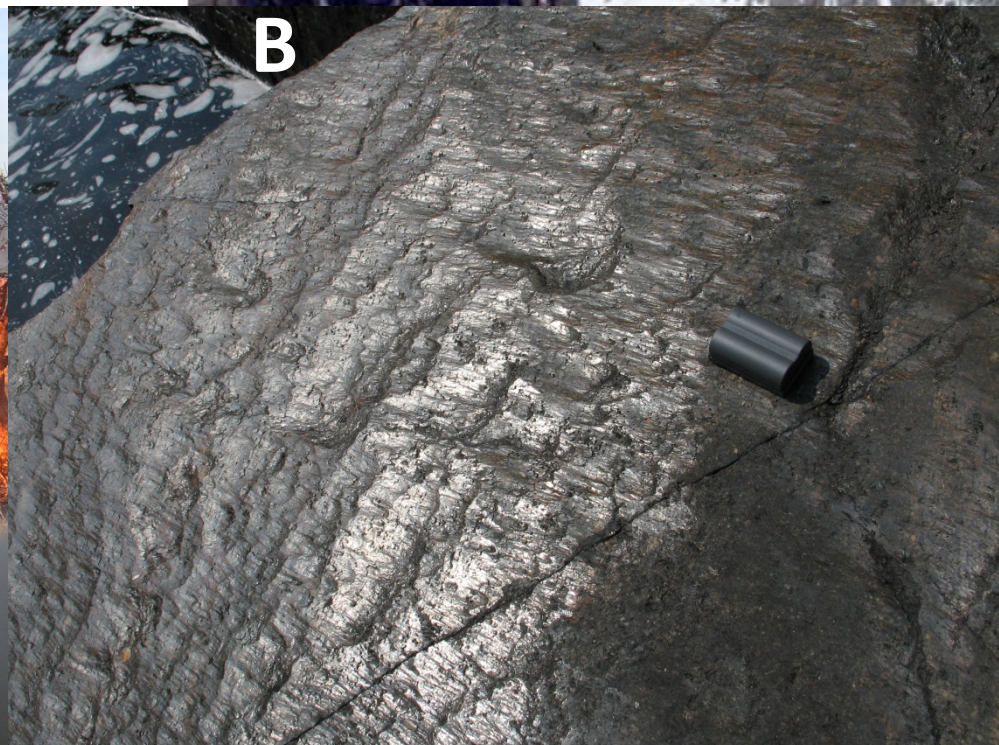
Physical Weathering

1. **Collision**
    1. ***Abrasion***
    2. ***Comminution***
2. **Expansion**
    1. ***Thermal***
    2. ***Mineralogical***
    3. ***Depressurization***
3. **Wedging**
    1. ***Roots***
    2. ***Ice***

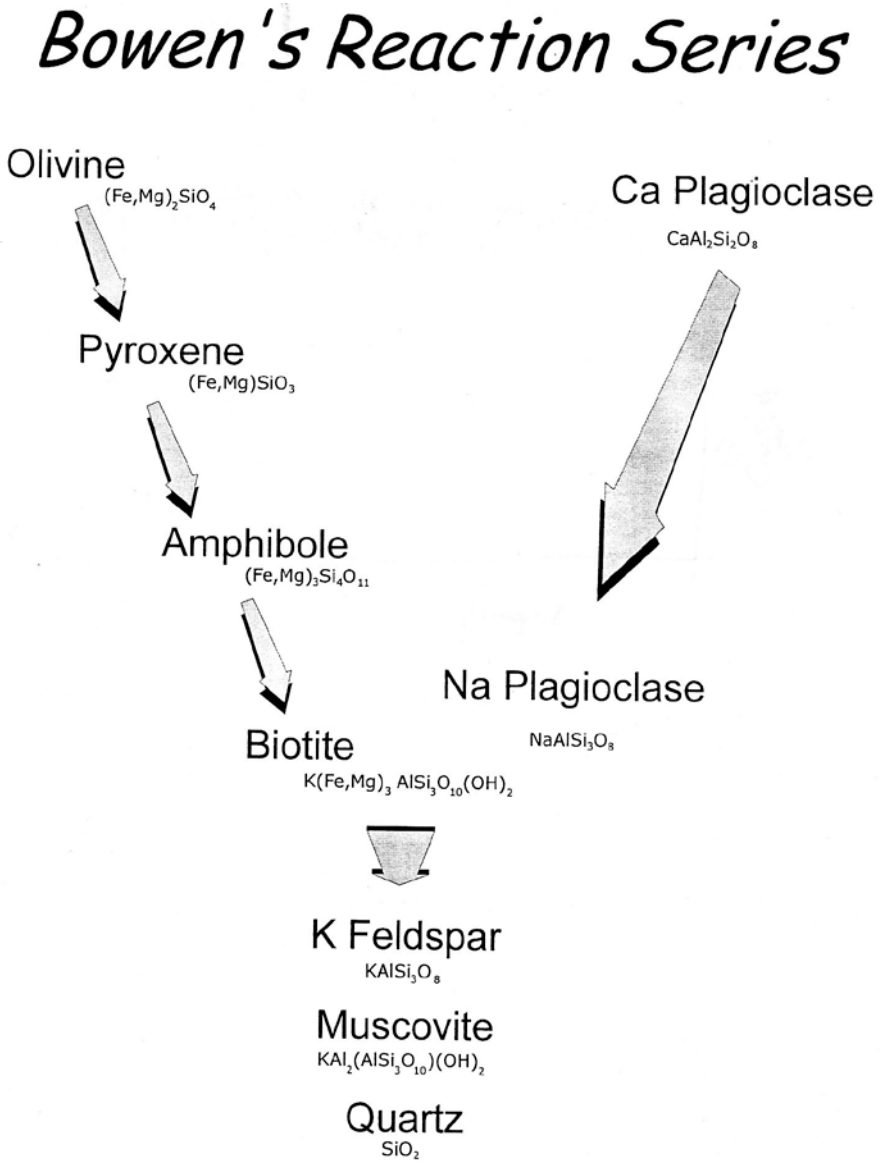


Chemical Weathering

1. **Dissolution – creation of an ionic solution**

2. **Hydrolysis – combination of a mineral with hydrogen from water, often by exchange with another cation**

3. **Redox – change of electropotential often associated with a change in the presence (or absence) of oxygen**



Chemical Weathering

Dissolution

$CaCO_{3(s)}$ + <===> $Ca^{2+}_{(aq)} + CO_3^{2-}{}_{(aq)}$
Calcite = Calcium ion + Carbonate ion

$NaCl_{(s)}$ <===> $Na^{+}_{(aq)} + Cl^{-}_{(aq)}$
Halite = Sodium ion + Chlorine ion

Hydrolysis

$2KAlSi_30_8 + 2H^+ + H_20$ <===> $Al_2Si_20_5(OH)_4 + 2K^+ + 4Si0_2$
Orthoclase + acid + water = Kaolinite + Potassium ions + silica

$CaAl_2Si_2O_8 + 2H^+ + H_2O$ <===> + $Al_2Si_20_5(OH)_4 + Ca^{2+}$
Plagioclase(An) + acid + water = Kaolinite + Calcium ion

Redox

$4FeSi0_3 + 0_2$ <===> $2Fe_20_3 + 4Si0_2$
Pyroxene + Oxygen = Hematite + silica

$2Fe_2SiO_4 + O_2$ <===> $2Fe_2O_3 + 2SiO_2$
Olivine + Oxygen = Hematite + silica

Erosion

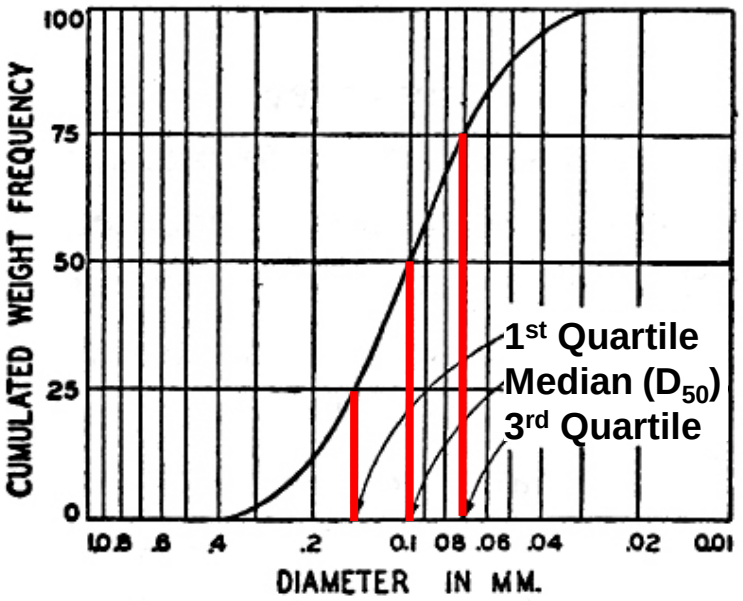
Particle Attributes

1. Size:

Millimeters	Microns	Φ (Phi Scale)	Wentworth Size Class	
4096		-12		
1024		-10	Boulder (-8 to -12ϕ)	
256		-8		
			Cobble (-6 to -8ϕ)	Gravel
64		-6		
16		-4	Pebble (-2 to -6ϕ)	
4		-2		
3.36		-1.75		
2.83		-1.5	Granule	
2.38		-1.25		
2.00		-1.0		
1.68		-0.75		
1.41		-0.5	Very coarse sand	
1.19		-0.25		
1.00		0.0		
0.84		0.25		
0.71		0.5	Coarse sand	
0.59		0.75		
0.50	500	1.0		
0.42	420	1.25		
0.35	350	1.5	Medium sand	Sand
0.30	300	1.75		
0.25	250	2.0		
0.210	210	2.25		
0.177	177	2.50	Fine sand	
0.149	149	2.75		
0.125	125	3.0		
0.105	105	3.25		
0.088	88	3.5	Very fine sand	
0.074	74	3.75		
0.0625	62.5	4.0		
0.053	53	4.25		
0.044	44	4.5	Coarse silt	
0.037	37	4.75		Silt
0.031	31	5.0		
0.0156	15.6	6.0	Medium silt	
0.0078	7.8	7.0	Fine silt	
0.0039	3.9	8.0	Very fine silt	
0.0020	2.0	9.0		
0.00098	0.98	10.0	Mud	still Mud

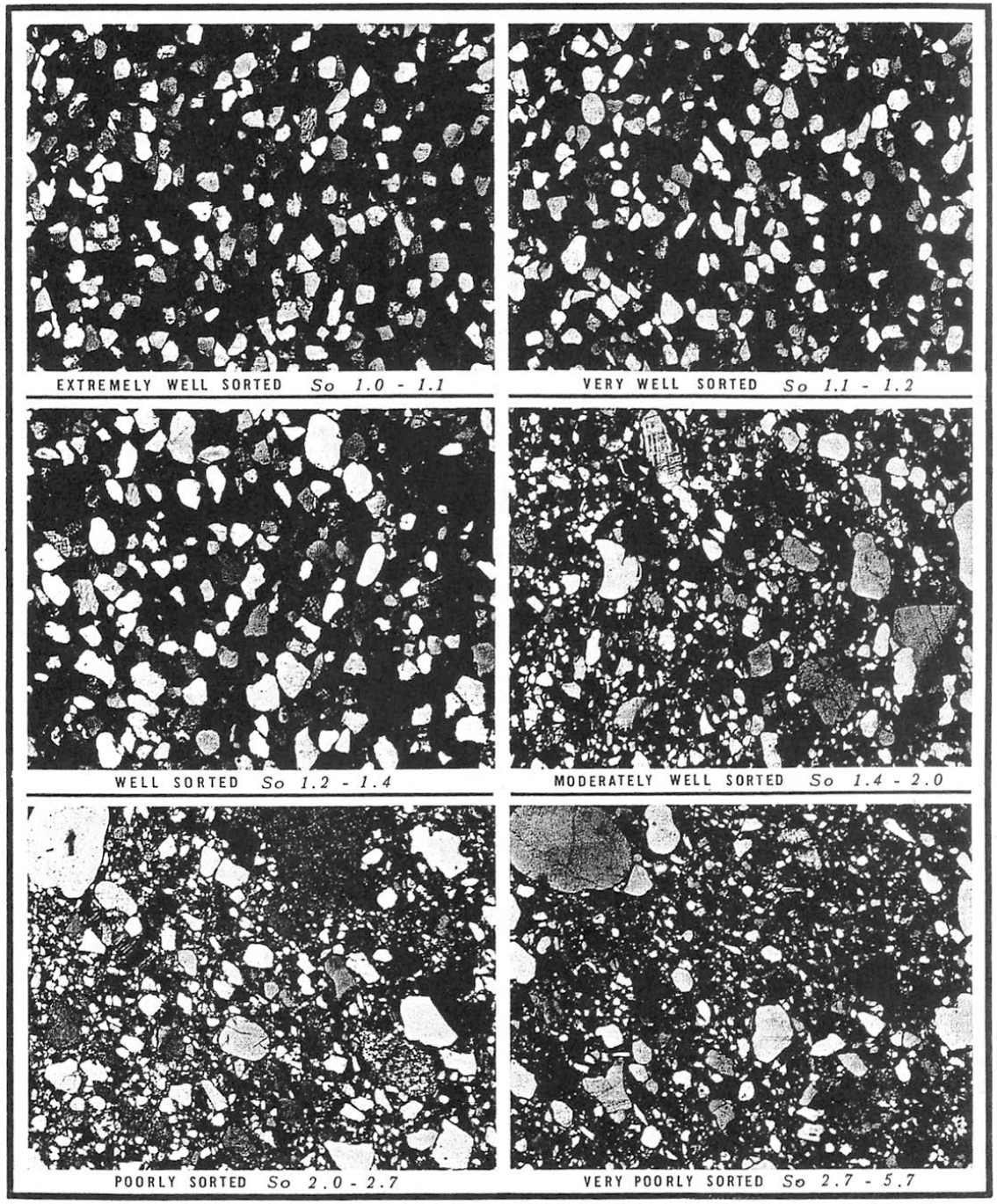
Particle Attributes

2. Sorting



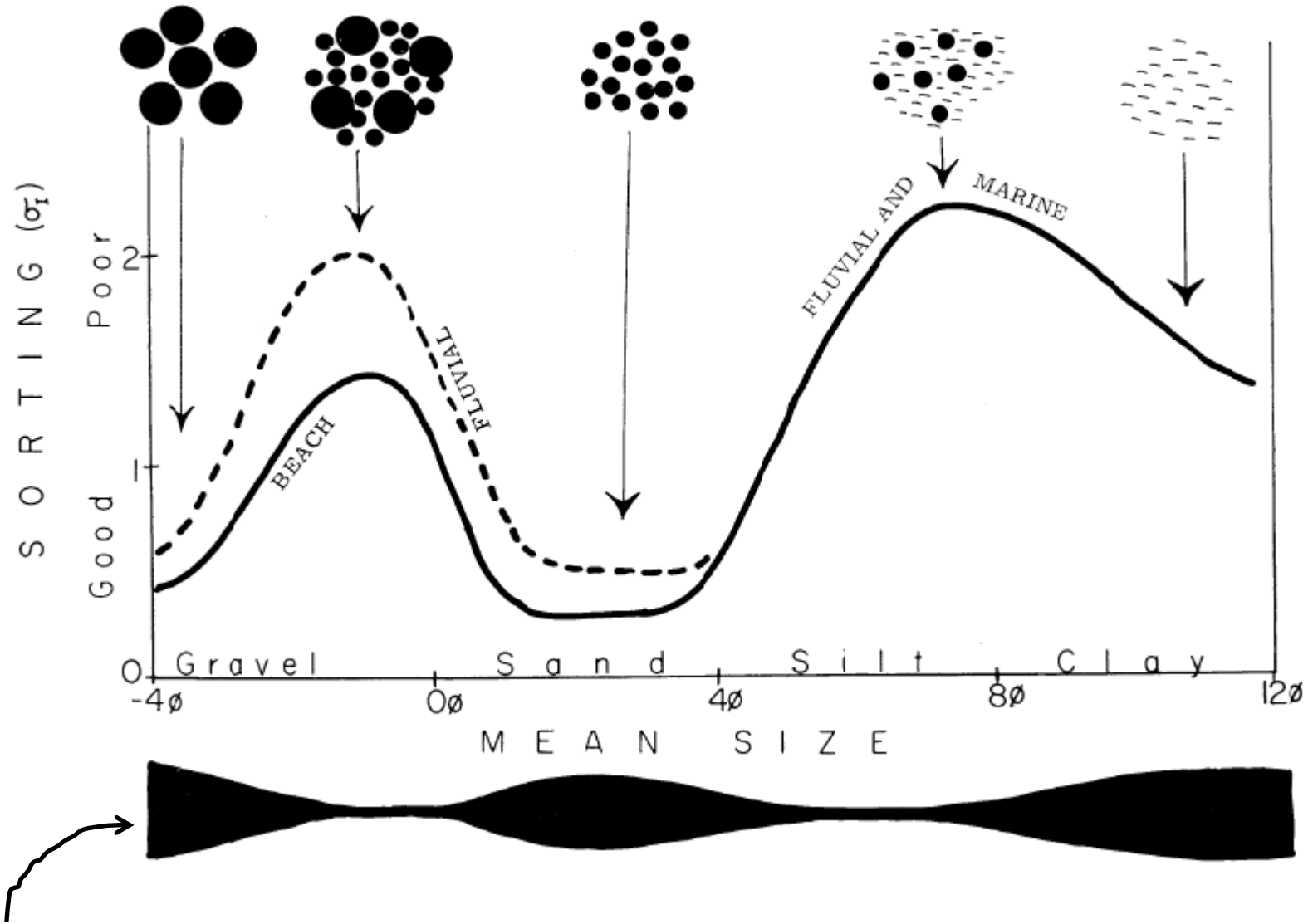
Trask Sorting Coefficient =

$$So = \sqrt{\frac{D_{25}\ (1^{st}\ Quartile)}{D_{75}\ (3^{rd}\ Quartile)}}$$



0 1
MM.

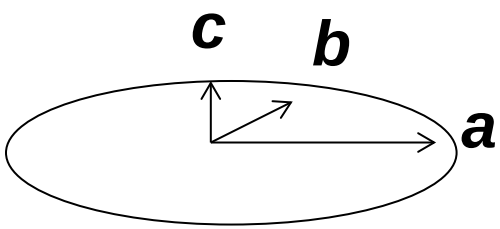
Beard, D.C., and Weyl, P.K., 1973, Influence of texture on porosity and permeability of unconsolidated sand: AAPG Bulletin.



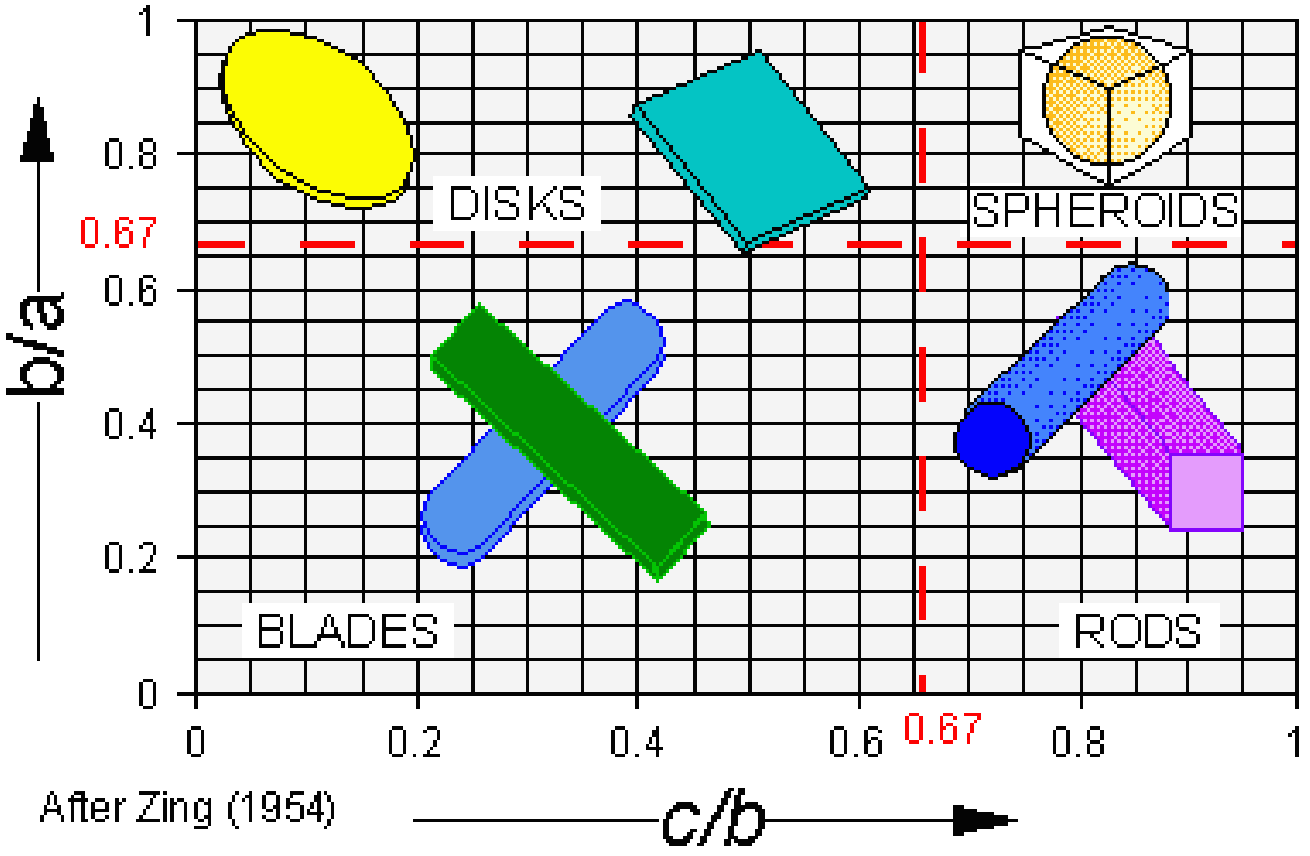
ABUNDANCE OF GRAIN SIZE IN GLOBAL SEDIMENTS

Particle Attributes

3. Shape:



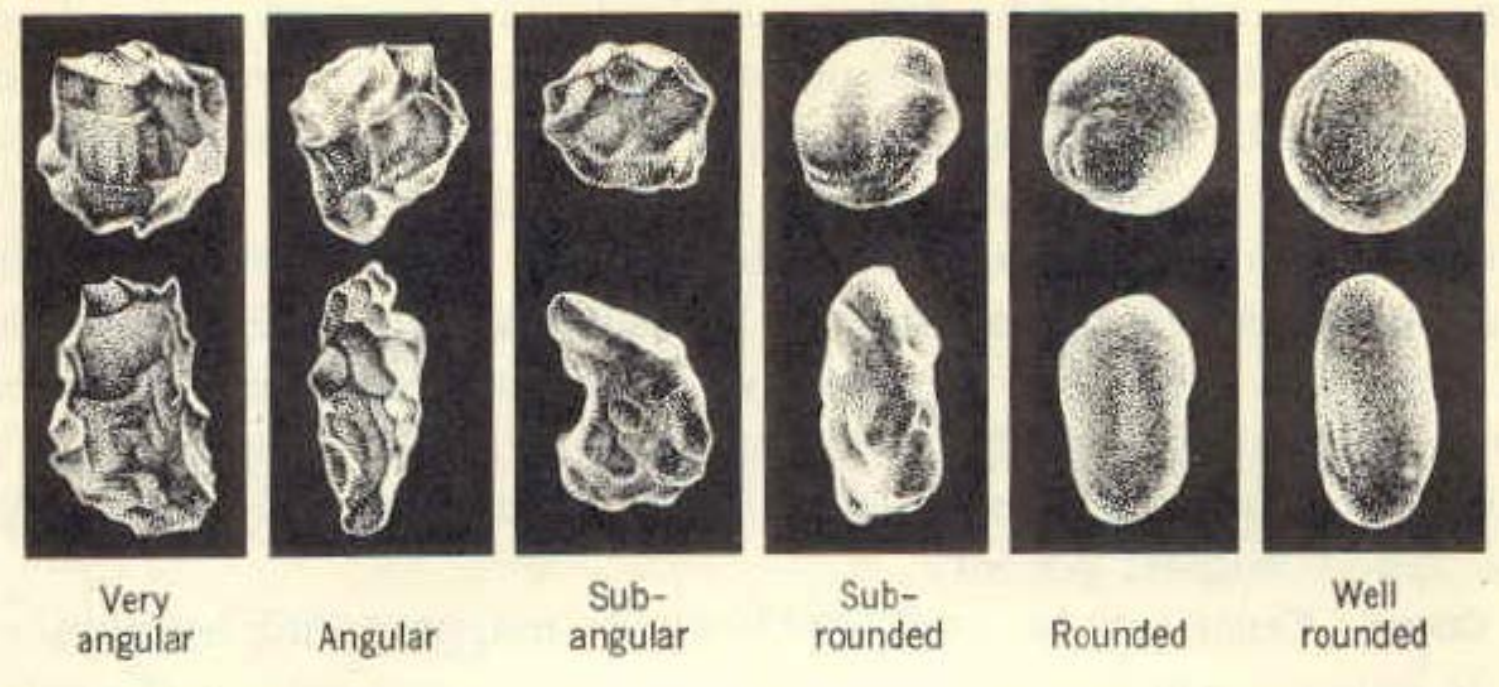
$$CSF = \frac{c}{\sqrt{ab}}$$



Where ***a***, ***b***, and ***c*** are the longest, intermediate and shortest axis of the particle (and are mutually perpendicular).

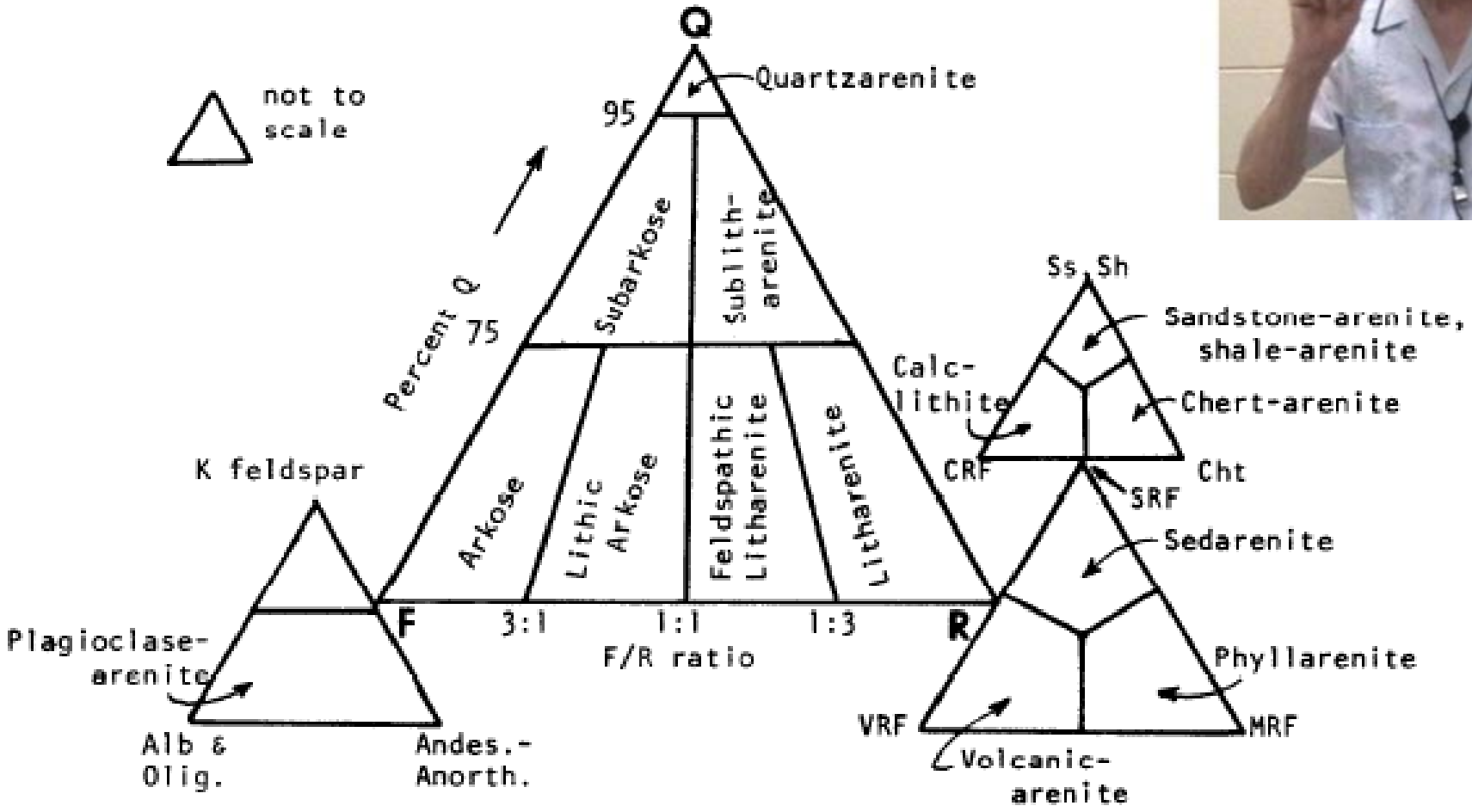
Particle Attributes

4. Roundness (or Angularity)

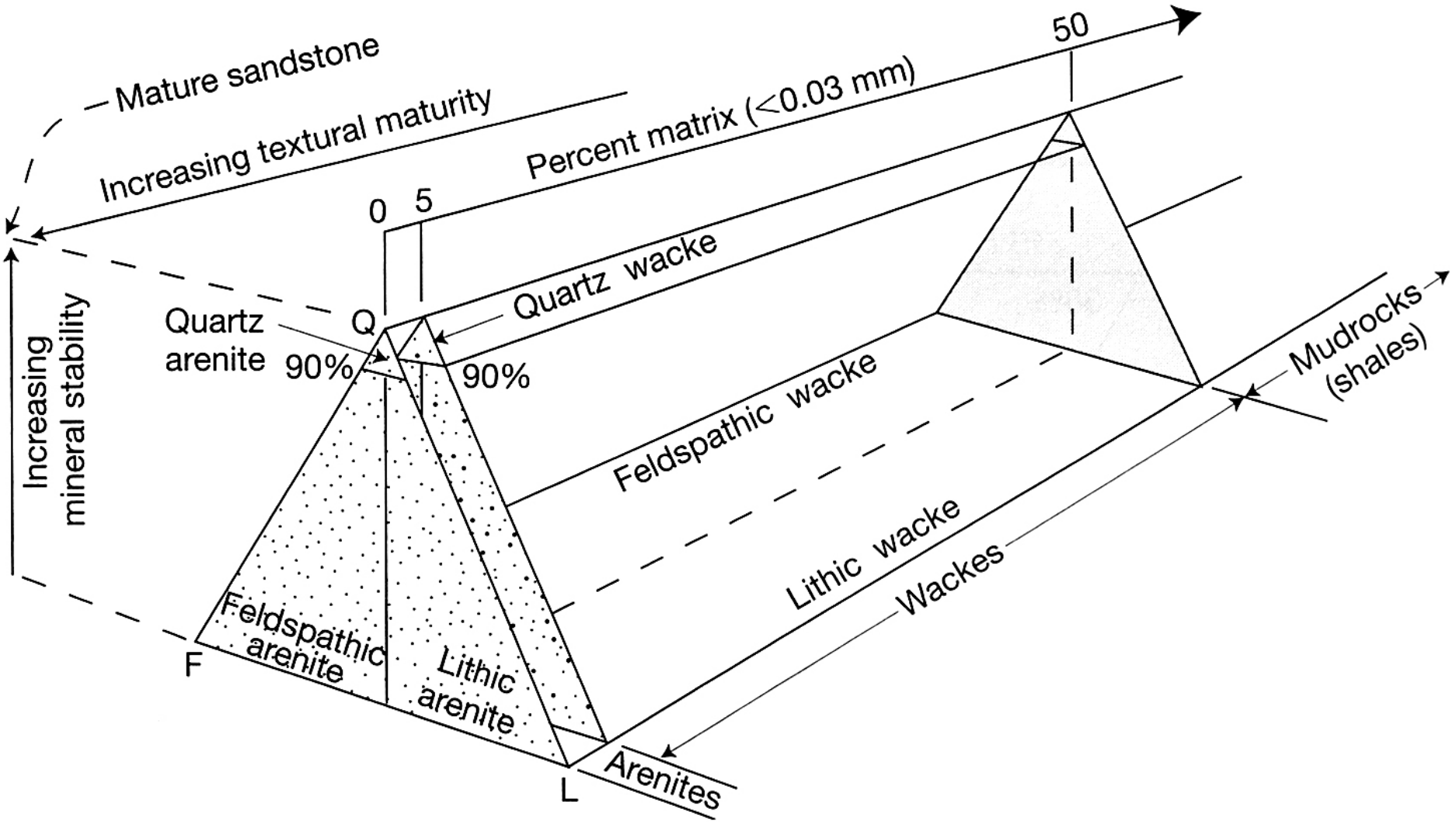


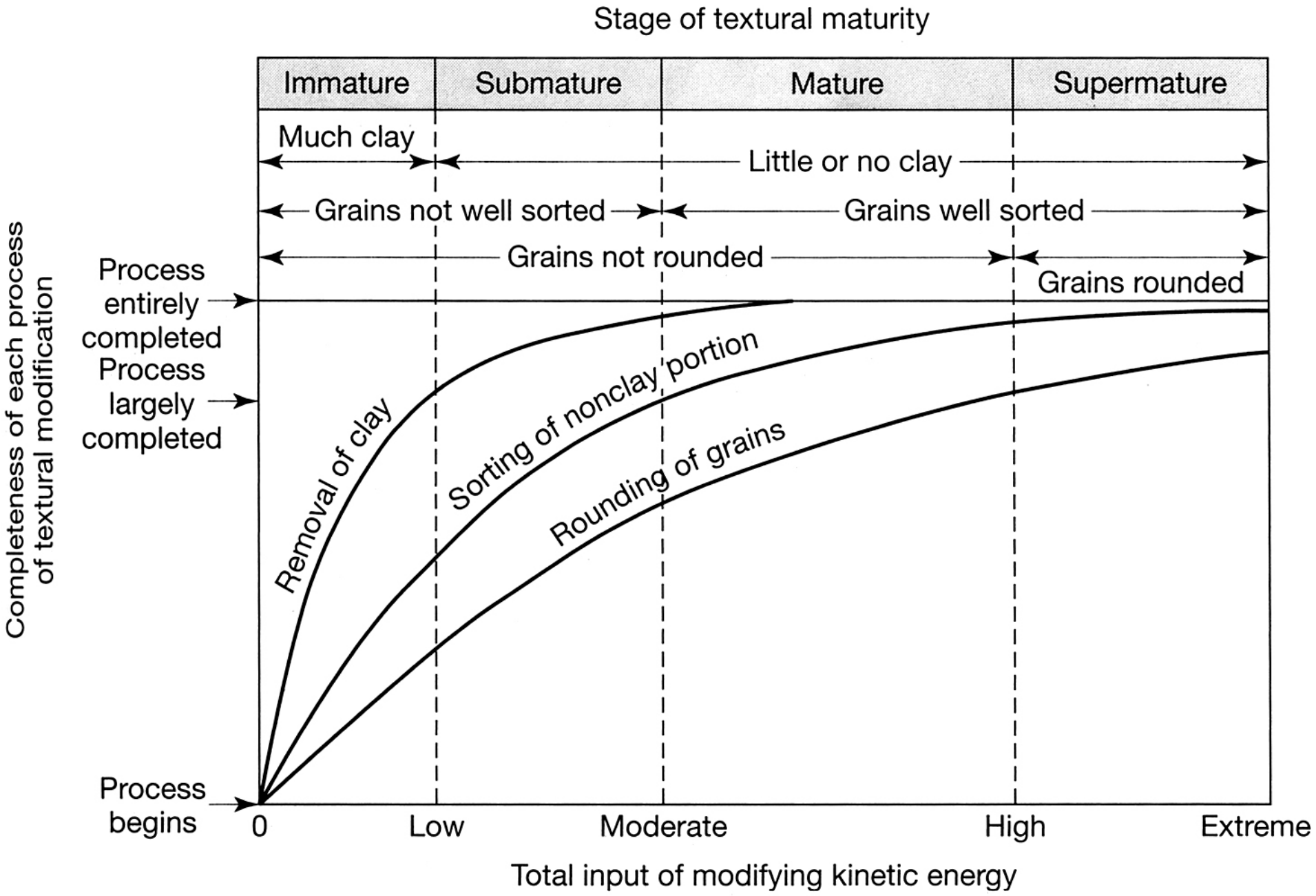
Modified after Powers, M . C., 1953, Journal of Sedimentary Petrology, v. 23, p. 118.

~Sandstones


Q
not to scale
95
Quartzarenite
Percent Q
75
Subarkose
Sublith-arenite
Arkose
Lithic Arkose
Feldspathic Litharenite
Litharenite
K feldspar
F
3:1
1:1
1:3
R
F/R ratio
Plagioclase-arenite
Alb & Olig.
Andes.-Anorth.
Ss Sh
Sandstone-arenite, shale-arenite
Calc-lithite
Chert-arenite
CRF
Cht
SRF
Sedarenite
Phyllarenite
VRF
MRF
Volcanic-arenite

General Siliciclastics




Stage of textural maturity
Immature
Submature
Mature
Supermature
Much clay
Little or no clay
Grains not well sorted
Grains well sorted
Grains not rounded
Grains rounded
Process entirely completed
Process largely completed
Process begins
Removal of clay
Sorting of nonclay portion
Rounding of grains
Completeness of each process of textural modification
0
Low
Moderate
High
Extreme
Total input of modifying kinetic energy