CARBONATE PETROGRAPHY AND CLASSIFICATION

ATUL ADITYA PANDEY

Limestone occur throughout the world in every geological period from the Cambrian onwards.

Limestones are very varied in composition but broadly the components can be divided into four groups:

- Non skeletal grains
- Skeletal components
- Micrite
- Cement

Nonskeletal grains

- **OOIDS**: Ooids are spherical sub-spherical grains consisting of one or more regular concentric lamellae around a nucleus.

- Sediment composed of Ooids is referred to as an Oolite.

- Ooids typically form in agitated waters where they are frequently moved as sand waves ,dunes and ripples by tidal and storm currents and wave actions.

- **PELOIDS**: Peloids are spherical .cylindrical or angular grains composed of microcrystalline carbonate,but with no internal structure.
- Most peloids are of faecal origin and so can be reffered to as pellets.
- They are most common in the sediments of protected environments such as logoons and tidal flats. Pellets are very common in limestones and many micritic limestones seemingly without sand size grains may actually be pelleted .

Skeletal components

- The skeletal components of limestone are reflection of the distribution of carbonate secreting invertebrates through time and space.
- Environmental factors such as depth temperature salinity substrate and turbulence ,controlled the distribution and development of the organism in various carbonate subenvironments at a point in time.
- The main skeletal contributors to limestone are;
- Mollusca- gastropods,Cephalopods,Bivalves

Brachiopods,Corals,Echinoderms,Bryozoa,Foramenifera,

sponges,Arthropods,Calcispheres,Rhodophyta,Chlorophyta,Coccoliths,Stromatolites.

MICRITE

Many limestones have a fine grained usually dark matrix or are composed entirely of fine grained carbonate. This material is MICRITE

(Microcrystalline Calcite) with grain size less than 4 micrometer.

Micrites are susceptible to diagenetic alteration ann may be replaced by coarser mosaics of microspar through aggrading neomorphism.

Thank you

- References:

1. Sedimentary Petrology: An Introduction
    by Maurice Tucker.

2. Introduction to Sedimentology
    by S.M.Sengupta

Classification of Carbonates

- Three classification system are commonly usede each with a different emphasis :

1. A very simple but often useful scheme divides limestonews on the basis of grain size into :

Calcirudite:Most grains >2mm

Calcarenite: Most Grains between 2mm and 62micro mm

Calcilutite: Most grains < 62micro mm
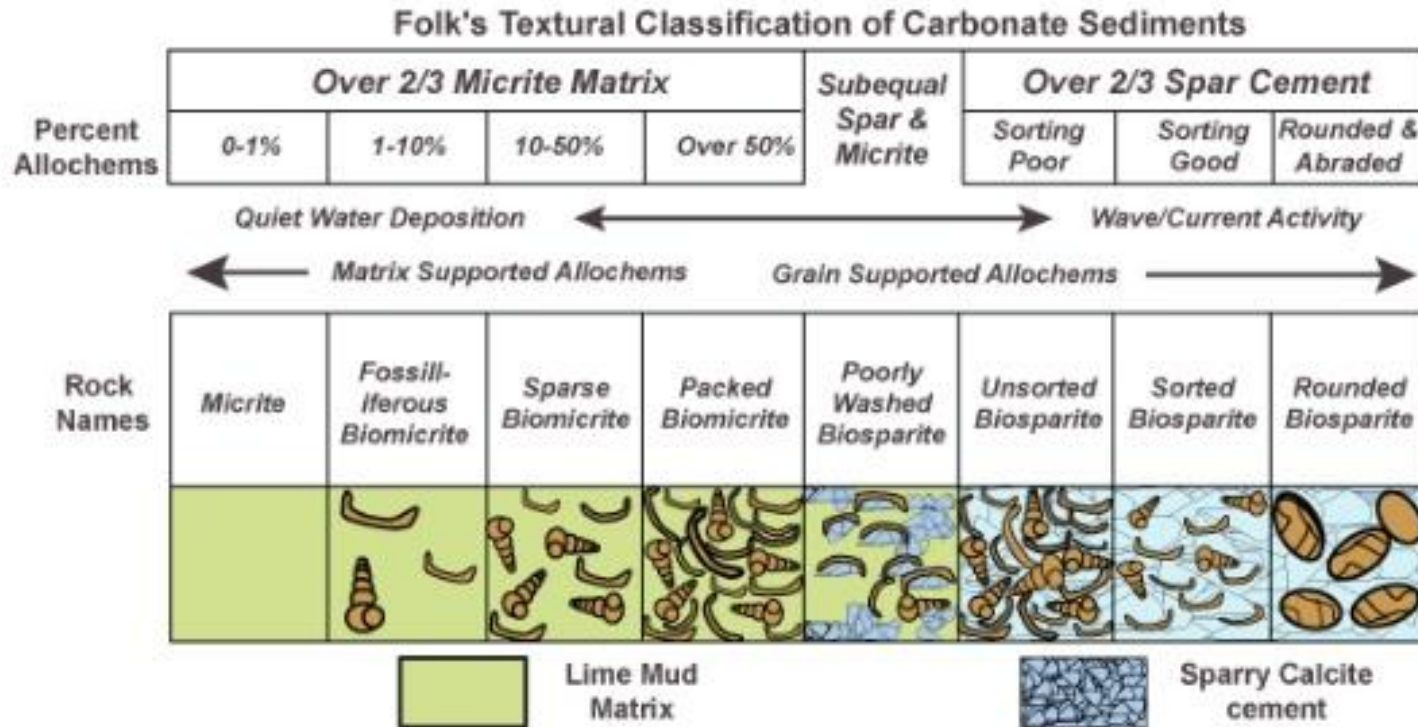
The classification scheme of Folk(1959,1962)

- Based mainly on composition ;distinguishes three components:
- The Allochems: Particles or grains
- Matrix: Chiefly Micrite
- Cement: Chiefly drusy Sparite

The classification scheme of Dunham(1962)

- Limestone is divided on the basis of texture into:
- Grainstone: grains without matrix
- Packstone: grains in contact with matrix
- Wackestone Coarse grains floating in a matrix
- Mudstone: Micrite with few grains

- Additional terms were added by Embry & Klovan 1972

- Floatstone and Rudstone Indication of coarse grain size.

- Boundstone: type of organic binding

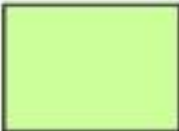- Bafflestone, Bindstone,Framestone give information on composition.

Folk Classification

Folk's Textural Classification of Carbonate Sediments

Percent Allochems	Over 2/3 Micrite Matrix				Subequal Spar & Micrite	Over 2/3 Spar Cement		
	0-1%	1-10%	10-50%	Over 50%		Sorting Poor	Sorting Good	Rounded & Abraded

Quiet Water Deposition ⟵———⟶ *Wave/Current Activity*

⟵ *Matrix Supported Allochems*   *Grain Supported Allochems* ⟶

Rock Names	Micrite	Fossill-iferous Biomicrite	Sparse Biomicrite	Packed Biomicrite	Poorly Washed Biosparite	Unsorted Biosparite	Sorted Biosparite	Rounded Biosparite

Lime Mud Matrix

Sparry Calcite cement

C.G.St.C. Kendall, 2005 (after Folk 1959)

The Folk classification is more complex than that of Dunham and incorporates relative abundances of allochems, matrix, and cement. Allochem type also plays part in this classification.

Dunham Classification

Original components not bound together at deposition					Original components bound together at deposition. Intergrown skeletal material, lamination contrary to gravity, or cavities floored by sediment, roofed over by organic material but too large to be interstices
Contains mud (particles of clay and fine silt size)			Lacks Mud		
Mud-supported		Grain-supported			
Less than 10% Grains	More than 10% Grains				
Mudstone	Wackestone	Packstone	Grainstone		Boundstone

C. G. St. C. Kendall, 2005 (after Dunham, 1962, AAPG Memoir 1)

The Dunham classification is similar to that of clastic rocks, in that it clearly shows the role of energy in sediment accumulation. The main distinction between rock types is based upon the relative abundance of allochems (framework grains) and matrix. Cement is treated as open pore space.

- The speciallity of Folks scheme is that the nomenclature gives complete petrographic description of the limestone.This scheme is quite popular among petrographers.

- Dunhams classification gives on the spot classification.It helps in well site and field investigators.hence popular among petroleum geologists.