Classification of sedimentary rocks

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Grabau in 1904 first attempted to classify the sedimentary rocks into two broad group.

Exogenetic – those derived from the products of weathering and erosion of pre-existing rocks.

Endogenetic- those formed by crystallization from solution

Latter attempts of sedimentary rock classifications were made on the basis of:

a. Textural and mineralogical characters

b. Genetic characters and tectonic control of sedimentation

Classification proposed by Greensmith in 1953 that based on texture and composition group sedimentary rocks into two broad division:

1. Clastic – these rocks are composed of the products of erosion and weathering by mechanical processes. It is further subdivided on the basis of the size of the clast as:

   i. Rudite- it consists of those fragments whose size are greater than 2 mm (Boulder, cobble, pebble) Example: conglomerate

   iii. Arenite- the size of the clast ranges between 0.062 and 2 mm (sands). Example: Sandstone

   v. Lutite- it is composed of the size clast less than 0.062 mm (clay). Example: mudrocks

2. Non-clastic- those rocks formed by chemical and biochemical processes. These are further subdivided on the basis of mineralogical and chemical compositions into:

i. Calcareous- composed of carbonate of Ca, Mg with mineral like calcite, aragonite, dolomite etc. Example limestone, dolomite, magnesite etc.

iii. Carbonaceous- composed of carbonaceous materials. Example coal, lignite etc.

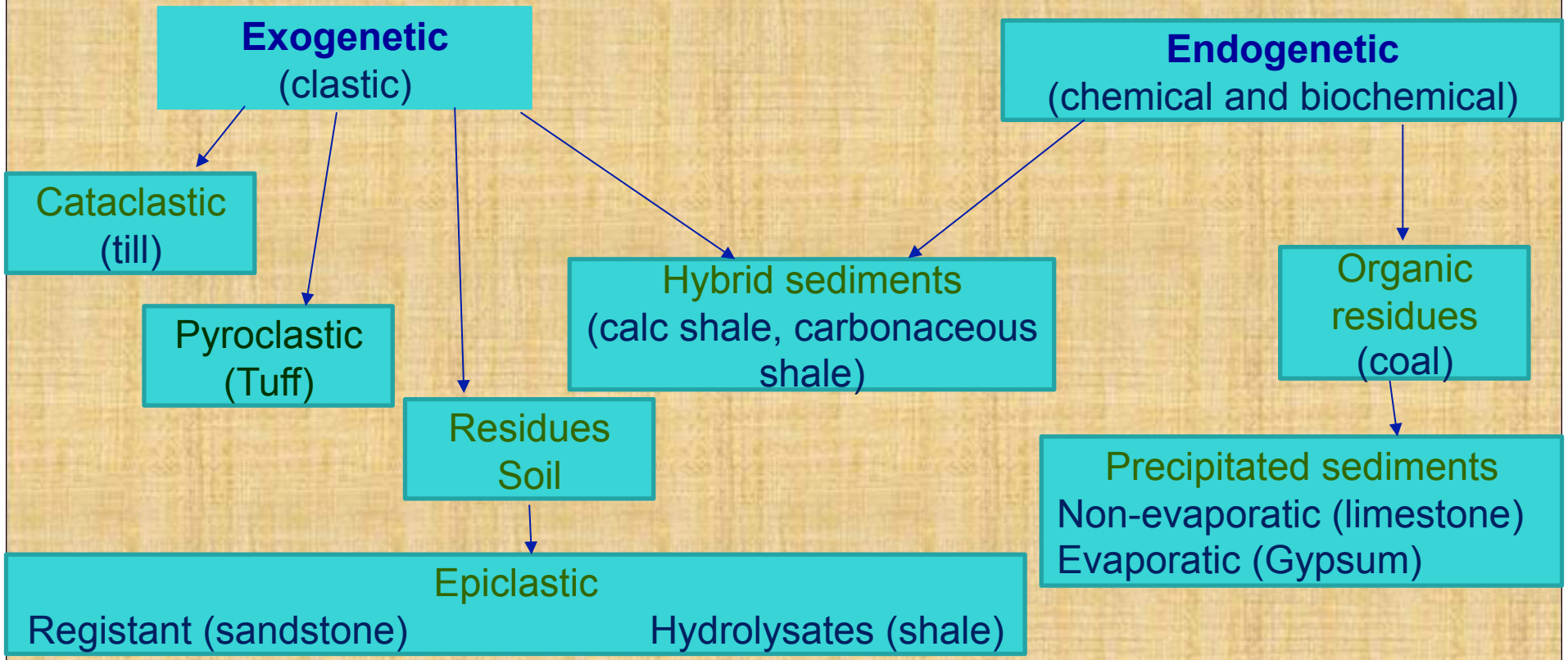
v. Ferruginous- consists of Fe_2O_3, MnO_2 etc. Example: ironstones, limonite etc.

vii. Siliceous- consists of SiO_2 in various forms e.g. chert, opal etc.

ix. Aluminous- formed by Al_2O_3 with some hydrous oxides. Example: Bauxite

xi. Phosphatic- composed of oxides and carbonates of phosphorous. Example: phosphorite

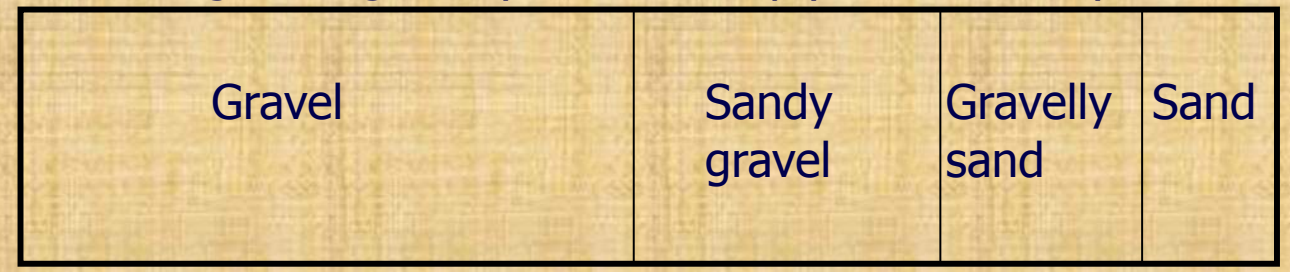
Pettijohn in 1957 proposed the classification based on the mode of formation of sedimentary rocks i.e. the environmental conditions and the tectonic setting of deposition as in the diagram.



Epiclasts belong to mineral fragments and rock fragments released from preexisting rocks by weathering or erosion and transported from their place of origin by water. Hydrolyzates: Sediments characterised by elements that are readily hydrolyzed, concentrate in the fine-grained alteration products of primary rocks, and are thus abundant in clays, shales, and bauxites. Hydrolyzate elements are aluminium and associated silicon, potassium, and sodium.

Conglomerate

Conglomerates are dominanently comprised by gravels as well as sandy gravels. The boundary between gravel, gravelly sand is simply illustrated by the following diagram



Conglomerate consists dominantly of gravel-size (>2 mm) well rounded to sub-angular clasts

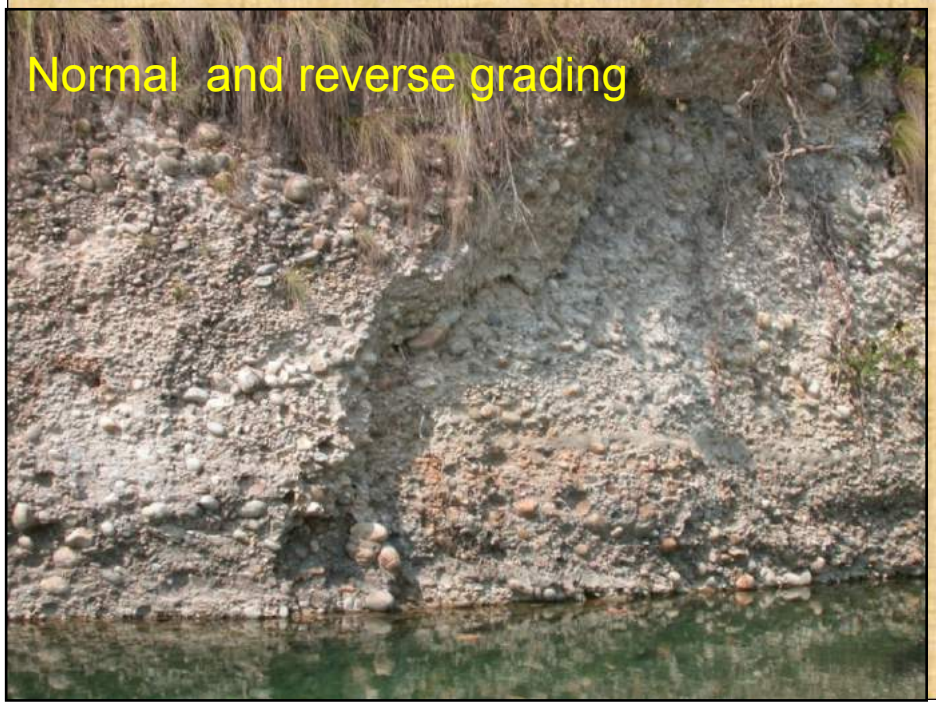
Breccia consists dominantly of gravel-size (>2 mm) angular clasts

Texture

Conglomerates that contain essentially no matrix (voids among pebbles unfilled) are called openwork conglomerates. Conglomerate tends to have two size modes, one in the gravel-size range (the open framework grains) and one in the sand- to mud-size range (the matrix grains). Gravel size particles can become moderately rounded in short distance of stream transport. For example clast in fluvial conglomerate may be well rounded. The form (spericity) of conglomerate clasts tends to be related to the shapes of the initial rock fragments released from the parent rocks. Usually disk shape fragments are composed of schistose or fissile parent rocks while more equant shaped clasts are of more massive parent rocks (quartzite).

Structure:

Many conglomerates are massive. Conglomerate may be non-graded, or may display normal, inverse, or normal-to-inverse size grading as well as imbrications structures. Sometime trough-cross bedding, planar horizontal or inclined stratification are present in conglomerate.



Composition

The framework grains of conglomerates are composed mainly of rock fragments (clasts) rather than individual mineral grains. These clasts may consists of any kind of rock. Some conglomerates are composed entirely of highly durable clasts of quartzite, chert, or vain quartz. Others are composed of a variety of clasts, some of which, limestone and shale clasts, for example, may be unstable or weakly durable. Conglomerates may contains various amount of matrix, which commonly consists of clay- or sand-size particles or a mixture of clay and sand.

Classification of conglomerate

1) Texture:

a) **Orthoconglomerate**- framework of gravel and sand bound together by chemical cement; matrix is less than 15%; pebbles are not supported by matrix; commonly bimodal

b) **Paraconglomerate**- matrix is greater than 15%; pebbles matrix supported; commonly polymodal

2) Composition:

a) **Polymictic**- pebbles of several rock types, one of which may predominate

b) **Oligomictic**- pebbles of few rock types

3) Source:

a) **Extraformational**- pebbles originate from extrabasinal sources

b) **Intraformational**- pebbles originate from within the basin

Table 13.4 Classification of gravelstones: conglomerates, breccias and diamictites. (Modified from Raymond, 2002.)

Gravelstone shape	Matrix support	Gravelstone composition	Rock name
Subrounded to very rounded (conglomerate)	Gravel- or sand-supported framework	Single composition	Oligomictic conglomerate (e.g., quartz conglomerate)
		Multiple compositions	Polymictic conglomerate
Subangular to very angular (breccia)	Gravel- or sand-supported framework	Single composition	Oligomictic breccia (e.g., limestone breccia)
		Multiple compositions	Polymictic breccia
Any shape	Mud-supported framework (diamictite)	Single composition	Oligomictic diamictite
		Multiple compositions	Polymictic diamictite


Oligomictic conglomrrate

(c)


Polymictic conglomrrate

(d)


Oligomictic quartz breccia


Polymictic diamictite