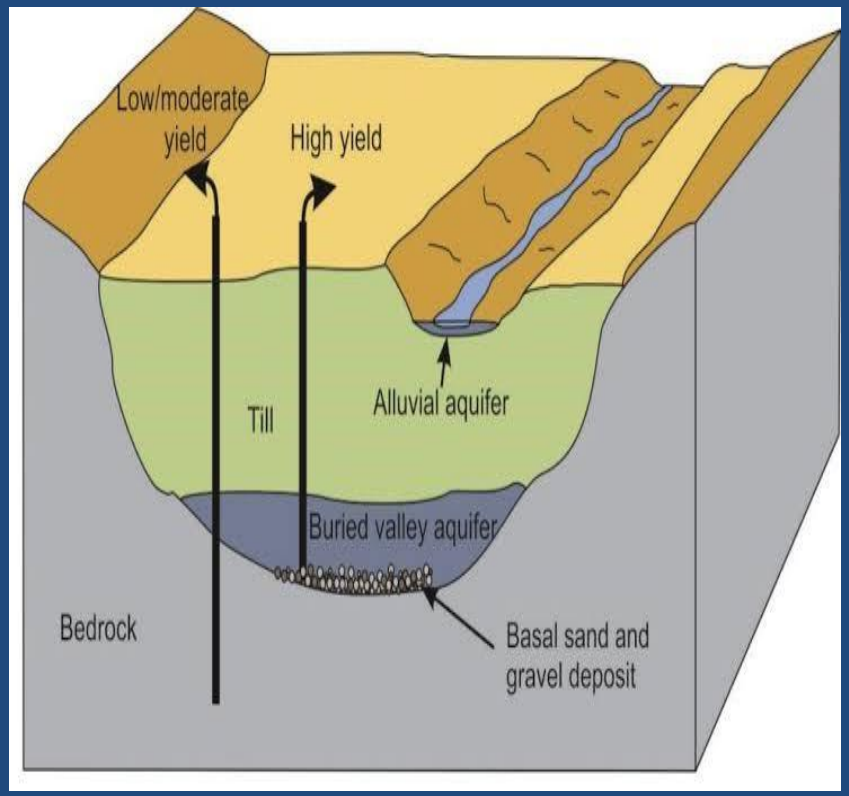
Abandoned or Burried Valleys –

Abandoned valleys are valleys no longer occupied by stream that form them.

Abandoned valleys are the ancient river or stream valleys those have been filled with glacial or unconsolidated sediments.

These sediments are made up of predominently gravels and sands with some silt & clay.

These types of sediments can often store and transmit large amounts of groundwater and act as a local aquifer.



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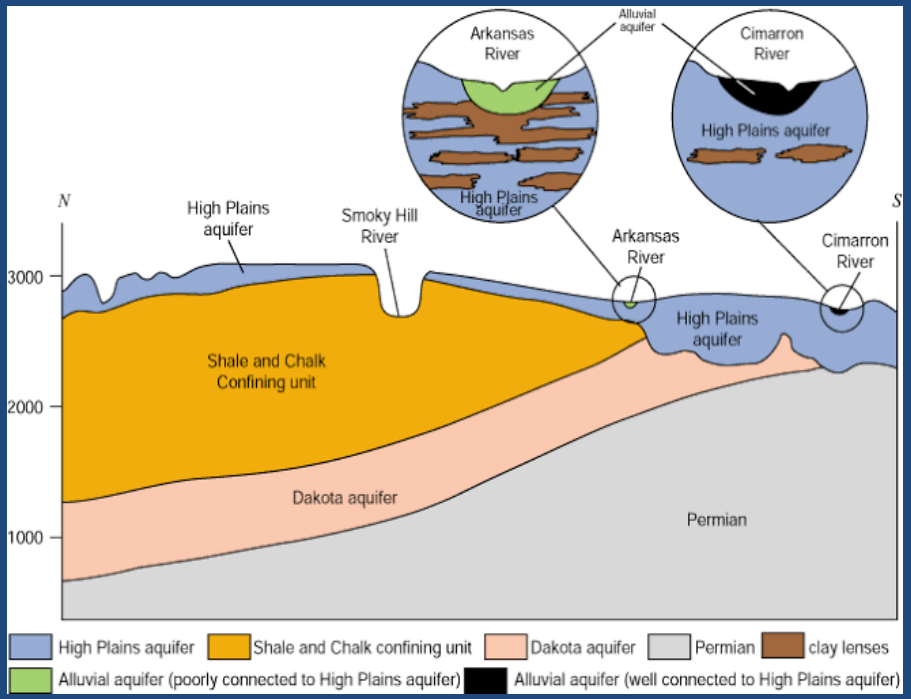
Plains -

Extensive high plains underlain by unconsolidated sediments(some time gravel & sand bed) form important unconfined aquifers.

The aquifers are recharged chiefly in areas acessible to downward percolation of water from precipitation and form occasional streams.



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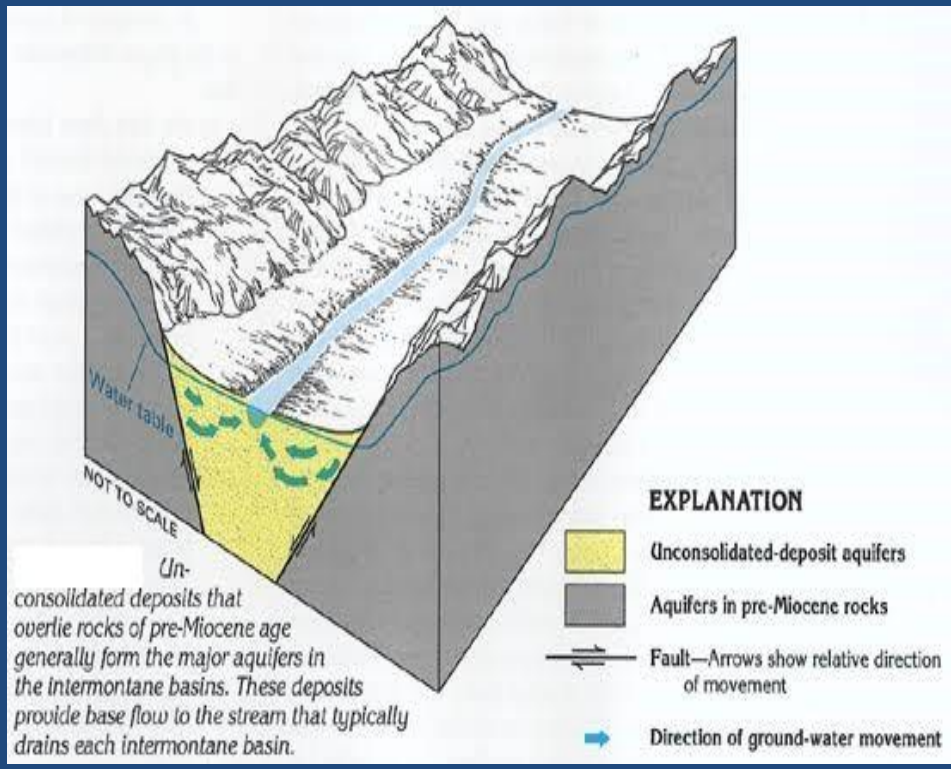
Intermontane valleys –

Intermontane valleys are underlain by tremendous volumes of unconsolidated rock materials derived by erosion of bordering mountains.

Intermontane valleys contain unconsolidated alluvial deposits consisting mainly of sands & gravel layers that can supply large amount of water to the wells.



Un-consolidated deposits that overlie rocks of pre-Miocene age generally form the major aquifers in the intermontane basins. These deposits provide base flow to the stream that typically drains each intermontane basin.

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- **Limestone** –

  Limestone is sedimentary rock composed mainly of calcium carbonate ($CaCO_3$) formed by precipitation of $CaCO_3$ from natural waters or by organic processes involving lime-secreting animals.

  Limestone varies widely in density,porosity and permeability depending on degree of consolidation and development of permeable zone after deposition.

  Limey deposits often have high original porosities,but as they are changed to sedimentary rock through compaction,they often become dense,hard rock with lower porosity.

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Limestone owe its unique hydrologic properties to the solubility of its major constituent $CaCO_3$ in water.

Rainwater seeping down into the cracks of limestones,nearly always carries CO_2 (Carbondioxide) in solution.

This gives the water a slight acidity and causes a certain amount of $CaCO_3$ to desolve.

Not in a month or even in a year,over a few hundred years due to the soluble character of $CaCO_3$,cracks and openings would widen noticeably.

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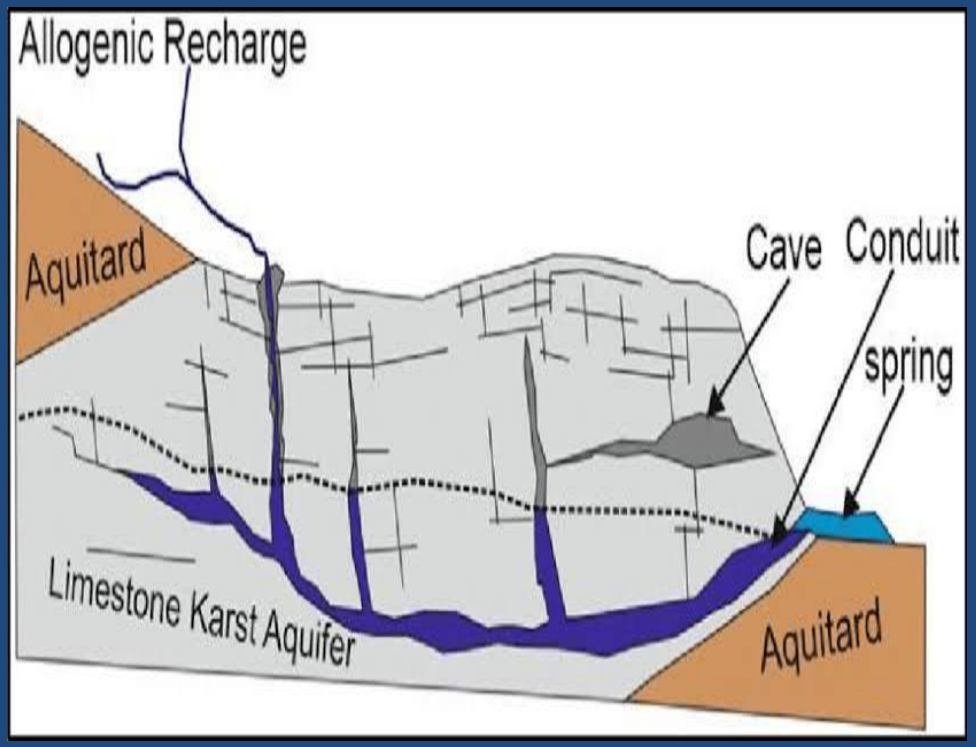
The ultimate result could be a limestone cavern,but generally it becomes just a slightly enlarged solution opening that allows water to infitrate and flow through the rock.

Eventually,even the densest limestones can acquire enough porosity and permeability to become good aquifers.



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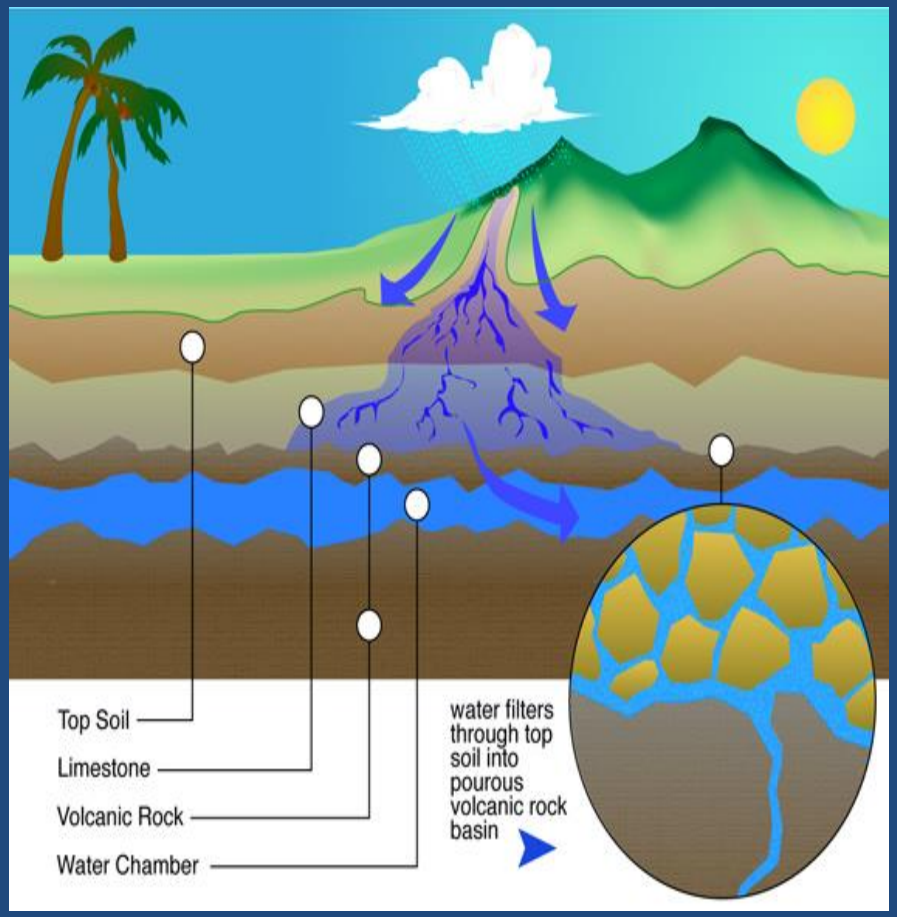
- **Volcanic rocks** –

  Volcanic rocks,especially lavas make good aquifers.

They are important water-bearing formations because of their distinctive systems of fractures and porous zone.

Simultaneously their widespread occurance is also favourable for good aquifers.



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The types of openings contributing to the permeability of basalt aquifers.

Basalt lava where it covers extensive areas often provides with both conduits for groundwater transmission and reservoirs for water storage.

The vertical fractures in many basalt flows provide pathways for rainwater to penetrate the otherwise dense lava rock and seep down to porous zones between flows.

Porous interflow zones are efficient,long-range conduits for groundwater.

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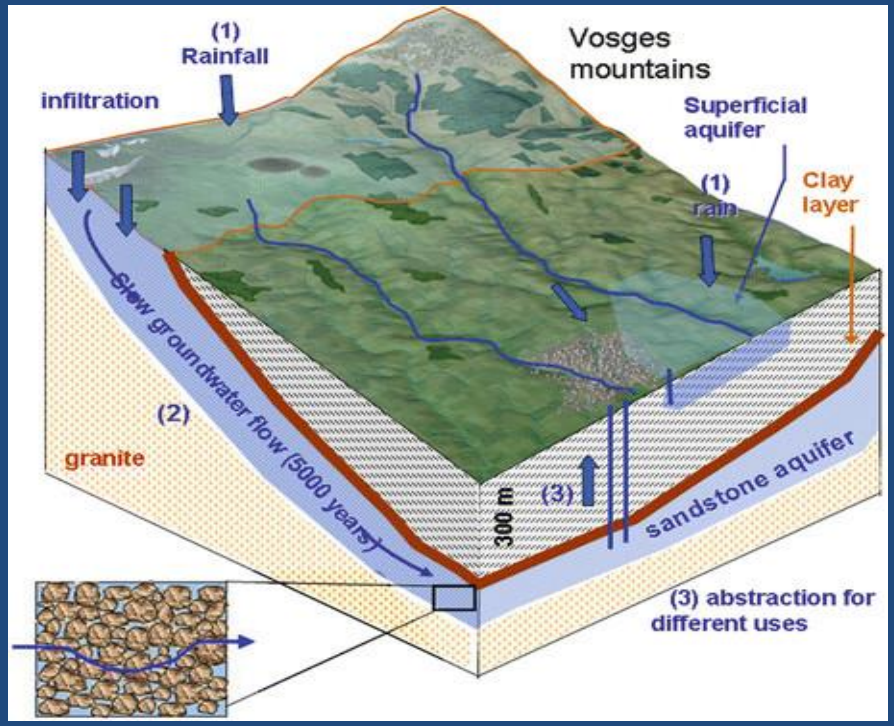
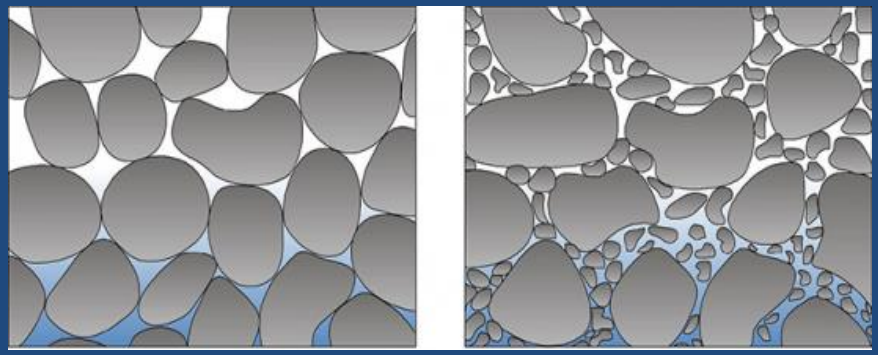
- **Sandstone** –

  Sandstone is the cemented form of sand. It's porosity and yield has been reduced by the cement.



  The best sandstone aquifers yield water through their joints.



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- **Igneous and Metamorphic rocks** –

  In solid forms igneous and metamorphic rocks are relatively impermeable and hence serve as poor aquifers.

  Rock names and formations are not important, except as they influence the rocks' hydrologic properties.

  Volanic rocks are also igneous rocks but because they have very different hydrologic properties, they are considered in a separate category.

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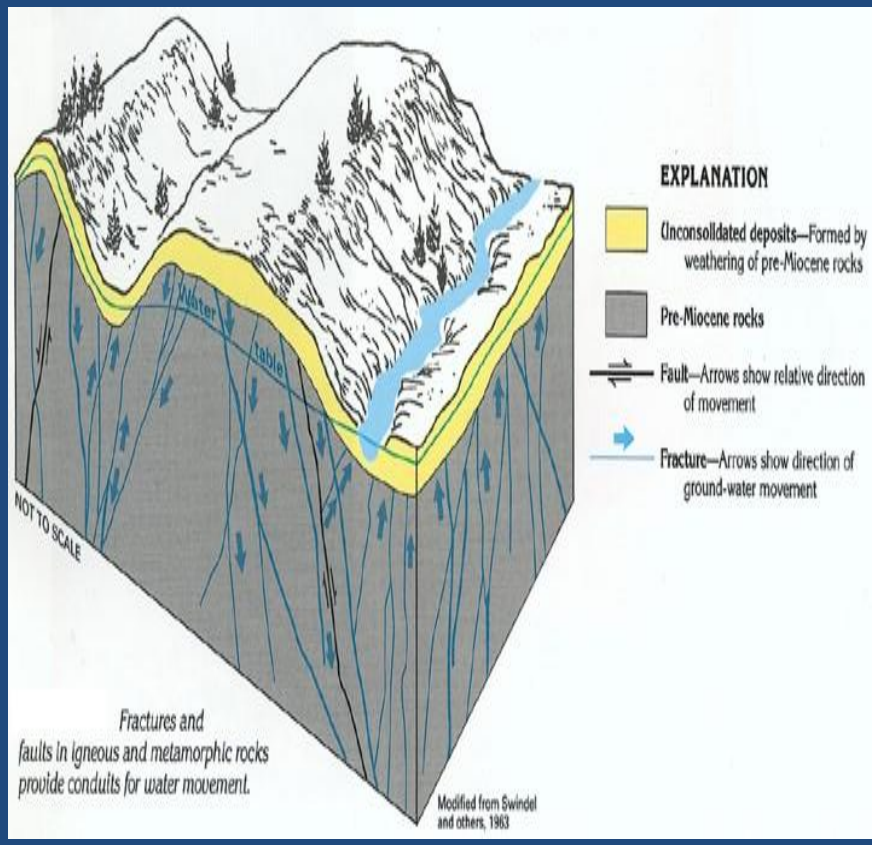
Crystalline rocks share two important attributes:

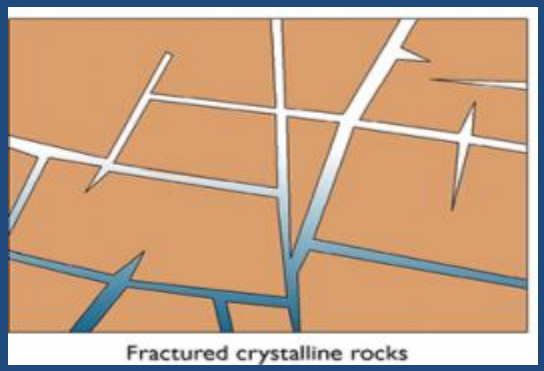
1. They are almost always uniformly hard, dense, rocks.

2. They have very low porosities and permeabilities.

Since aquifers depend on porosity for storage and permeability for water transmission.

Crystalline rocks generally poor aquifers. Groundwater reserviors in these rocks appear mainly interconnected three diamensional fracture systems that store and transmit water through the rock's main body.




Fractured crystalline rocks

THANK YOU