Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third Year)

Subject: Geology

Course Code: GEC 108

Course Title: Sedimentary Petrology

Unit: I

Module Name: Textures in Sedimentary Rocks: Part 3

Module No: 04

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Notes:

- Texture is the size, shape and arrangement of the component elements of a sedimentary rock.
- The size and uniformity of size or sorting is a measure of the competence and efficiency of the transporting agent.
- Sorting is the process by which a transport medium selects particles of different shapes, size and densities.
- The second important aspect of texture of sedimentary rocks is Shape of the grains.

Shape of the Grains:

- Particle Shape is difficult to quantify or describe
- Shape is commonly described with reference to three axes at 90° each other that can theoretically be placed inside any particle.
- The longest axis is “a”, shortest is “c” and the intermediate is “b”

- In a sphere or cube, those axes at intersect at the centre and have equal length

Determination of Particle Shape in Sediments:

- The shape of a sedimentary particle consists of two important attributes, namely
    - ROUNDNESS, and
    - SPHERICITY.
- These two attributes of sedimentary particles are very useful for reconstruction of transportation history (wear and tear). They are also useful in determining the porosity of reservoir rocks and aquifers. It may also be useful in correlation of sediments.
- ROUNDNESS may be defined as the sharpness of the corners and edges of a grain, or the lack of it;
- while SPHERICITY is the ratio existing between the length, breadth and thickness of the grain.
- Two methods of determining the shape of a grain include:

1. Qualitative or Visual methods of estimation, and
2. Quantitative methods of estimation.

SPHERICITY

- Visual estimation of SPHERICITY can be made by using the following categories:

1. Equant – Length of the grain upto 1 ½ times its breadth
2. Elongated – Length 1 ½ times – 3 times its breadth (Prismatic) or thickness (Tabular)
3. Acicular – Length is over 3 times its breadth or thickness respectively.

- A QUANTITATIVE METHOD of determining SPHERICITY is using Wadell's formula (s/S), where 's' is the surface area of a sphere

of the same volume as the fragment under examination and 'S' is the actual surface area of the object.

- Owing to difficulties in measuring the surface area of an irregular solid, the sphericity may also be obtained by

$$Sphericity = \frac{d_n}{D_s}$$

  - where **dn** is the nominal diameter (diameter of a sphere of the same volume as the object), and
  - **Ds** is the diameter of a circumscribing sphere (generally the long diameter).
- **dn** can be determined with the help of a measuring cylinder from which the volume can be determined.
- The longest diameter, **Ds**, is measured with the help of a Vernier caliper.

- From a two-dimensional figure (which is more convenient to work with), obtained by projecting the fragment onto a paper using a Camera Lucida, sphericity is obtained by the formula
- A sphere has a sphericity of 1.0, and all other objects have values less than 1.0.

Zingg's Classification of Pebble Shapes:

- Zingg (1935) used the ratios b/a and c/b (where a, b, and c are length, breadth and thickness, respectively) to define four shape classes.
  - a – Long Axis (l)
  - b – Intermediate Axis (i)
  - c – Short Axis (s)
- Note that the representative solids shown have the same roundness (0) but that they have different shapes

ROUNDNESS:

- A QUANTITATIVE METHOD of determination of **ROUNDNESS** can be done using Wadell's method, consisting of projecting the grains with suitable objectives using a Camera Lucida. After the grains are projected and the drawings are made, roundness is determined by using the formula:

$$\sigma = \frac{\Sigma r_i / R}{N}$$

Where **σ** = Degree of Roundness

r_i = The average radius of curvature of the corners of the fragment,

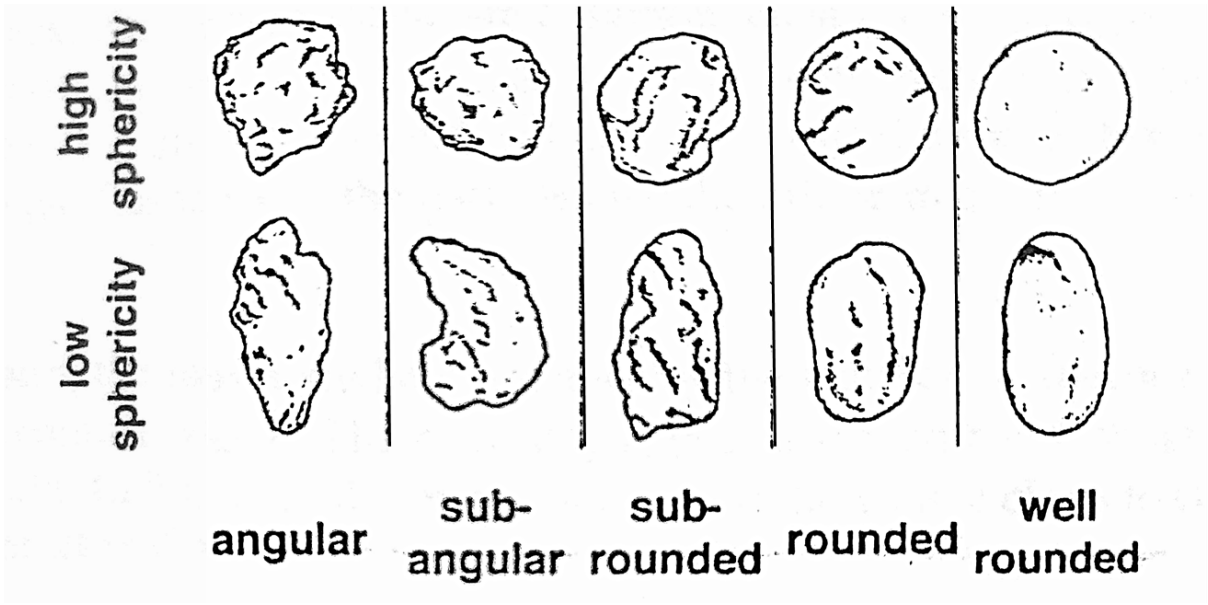
R = Radius of curvature of the maximum inscribed circle,

N = Number of corners

- The value of Roundness obtained is compared with the table given below to determine the degree of roundness of the grain:

	By: Russell and Taylor	
Grade Terms	Class Limits	Midpoint
ANGULAR	0.00 – 0.15	0.075
SUBANGULAR	0.15 – 0.30	0.225
SUBROUNDED	0.30 – 0.50	0.400
ROUNDED	0.50 – 0.70	0.600
WELL ROUNDED	0.70 – 1.00	0.850

- Degree of roundness helps in knowing the distance of transportation
- Angular Clasts - short distance transport from the source
- Rounded Clasts - long distance transport


high sphericity
low sphericity
angular
sub-angular
sub-rounded
rounded
well rounded