Introduction to clastic sedimentary rocks

Arenites describe sandstones that have less than 5-15% (depending on the classification scheme used) clay matrix in between the framework grains.

- **Quartz Arenite**s are sandstones that are composed predominantly of siliceous (quartz) grains. Quartz arenites are texturally mature to supermature sandstones. The compositional maturity of these sands indicates extensive weathering that removed everything but quartz grains due to the high stability of quartz at surface conditions. They are deposited in a stable cratonic environment, such as dunes or marine shelf environments.
- **Feldspathic Arenites** are sandstones that contain < 90% quartz (Dott classification), and more feldspar than lithic fragments. Feldspathic sandstones are commonly immature or sub-mature. These sandstones occur in association with cratonic or stable shelf environments. They are commonly derived from rapidly eroding granitic and metamorphic terrains where there is more mechanical wreathing than chemical weathering.
- **Lithic Arenites** are sandstones that contain < 90% quartz (Dott classification) and more lithics (unstable rock fragments) than feldspars. They are commonly immature to submature and are associated with fluvial conglomerates and other fluvial deposits, or in deeper water marine conglomerates. They form under conditions that produce large volumes of unstable material, derived from fine-grained rocks, mostly shales, volcanic rocks, and metamorphic rock.

Wacke describes sandstones that contain more than 5-15% clay matrix in between framework grains.

Diagenesis refers to all of the processes that sediment undergoes from the time of deposition to lithification. Unlike metamorphism, these changes happen at relatively low temperatures and pressures.

Cementation refers to the processes through which chemical precipitates form within the pore spaces of a sediment and help bind it into a sedimentary rock. The three most common cements are: quartz, calcite, and hematite

Chemical processes during diagenesis:

Oxidation

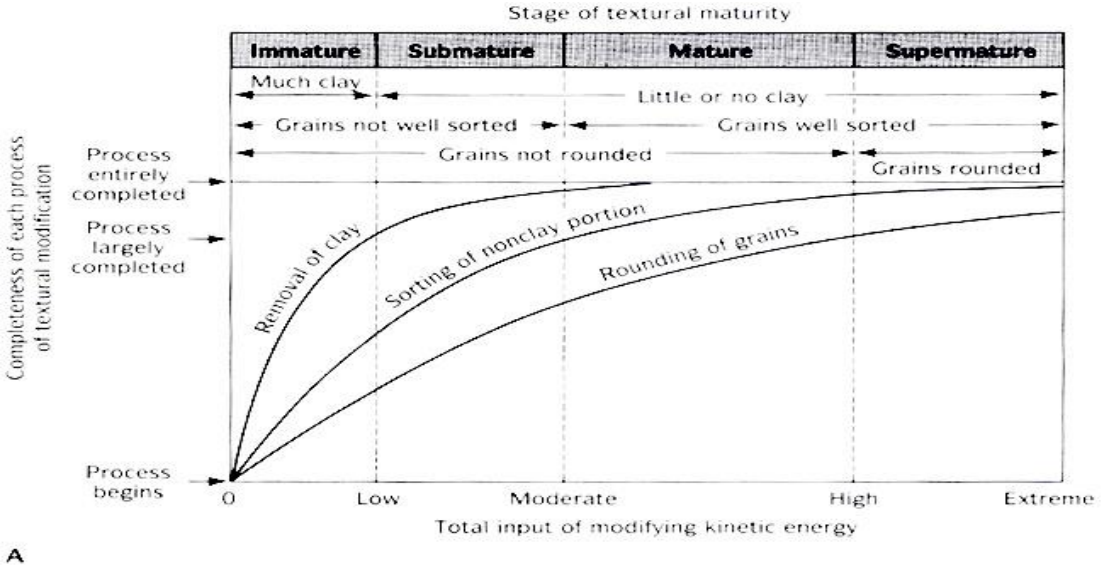
- $4Fe^{+2} + 3O_2 \rightarrow 2Fe_2O_3$
  iron + oxygen combine to form hematite

Dissolution

- $H_2O + CO_2 + CaCO_3 \rightarrow Ca^{+2} + 2HCO_3^-$
  water + carbon dioxide + calcite dissolve to form ions in solution

Hydrolysis

- $2KAlSi_3O_8 + 3H_20 \rightarrow Al_2Si_2O_5(OH)_4 + 4SiO_2 + 2K(OH)$
  feldspar in acidic water hydrolyses to form clay minerals + quartz + potassium hydroxide = Hydrolysis



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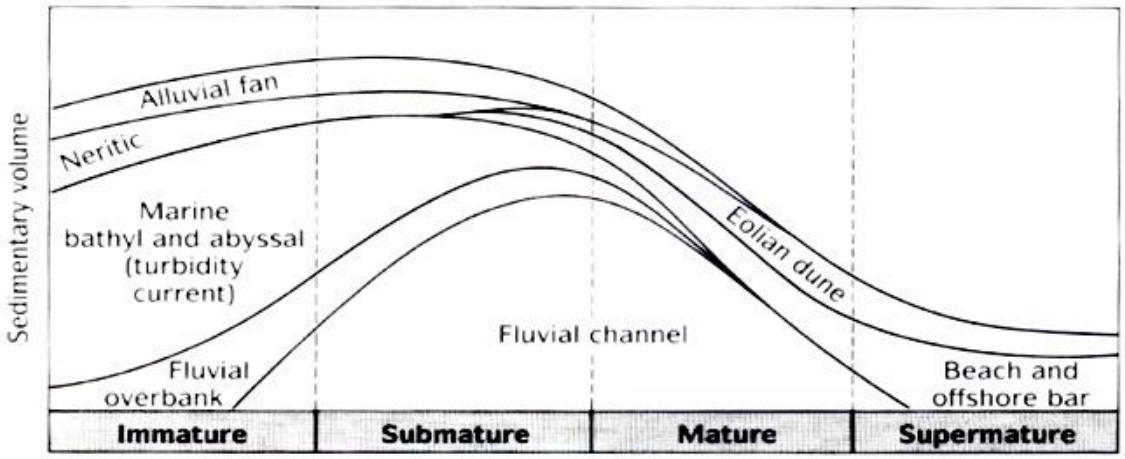
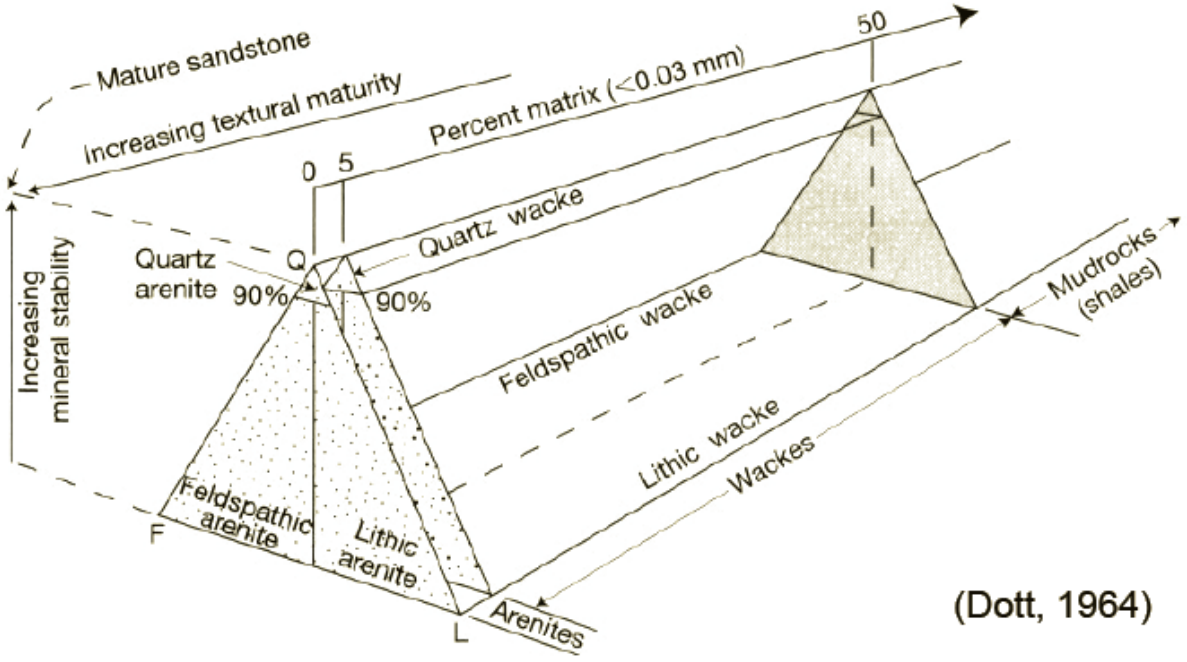
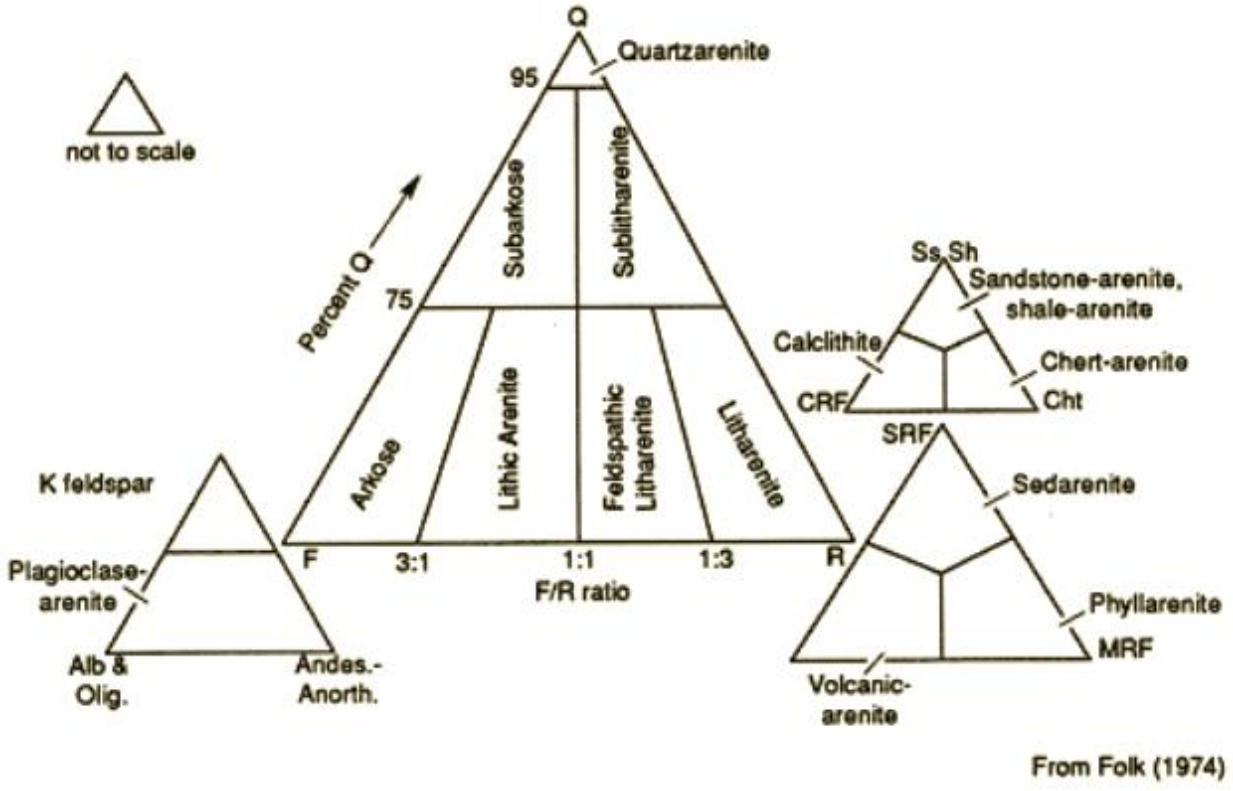


CLASSIFICATION SCHEMES



(Dott, 1964)



From Folk (1974)