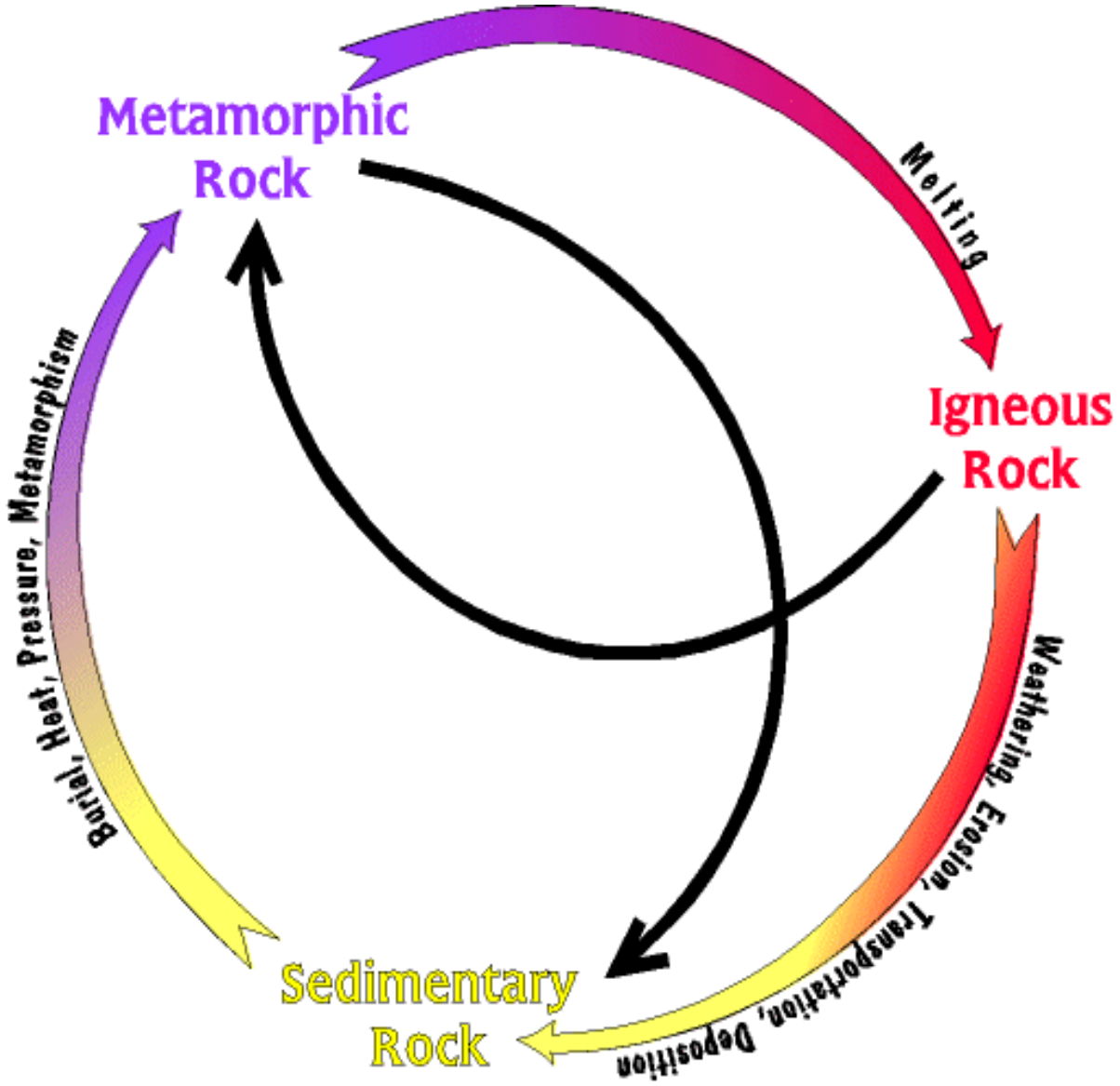
# Sedimentary Rocks



**Objectives:**

1. Explain the formation of sedimentary rocks in terms of the rock cycle.

2. Identify various environments of deposition of sediments.

3. Identify textural characteristics of sediments

4. Contrast the basic groups of sedimentary rocks.

**Sediment** = loose particulate material (clay, sand, gravel, etc.)

Sediment becomes sedimentary rock through **lithification**, which involves:

- Compaction
- Cementation
- Recrystallization (of carbonate sediment)

## Types of sedimentary rocks

### 1. Terrigenous (also called detrital or clastic)

- Conglomerate or Breccia
- Sandstone
- Siltstone
- Shale

### 2. Chemical/biochemical Sedimentary Rocks

- Evaporites
- Carbonates (limestones and dolostones)
- Siliceous sed. rocks

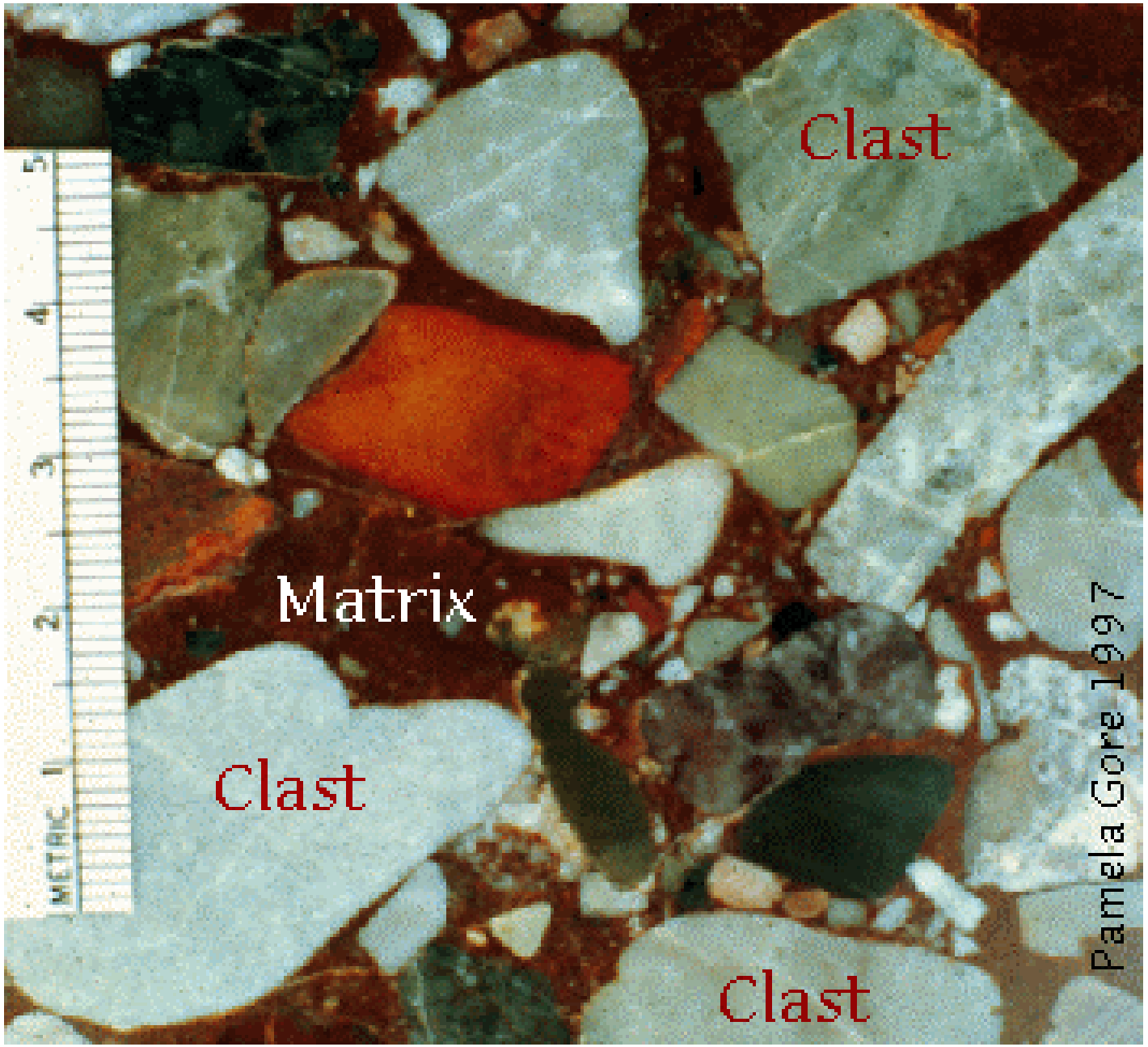
### 3. Organic

# A. Terrigenous (also called detrital or clastic)

Terrigenous sedimentary rocks are derived from the weathering of pre-existing rocks, whch have been *transported to the depositional basin*.

They have a **clastic** (broken or fragmental) texture consisting of:

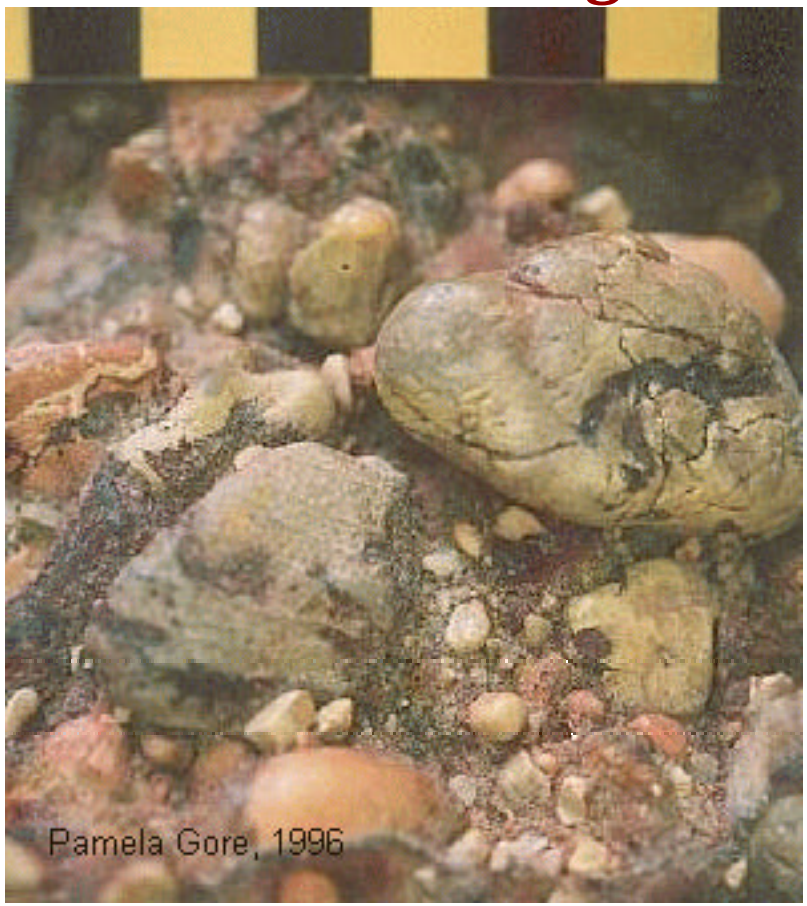
- **Clasts** (larger pieces, such as sand or gravel)
- **Matrix** (mud or fine-grained sediment surrounding the clasts)
- **Cement** (the glue that holds it all together), such as:
  - calcite
  - iron oxide
  - silica


Clast
Matrix
Clast
Clast
Pamela Gore 1997

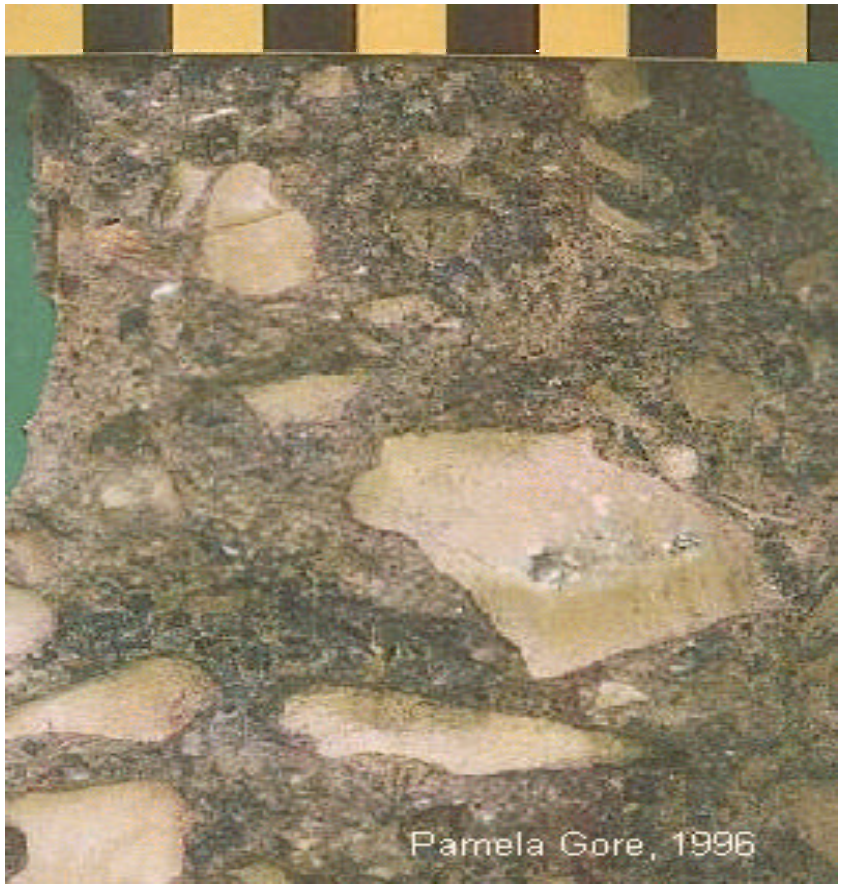
**Terrigenous sedimentary rocks are classified according to their :**

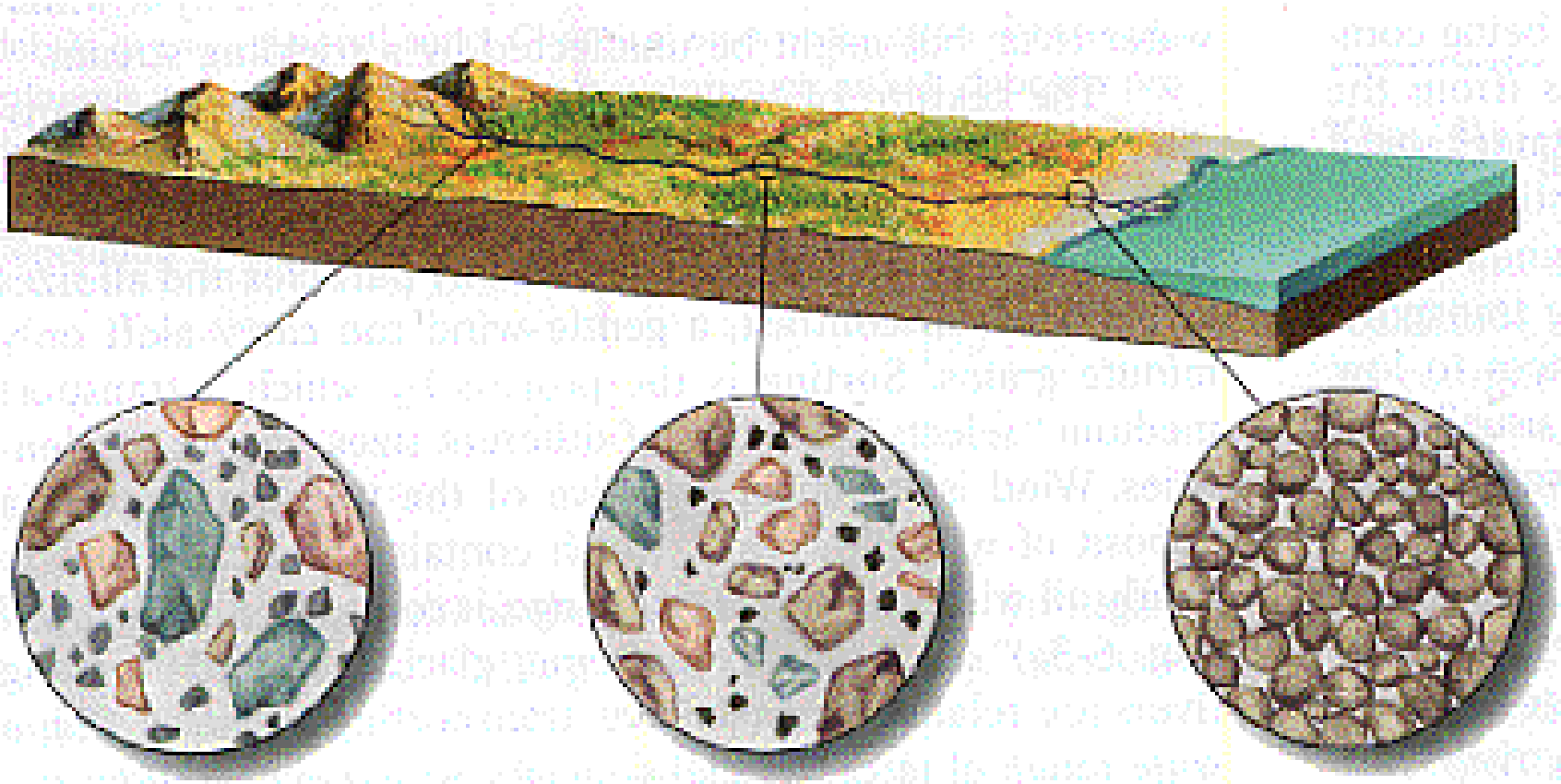
- **Texture/grain size**
- **Gravel:** Grain size greater than 2 mm

If rounded clasts = **conglomerate**




If angular clasts = **breccia**





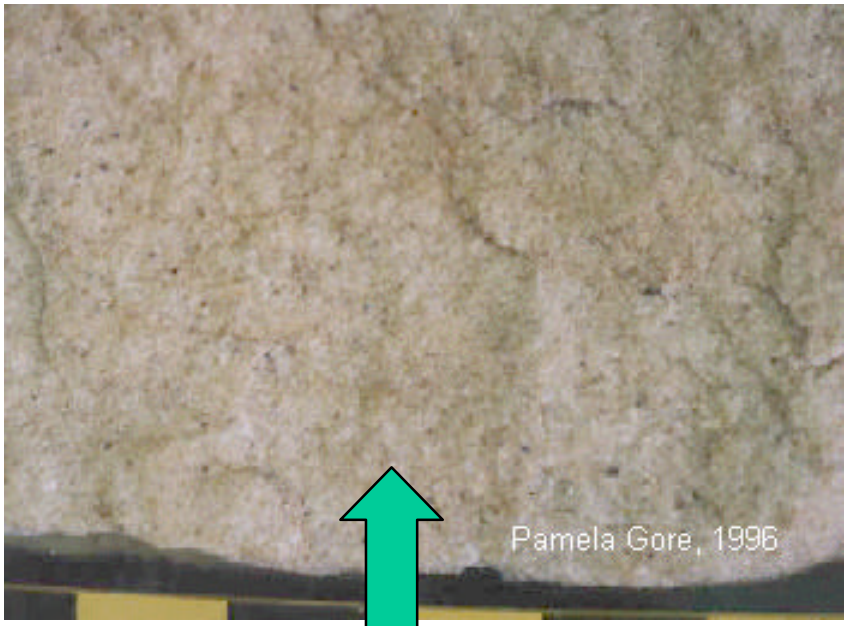
Particles are large and irregular, and consist of a variety of lithologies, including the least resistant.

Particles are mid-sized and of intermediate sphericity, and include resistant and nonresistant lithologies.

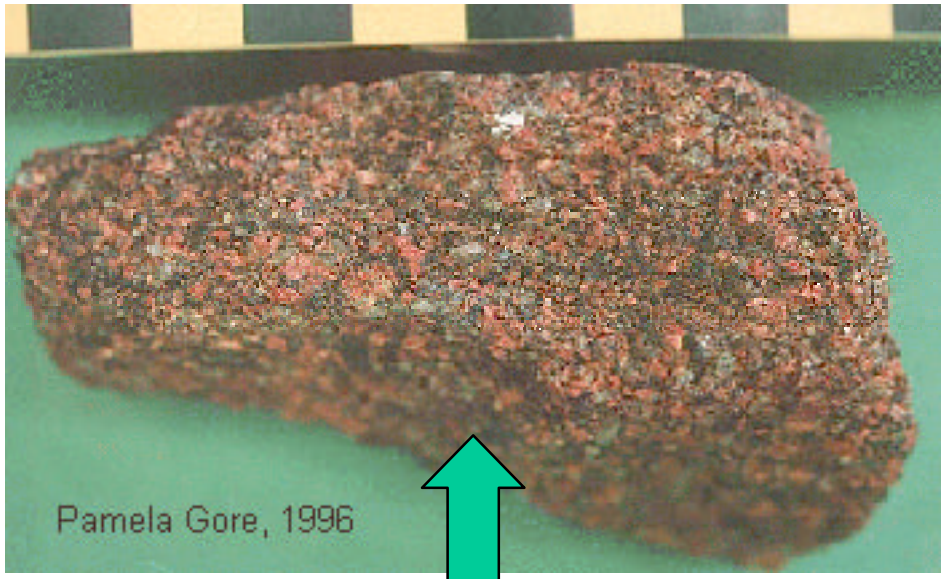
Particles are small and nearly spherical, and consist mainly of the most resistant lithologies, such as quartz.

**Sand**: Grain size 1/16 to 2 mm

- Sandstone
- If dominated by quartz grains = **quartz sandstone** (also called **quartz arenite**)
- If dominated by feldspar grains = **arkose**
- If dominated by sand-sized rock fragment grains = **lithic sandstone**

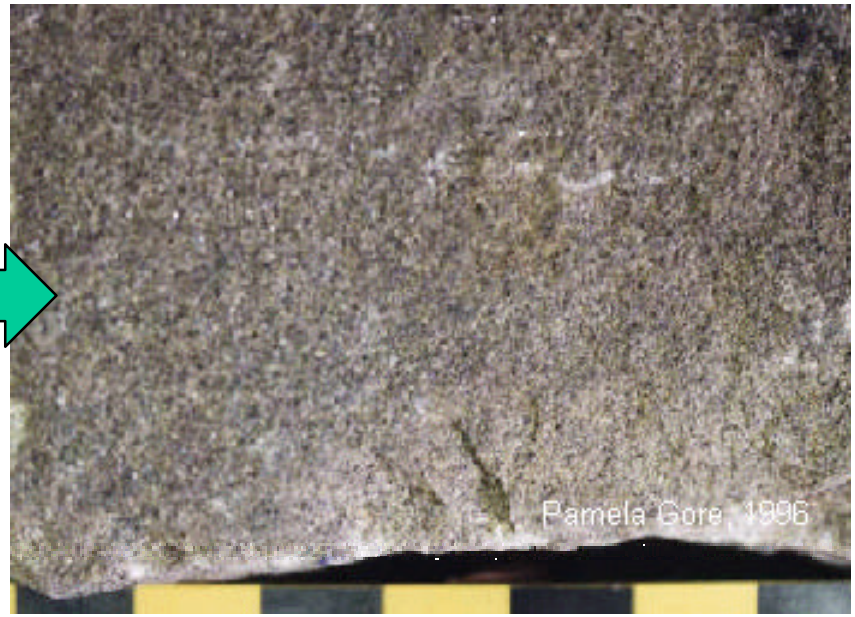



**quartz sandstone**




**arkose sandstone**

**lithic sandstone**



**Clay**: Grain size less than 1/256 mm (smooth)

**Shale** (if fissile)


**Claystone** (if massive)

## B. Chemical/biochemical Sedimentary Rocks

This group includes:

- **evaporites**
- **carbonates** (limestones and dolostone)
- **siliceous rocks.**

**1.Evaporites -** The evaporites form from the evaporation of water (usually seawater).

- **Rock salt -** composed of halite (NaCl).


*Bonneville Salt Flats of the Great Salt Lake, Utah. The lake bed is covered with rock salt which gives it the white color. The salt is mined by the Morton Salt Company.*

**2. Carbonates -** The carbonate sedimentary rocks are formed through both chemical and biochemical processes. They include the **limestones** (many types) and **dolostones**.

Two minerals are dominant in carbonate rocks:

1. **Calcite** ($CaCO_3$)
2. **Dolomite** ($CaMg(CO_3)_2$)

**Carbonate rock names:**

**Fossiliferous limestone** (look for various types of fossils in a limestone matrix)

**Coquina** (fossil hash cemented together; may resemble granola)

**Chalk** (made of microscopic planktonic organisms such as coccolithophores; fizzes readily in acid)

**Siliceous rocks**

•dominated by silica ($SiO_2$)

•commonly form from silica-secreting organisms such as diatoms, radiolarians, or some types of sponges.

- **Chert** – Massive, microcrystalline quartz. May be dark or light in color. Often replaces limestone. Does not fizz in acid.

## Organic Sedimentary Rocks (Coals)

- composed of organic matter (mainly *plant fragments*).

In order of increasing depth of burial (temperature and pressure):

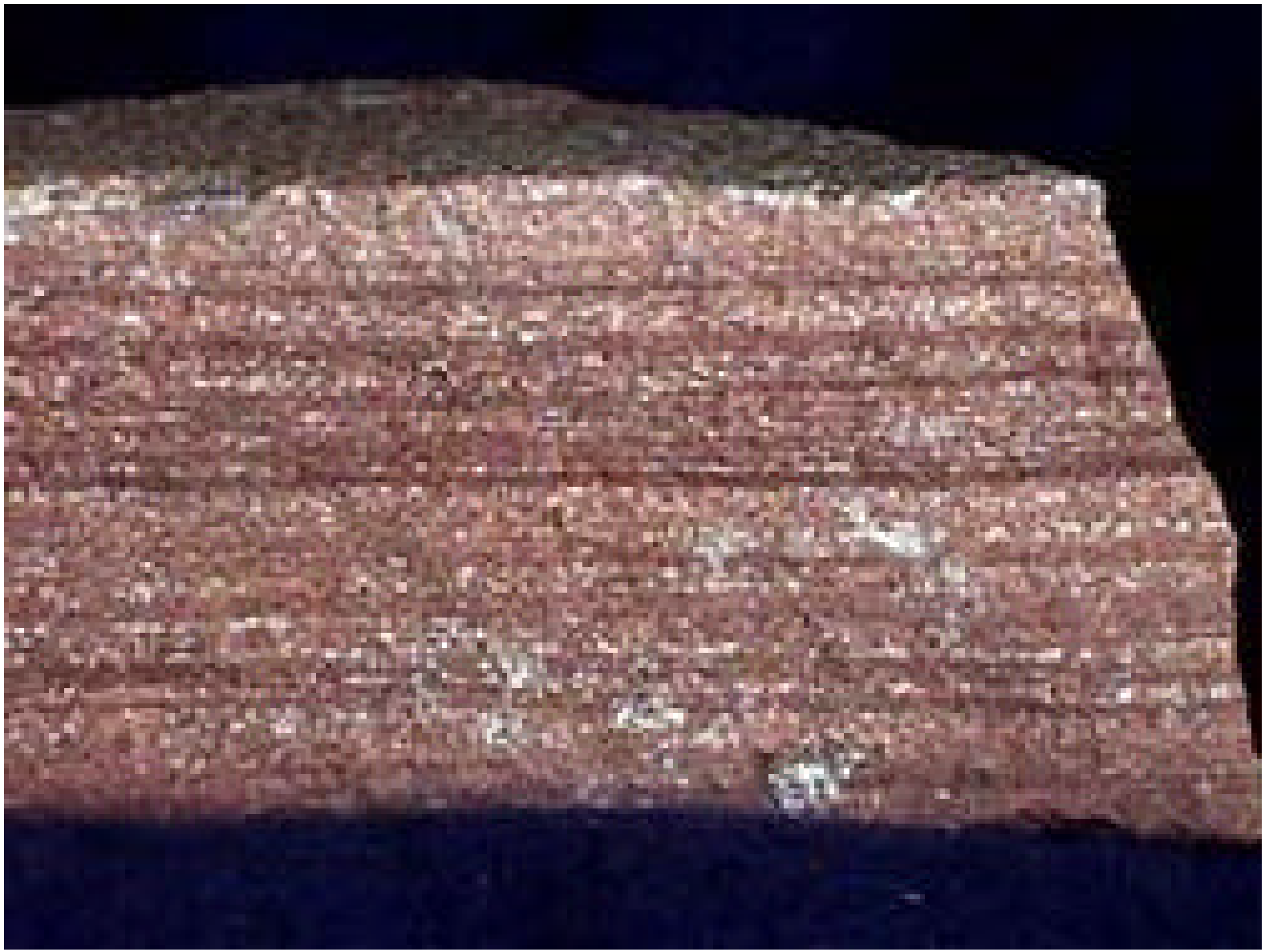
- **Peat** (porous mass of brownish plant fragments resembling peat moss)
- **Lignite** (crumbly and black)
- **Bituminous coal** (dull to shiny and black; layers may be visible)

## Sedimentary Structures

Sedimentary structures form in the basin of deposition, as a result of the action of natural processes such as waves, currents, drying events, etc.

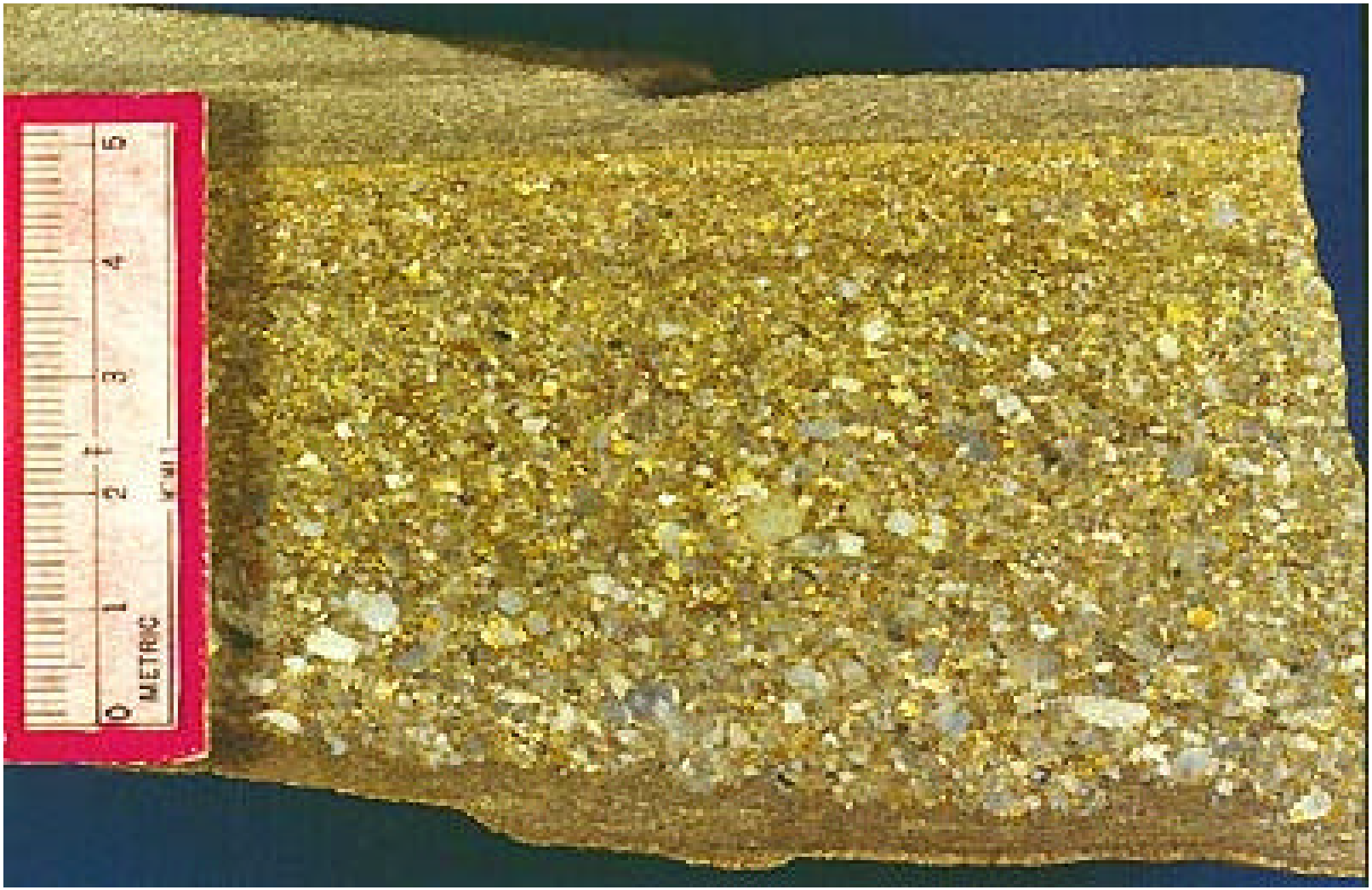
- Beds or strata
- Cross-bedding
- Graded beds
- Ripple marks
  - Current ripple marks (asymmetrical ripples)
  - Oscillation or wave ripple marks (symmetrical ripples)
- Mud cracks

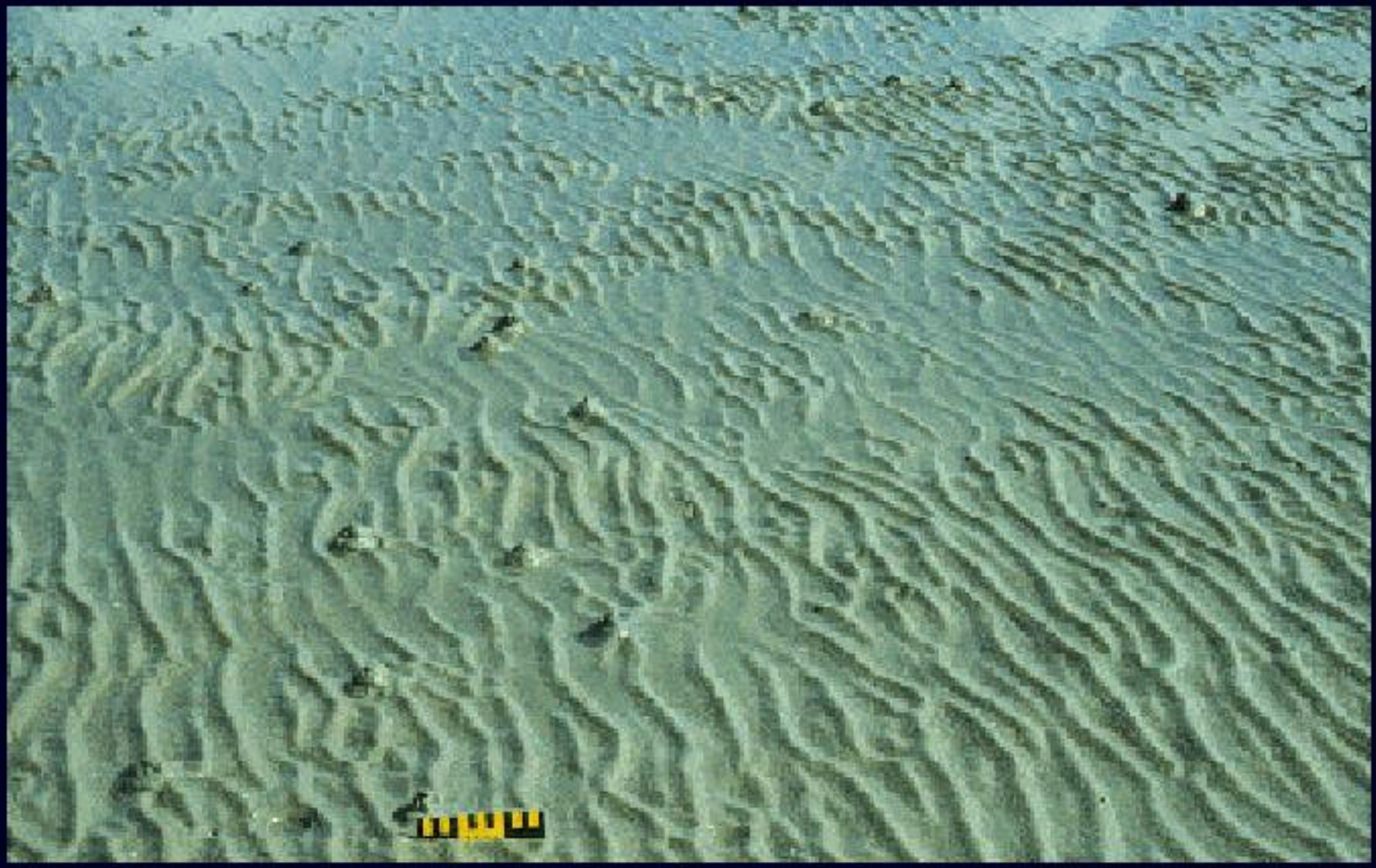
# Beds or strata



# Cross-bedding

# Graded bedding





Modern ripple marks forming on a sandy beach

(Beaufort Island, NC)


100 million-year-old ripple marks in sandstone

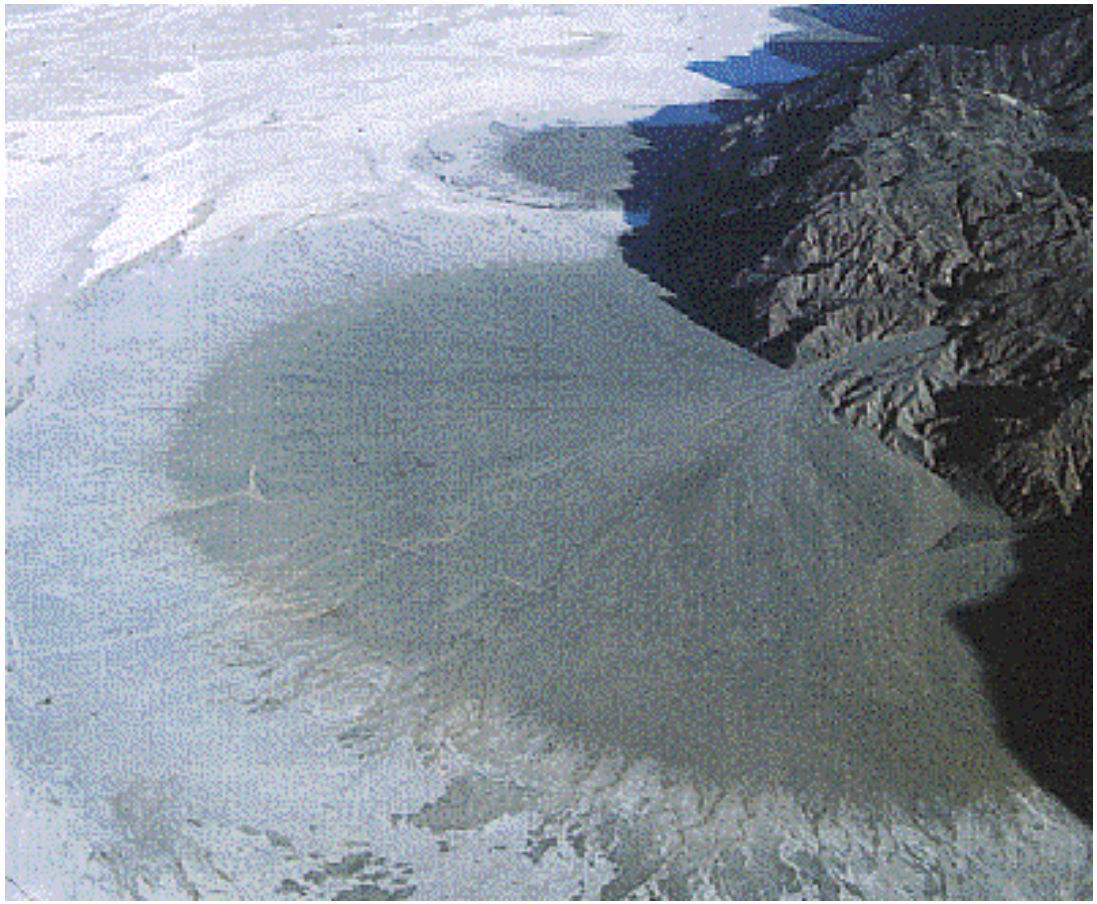
(San Juan Basin, NM)

# Mud cracks

**Sedimentary Environments:**

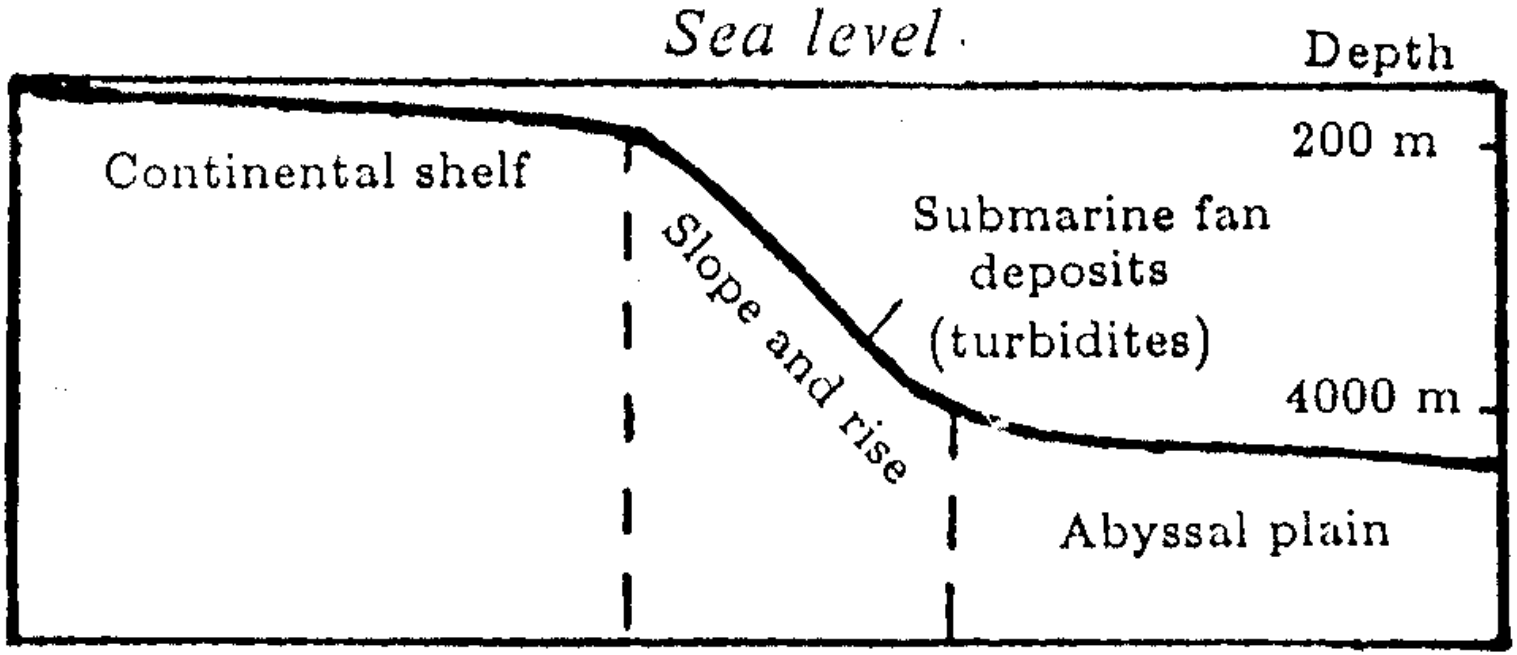
places where sediments accumulate and sedimentary rocks formed. They can be grouped into:

- **Terrestrial environments** (non-marine)
  - Rivers (fluvial environment)
  - Alluvial fans



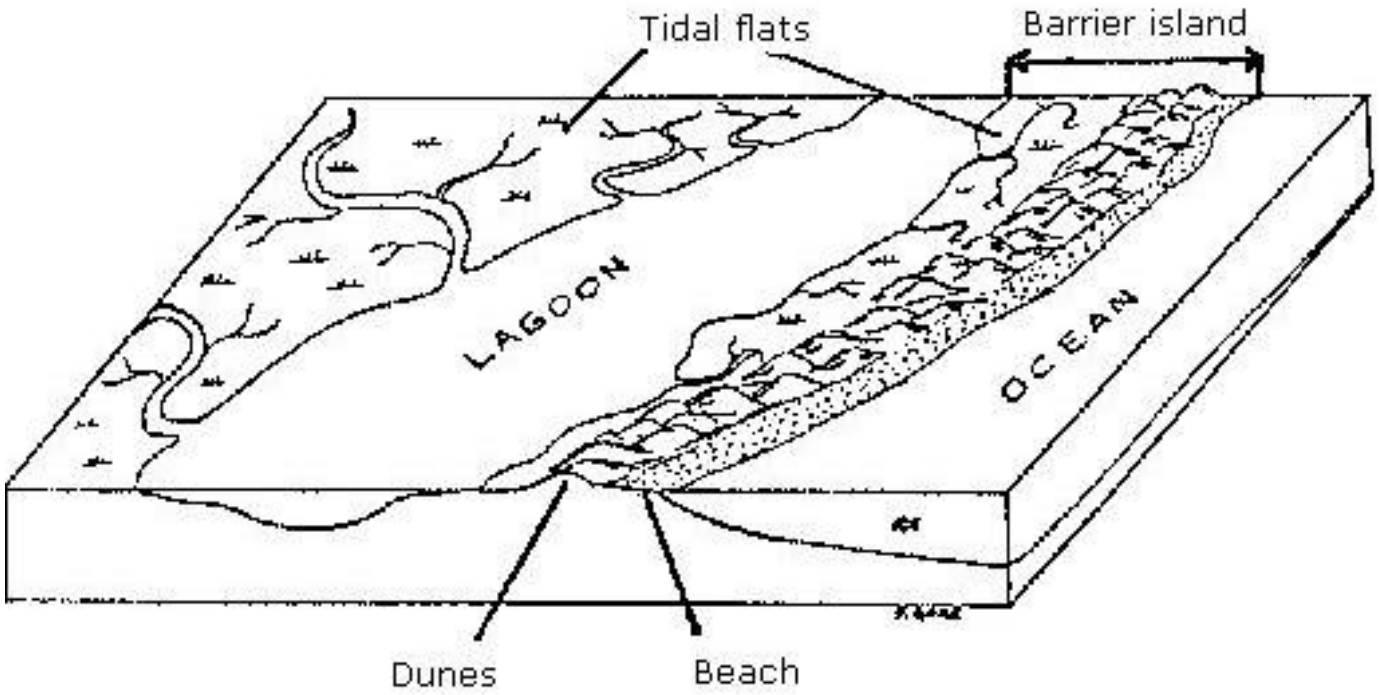
- Lakes (lacustrine)
- Swamps
- Deserts (aeolian)
- Glacial environments

- **Marine environments**
  - Continental shelf
  - Continental slope and rise (deep sea fans)
  - Abyssal plain
  - Reefs

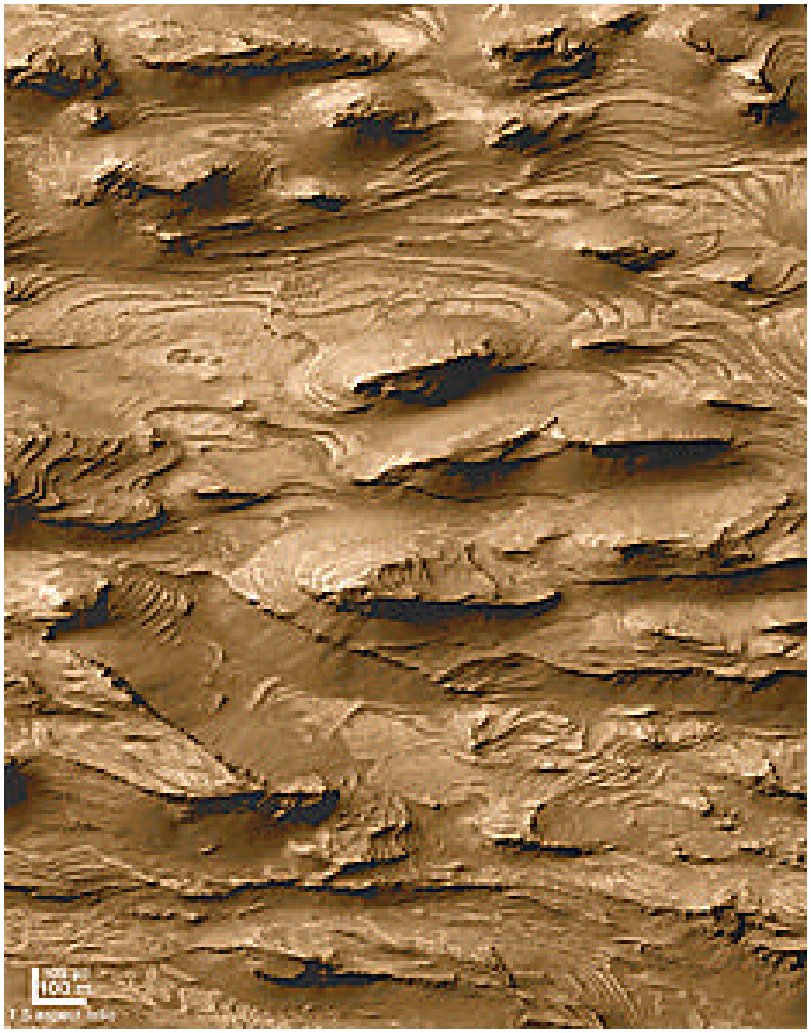


•**Transitional environments** (at the transition between the marine and non-marine environments)

- •Beach and barrier islands
- •Delta
- •Lagoons
- •Estuaries



# Sedimentary Mars



**New Mars Global Surveyor images reveal sedimentary rock layers on the Red Planet that may have formed underwater**

http://science.nasa.gov/headlines/y2000/ast04dec_2.htm

# Fossils

## Thomas Farm