



**GGY 4031**  
**LECTURE NOTES 2b**

# SEDIMENTOLOGY



**NOTE: MATRIX IS NOT CEMENT BUT FINE MATERIALS: SILT/SAND THAT FILL THE INTERSTITIAL SPACE DEPOSITED TOGETHER WITH SEDIMENTS**

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## •MATRIX



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## SANDSTONE CLASSIFICATION

- Arenites-up to 15% of matrix content. Arenites are texturally clean, matrix poor sandstone.
- Wackes (or graywackes)- 15% -75% of matrix content. Or dirty, matrix-rich sandstone are called wackes

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## ARENITES (0-15% MATRIX): PORES OPEN OR CEMENT-FILLED

Arenites can further be subdivided into 3 main types:

1. Quartz arenite---90-95% Q (mono- or polycrystalline).
2. Arkosic arenite--  $<90\% Q: > 25\% F$
3. Lithic arenites--- $< 90\% Q: RF > F$

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WACKES (15-75% MATRIX OR > 15% MATRIX):

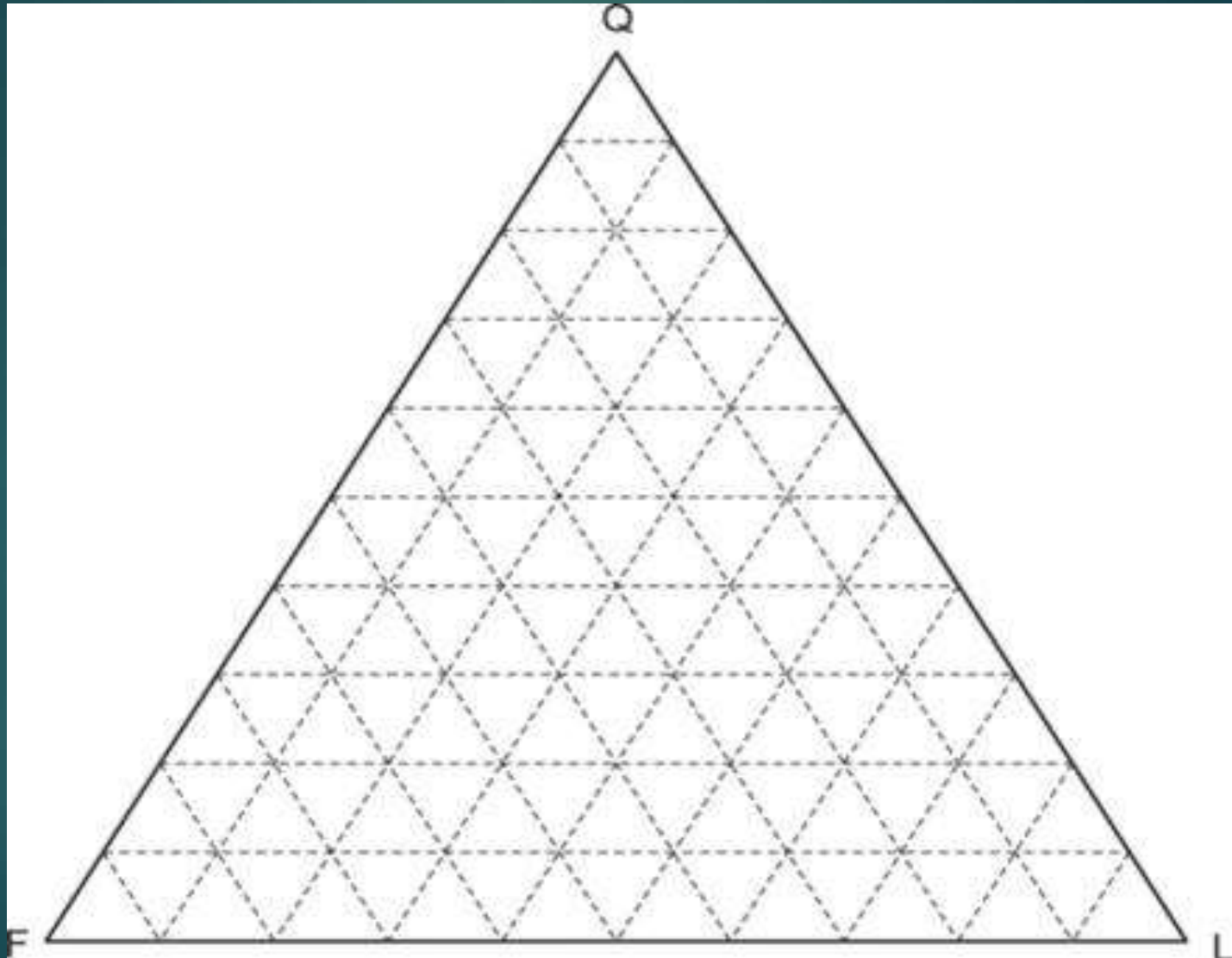
NO CEMENT

Similar to arenites, Wackes can be subdivided into 3 groups:

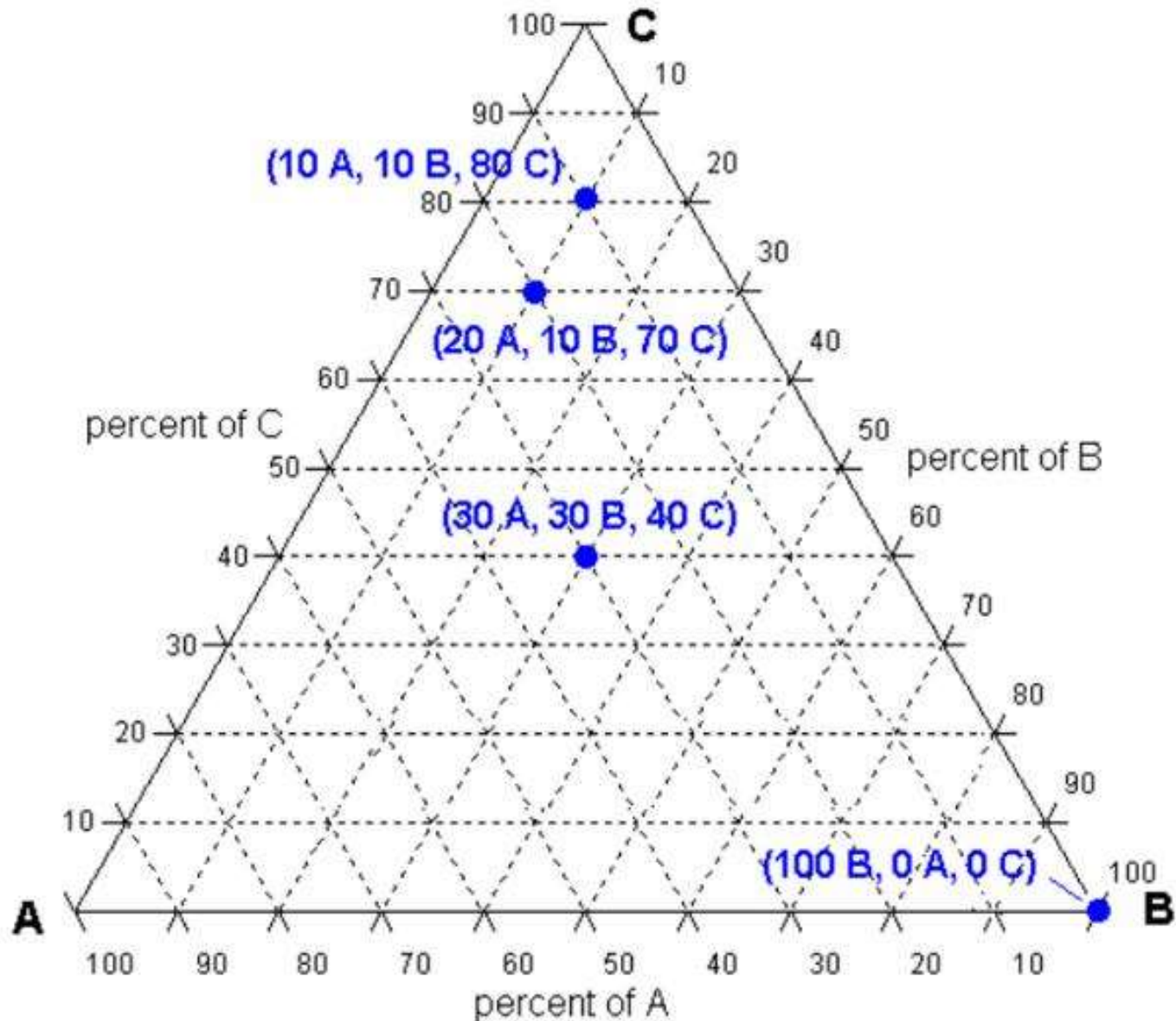
1. Quartz Wackes- 90-95% Q
2. Arkosic Wackes-- < 90% Q: F>RF
3. Lithic Wackes-- < 90% Q: RF>F

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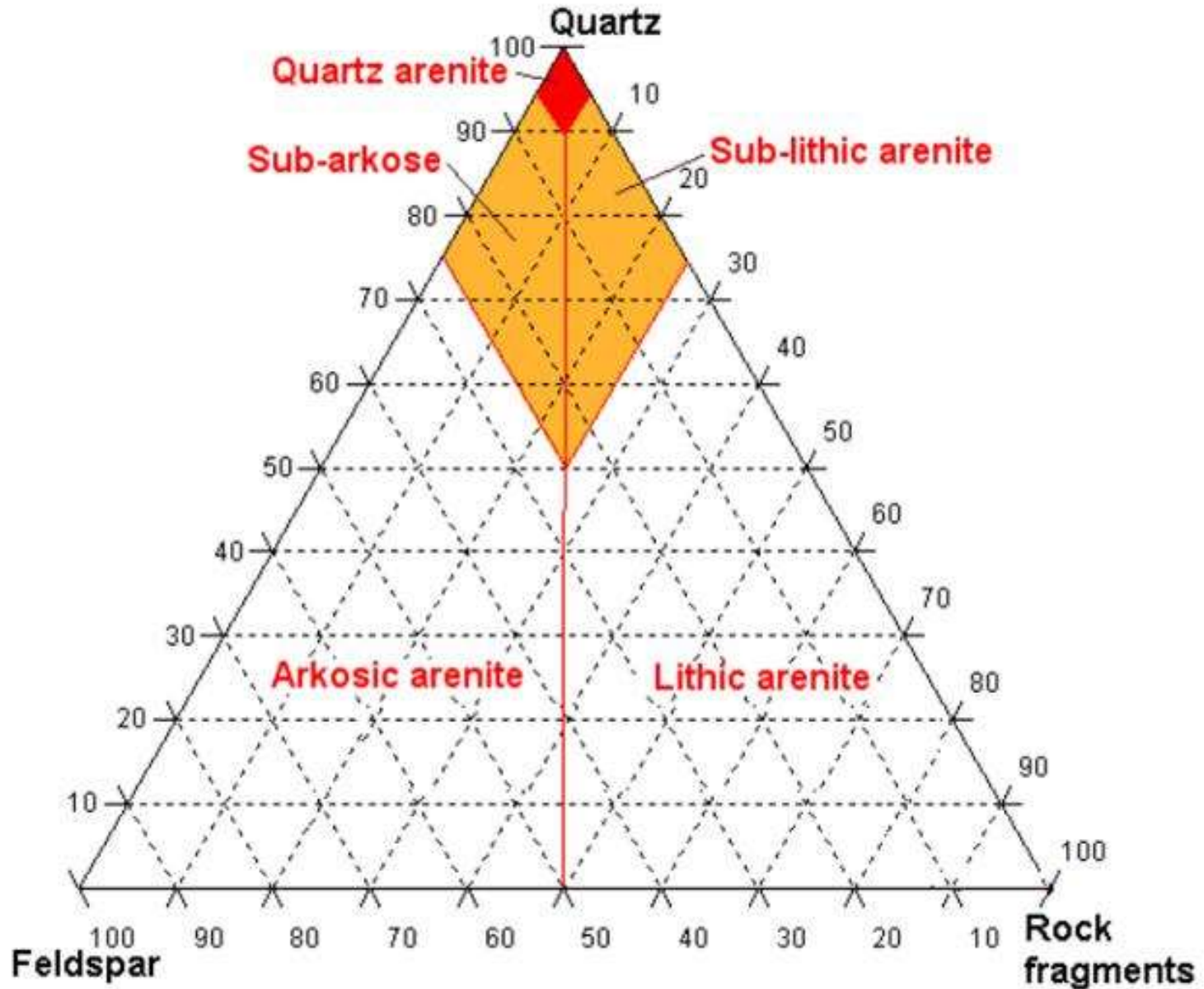
## TERNARY DIAGRAM



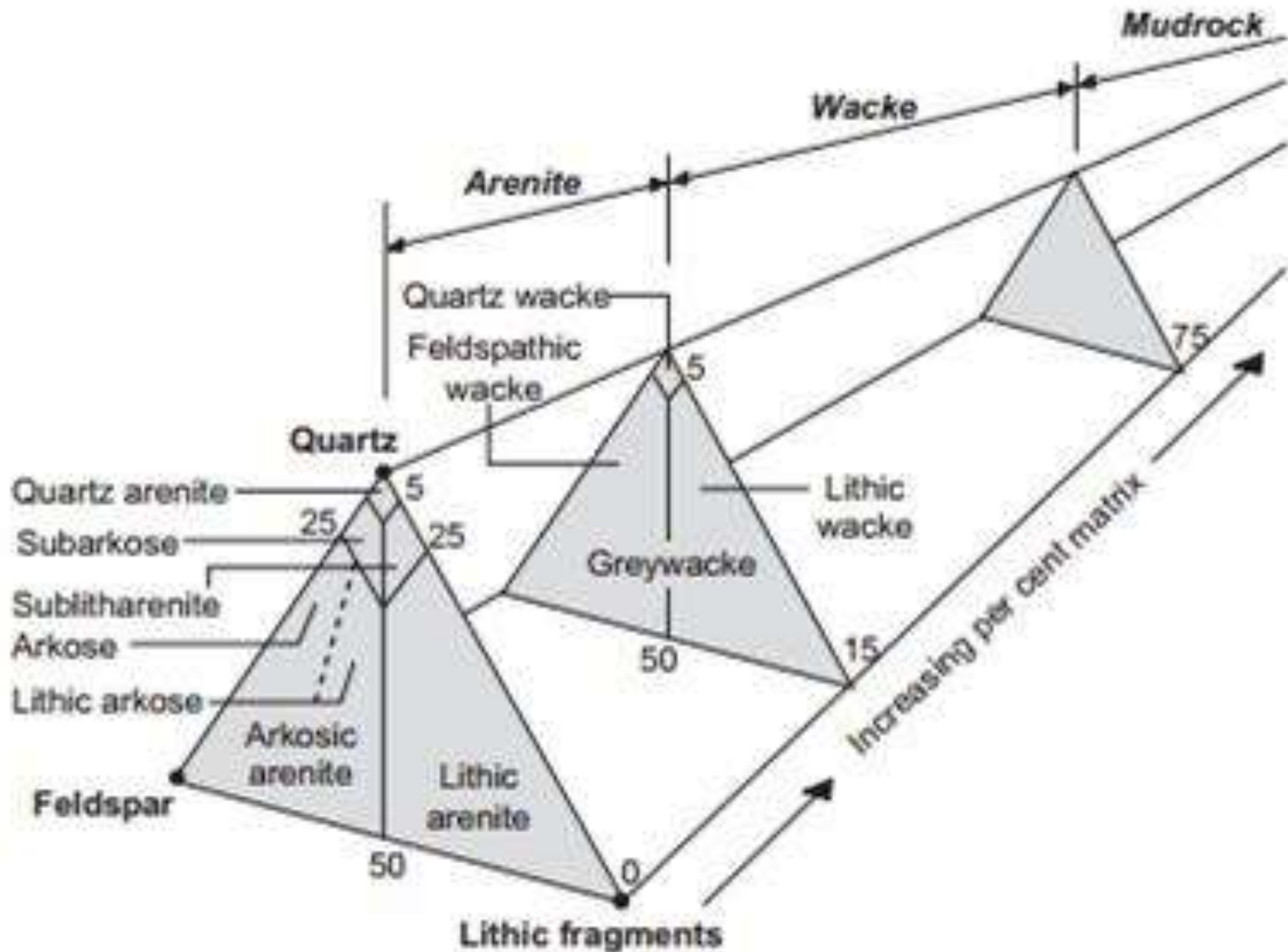
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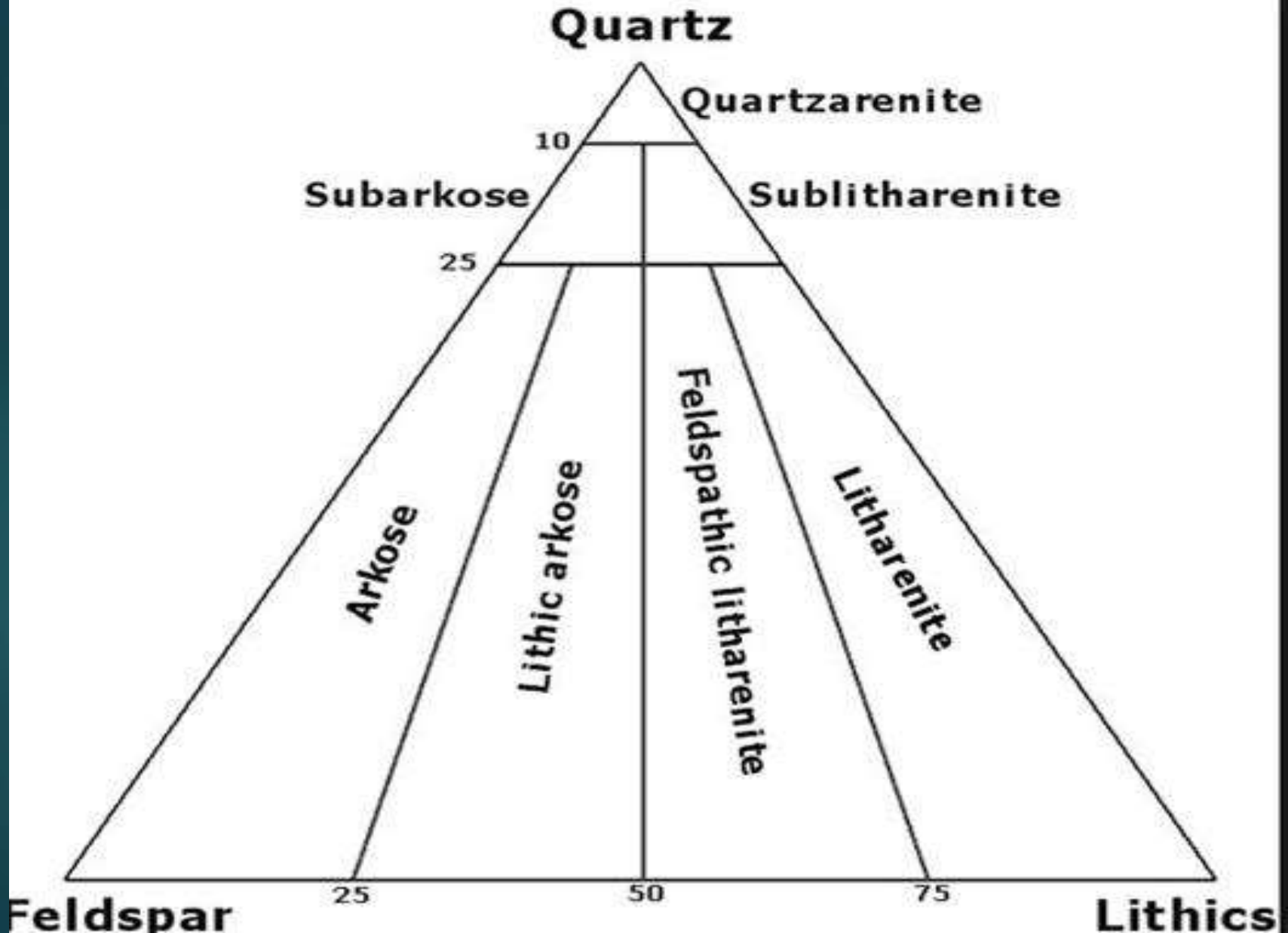
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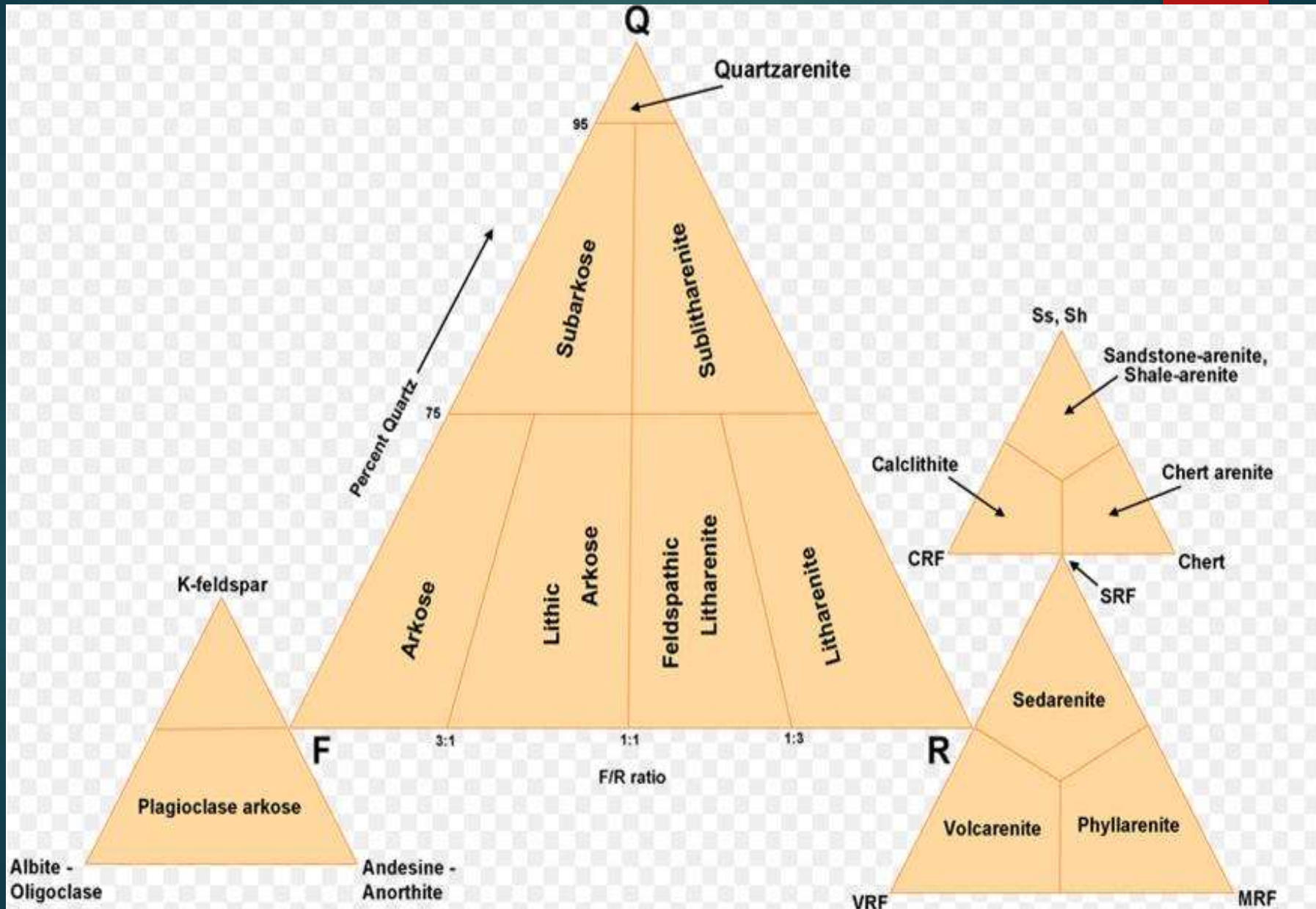
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## • RUDITES (Gravel, Conglomerate, Breccias, Rubble)

✓ Conglomerates is lithified gravel made up of rounded to subrounded clasts whose diameters  $>2$  mm. OR lithified (consolidated) gravel is called **conglomerate**

✓ Breccias are composed of very angular, gravel-size fragments

The % or proportions of clasts to matrix vary from author to author:

- $> 50\%$  of clasts over 2mm (Willman, 1942)
- $> 30\%$  of clasts over 2mm (Folk, 1959)
- $> 10\%$  of clasts over 2mm (Pettijohn, 1949)

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## Breccia



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**Table 5.1** Major Categories of Terrigenous Sediment and Sedimentary Rocks

Clast Diameter (mm)	Clast Name	Unconsolidated Sediment		Sedimentary Rock	
		Rounded, Subrounded, Subangular Clasts	Angular Clasts	Rounded, Subrounded, Subangular Clasts	Angular Clasts
>256	Boulder	Gravel <sup>a</sup>	Rubble <sup>a</sup>	Conglomerate	I. Breccia
256	Cobble				
64	Pebble				
4	Granule				
2	Sand	Sand		II. Sandstone (clast roundness variable)	
$\frac{1}{16}$	Silt	Mud		III. Mudrock	
$\frac{1}{256}$	Clay			(clast roundness variable) Siltstone <sup>b</sup> Mudstone Claystone <sup>b</sup>	

<sup>a</sup> A descriptive prefix derived from the most common coarse clast type (by size and/or composition) can be used to specify very coarse clastic sediment or sedimentary rock; for example, granite boulder rubble; rhyolite cobble conglomerate.

<sup>b</sup>Mud is an unconsolidated mixture of silt and clay. Mudrock is lithified mud. Most terrigenous sedimentary rocks finer than sand are intermixtures of silt and clay. Siltstone, claystone, and mudstone are collectively grouped as mudrock. **Shale** is fissile mudrock; that is, it breaks into thin slabs along planar surfaces.

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## CLASSIFICATIONS OF CONGLOMERATES

ORTHOCONGLOMERATE: is **clast-supported**. Formed by water current transport. It includes a spectrum of oligomict to polymict (=petromict) type:

- Oligomict orthoconglomerate (oligo=few), contain a low diversity of mineral components commonly quartz predominating. These share commonly quartz pebble abrasion, sorting, etc.,,. Relatively mature rocks. Commonly 2 stage deposits with matrix infiltrating pore spaces

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## Oligomictic Breccia,



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- Polymict orthoconglomerate (“poly”=many) contains multiple components, and is relatively texturally and compositionally immature



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Paraconglomerate is a matrix-supported. Rocks are texturally and compositionally immature. 1-stage deposition  
Intraformational conglomerates are formed by penecontemporary erosion, transport and redeposition of partly consolidated (partly lithified or indurated) sediment.

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Intraformational= redeposited fragments. of weakly consolidated beds. Thin, short term events e.g. landslides.



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## GLACIAL DEPOSITS

The ice itself creates a unique type of deposit known as glacial till (diamicton) which is a mixture of fragments ranging in size from very fine clay to very large boulders.

Primary characteristic and diagnostic feature of till:

- unsorted and unstratified. This is because they have been transported by ice (either within or underneath the ice), and not by water or wind
- Tills are commonly clayey-rich with larger fragments as well).

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**DIAMICTITE-** lithified deposits of poorly sorted material associated with glacial facies.



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## MUDROCKS ( MUD, MUDSTONE, SHALE, SILTSTONE, CLAY, CLAYSTONE)

- Consists of the finest products of rock weathering with particles smaller than  $< 1/16\text{mm}$ )

Most field classifications make use of properties such as:

- The type of silt-sized mineral grains present (quartzose siltstone, micaceous siltstone)
- The type of cement (e.g. calcareous , ferruginous)
- The degree of induration (compaction). Producing soft to hard rock types—silt to siltstone to argillite to slate

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- The *color* reflects aspects of composition. e.g. (red and green shales differentiated by oxidation state of Fe compounds: black shales containing organic carbon, bitumen, etc..)
- The *fossil content* (e.g. graphitic shale, fossiliferous siltstone, etc...)

**Mud**=silt + clay (mixture)

**Mudstone** = siltstone + claystone (mixture)

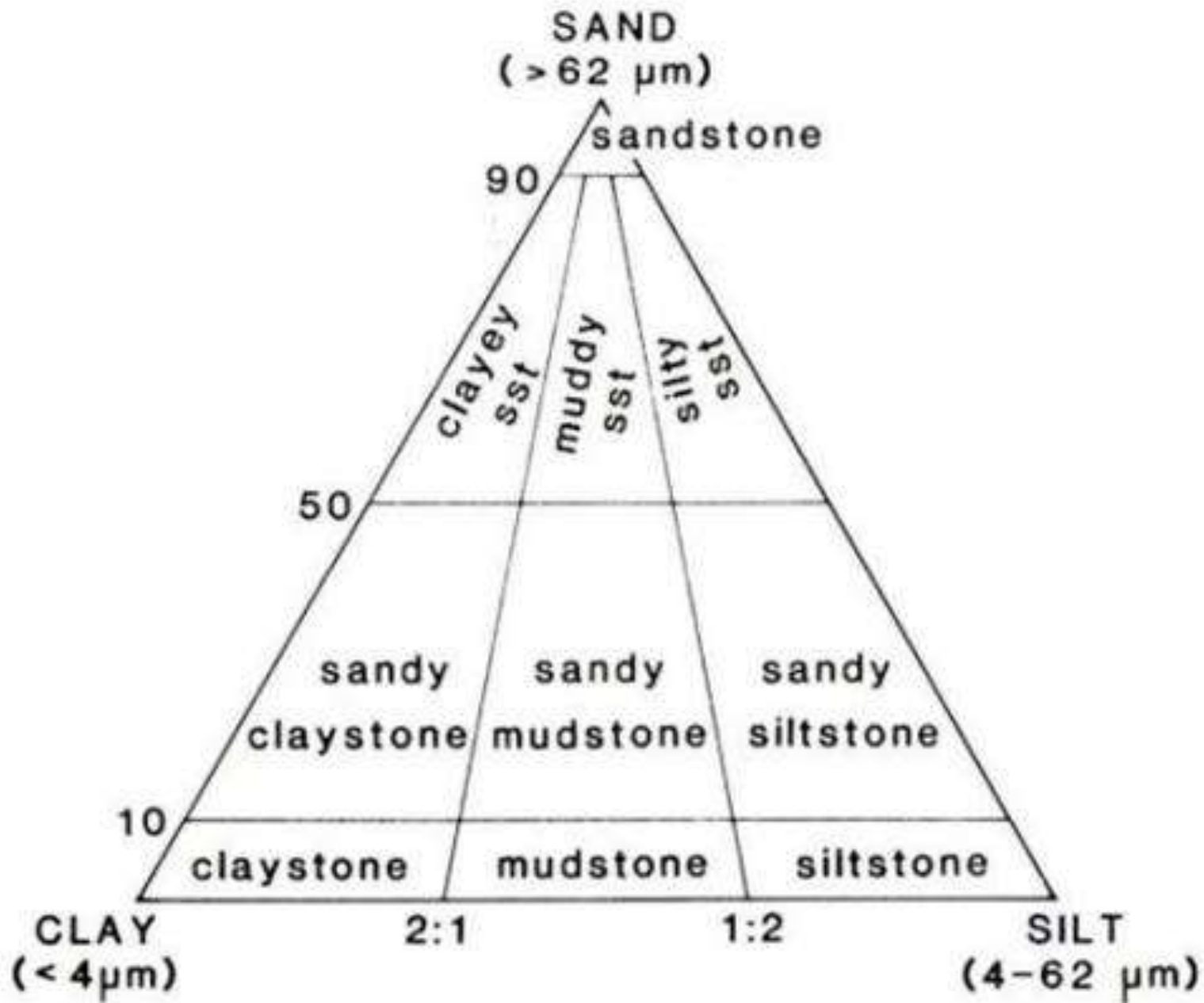
**Shale** = mudstone with fissility

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## MUDROCKS

<b>Unindurated</b>	<b>Indurated</b>	<b>After Incipient Metamorphism</b>
	Mudstone	
Silt	Siltstone	Argillite
Mud	Shale (fissile)	
Clay	Claystone	

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Siltstone showing thin bands of silt and silty clay

