

## ANSWER KEY

### GOL 106 – Sedimentary Rock Identification & Interpretation Worksheet

Classify the set of sedimentary rocks by describing the composition, texture and any other notable properties. Next, interpret possible depositional environments based on your observations.

#### COMPOSITION

##### **Detrital/Clastic**

- Contains gravel
- Primarily sand (visible grains)
- Silt (barely visible)
- Clay (too fine to see)

##### **Biochemical**

- Carbon/charcoal
- Calcareous (fizzes with dilute HCl)
- Shells/shell fragments
- Corals/coral fragments
- Calcareous fossils/microfossils

##### **Chemical**

- Oolitic
- Crystalline/microcrystalline

#### TEXTURES & OTHER PROPERTIES

- Angular grains (often of similar composition)
- Rounded grains (often of different composition)
- Poorly sorted
- Moderately sorted
- Well sorted
- Mostly quartz
- Mostly feldspar
- Mix of sand grains w/ silt & mud
- Gritty
- Smooth
- Blocky
- Fissile (breaks into thin sheets)
- Black (dark) color
- Red (rust) color

- Visible shells or other fossils (whole and/or fragments)
- Loosely cemented shell fragments
- Chalky (gets all over your hands)
- Fizzes with dilute HCl
- Black and sooty
- Black and shiny (bright)
- Brittle

- Ooids/Oolites (spherical calcite grains)
- Banded appearance/layering
- Pores or cavities
- Fizzes with dilute HCl
- Fizzes with dilute HCl only if powdered
- Conchoidal fracture
- Dark yellow to dark rusty-red chemical residue (streak)
- Salty taste
- Hard ( $H > 5.5$ )
- Soft ( $H \leq 5.5$ )

#### ROCK CLASSIFICATION

- Conglomerate
- Breccia
- Quartz sandstone
- Arkose
- Greywacke
- Siltstone
- Claystone
- Silt shale
- Clay shale

- Bituminous coal
- Calcareous (Fossiliferous limestone)
- Chalk
- Coquina
- Micrite (Chemical limestone)

- Oolitic limestone
- Travertine
- Micrite (Chemical limestone)
- Chert (white):
  - o Jasper (red)
  - o Flint (black)
  - o Agate (banded)
  - o Petrified wood (multicolored)
- Ironstone (hematite or limonite)
- Rock salt (halite)
- Rock gypsum

#### SEDIMENTARY STRUCTURES

- Raindrop impressions
- Horizontal strata
- Graded bedding

- Ripple marks (current/oscillation)
- Cross-bedding
- Mudcracks

- Flutes/flute casts
- Plant root/animal burrows
- Animal tracks/trails

#### SEDIMENTARY ENVIRONMENTS

##### **Terrestrial**

- Rift Valley/Alluvial fan (tectonically active regions)
- Rivers/Streams (fluvial)
- Lakes (lacustrine)
- Swamps/Marshes (paludal)
- Desert/Dunes (aeolian)

##### **Transitional**

- Delta
- Beach/Barrier Island
- Lagoon
- Tidal Flat

##### **Marine**

- Reefs
- Carbonate Bank/Platform
- Nearshore/Continental Shelf
- Deep Sea

1.) These three samples look slightly different based on color and composition, but they are all classified as the same type of sedimentary rock.

|   |   |  |
|---|---|--|
| Composition:  | Clastic<br>Contains gravel                                    |  |
| Texture & Other Properties:   | Rounded grains<br>Poorly sorted                               |  |
| Rock Classification:  | Conglomerate  |  |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Rivers (fluvial)<br>Rift valleys |  |
| Were these rocks deposited in a turbulent, high-energy environment or a quiet, low-energy environment?                    | Turbulent<br>High-energy                                      |  |
| Were the clasts in these rocks deposited close to their source area or were they transported away from their source area? | Transported   |  |
| Are these rocks texturally mature or immature?  | Immature  |  |

2.)

|   |  |  |
|---|--|--|
| Composition:  | Biochemical<br>Carbon/charcoal                 |  |
| Texture & Other Properties:   | Black, shiny, sooty, brittle, light            |  |
| Rock Classification:  | Bituminous coal                                |  |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Swamps (paludial) |  |
| Were these rocks deposited in a turbulent, high-energy environment or a quiet, low-energy environment?  | Quiet<br>Low-energy                            |  |
| Was this rock deposited in an oxygen-rich (oxic) or oxygen-poor (anoxic) environment?                   | Oxygen-poor (anoxic)                           |  |
| What are the two, soft sedimentary rocks that are precursors to the formation of this sedimentary rock? | Peat<br>Lignite                                |  |

|   |  |
|---|--|
| 3.) Sample A  |  |
| Composition:  | Clastic<br>Primarily sand                                    |
| Texture & Other Properties:   | Well-sorted<br>Mostly quartz                                 |
| Rock Classification:  | Quartz sandstone   |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Beach<br>Desert/dunes (aeolian) |
| Sample B  |  |
| Composition:  | Clastic<br>Primarily sand                                    |
| Texture & Other Properties:   | Well-sorted<br>Mostly quartz                                 |
| Rock Classification:  | Quartz sandstone   |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Beach<br>Desert/dunes (aeolian) |
| Sample C  |  |
| Composition:  | Clastic<br>Primarily sand                                    |
| Texture & Other Properties:   | Well-sorted<br>Mostly quartz                                 |
| Rock Classification:  | Quartz sandstone   |
| Sedimentary Structures (if any):<br>Horizontal strata   | Sedimentary Environments:<br>Beach<br>Desert/dunes (aeolian) |
| Were the clasts in these rocks deposited close to their source area or were they transported away from their source area? | Transported  |
| Are these rocks texturally mature or immature?  | Mature   |
| Which sample(s) most likely formed in an arid desert environment?   | Sample C   |

| 4.)   |   |
|---|---|
| Composition:  | Biochemical<br>Shells/shell fragments                                     |
| Texture & Other Properties:   | Visible shell fragments<br>Loosely cemented<br>Fizzes on contact with HCl |
| Rock Classification:  | Coquina   |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Reef<br>Carbonate bank                       |
| Was this rock deposited in a turbulent, high-energy environment or a quiet, low-energy environment?                   | Turbulent<br>High-energy  |
| Were the clasts in this rock deposited within their source area or were they transported away from their source area? | Within their source area  |
| Is this rock texturally mature or immature?   | Immature  |

| 5.)   |   |
|---|---|
| Composition:  | Clastic<br>Clay (too fine to see)             |
| Texture & Other Properties:   | Smooth, black color, fissile, fossil (fern)   |
| Rock Classification:  | Clayshale                                     |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Swamp (paludial) |
| Was this rock deposited in a turbulent, high-energy environment or a quiet, low-energy environment? | Quiet<br>Low-energy                           |
| Was this rock deposited in an oxygen-rich (oxic) or oxygen-poor (anoxic) environment?               | Oxygen-poor (anoxic)                          |

6.) Both of these samples have some subtle differences but are classified as the same type of sedimentary rock.  
Sample A

|                                  |   |
|----------------------------------|---|
| Composition:                     | Clastic<br>Primarily sand                                   |
| Texture & Other Properties:      | Poorly to moderately sorted<br>Mostly feldspar              |
| Rock Classification:             | Arkose  |
| Sedimentary Structures (if any): | Sedimentary Environments:<br>Rift valley<br>River (fluvial) |

Sample B

|                                  |   |
|----------------------------------|---|
| Composition:                     | Clastic<br>Primarily sand                                   |
| Texture & Other Properties:      | Moderately sorted<br>Mostly feldspar                        |
| Rock Classification:             | Arkose  |
| Sedimentary Structures (if any): | Sedimentary Environments:<br>Rift valley<br>River (fluvial) |

Which is the more poorly sorted sample (A or B)? A

Which rock is more texturally mature (A or B)? B

What mineral is responsible for giving this rock its pink, salmon color? Potassium feldspar (K-spar, orthoclase)

7.) Both of these samples have different compositions and textures, but are broadly classified as the same type of sedimentary rock.

|   |   |  |
|---|---|--|
| Composition:  | Biochemical<br>Fossils                              |  |
| Texture & Other Properties:   | Visible fossils<br>Fizzes on contact with HCl       |  |
| Rock Classification:  | Fossiliferous limestone                             |  |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Reef<br>Carbonate bank |  |
| Which sample was most likely deposited in a quiet, low-energy environment?  | Sample A  |  |
| What common rock forming mineral is present in these rocks that also functions as a cementing agent?                            | Calcite   |  |
| Classify both of these samples using <a href="#">Folks Classification system</a> (may be required in some sections of GOL 106). | A: Biomicrite<br>B: Biosparite                      |  |

8.)

|   |  |  |
|---|--|--|
| Composition:  | Clastic<br>Silt (barely visible)   |  |
| Texture & Other Properties:   | Well-sorted, gritty, fissile, red color  |  |
| Rock Classification:  | siltshale  |  |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Rivers (fluvial) - floodplain<br>Lakes (lacustrine) |  |
| Was this rock deposited in a turbulent, high-energy environment or a quiet, low-energy environment? | Quiet<br>Low-energy  |  |
| Was this rock deposited in an oxygen-rich (oxic) or oxygen-poor (anoxic) environment?               | Oxygen-rich (oxic)   |  |

|   |   |
|---|---|
| 9.)   |   |
| Composition:  | Clastic<br>Contains gravel                                |
| Texture & Other Properties:   | Angular grains<br>Poorly sorted                           |
| Rock Classification:  | Breccia   |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Rift valley<br>Alluvial sand |
| Were the clasts in this rock deposited close to their source area or were they transported away from their source area? | Deposited close to source area                            |
| Is this rock texturally mature or immature?   | Immature  |

|   |   |
|---|---|
| 10.)  |   |
| Composition:  | Biochemical   |
| Texture & Other Properties:   | Chalky<br>Fizzes on contact with HCl  |
| Rock Classification:  | Chalk   |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Deep sea   |
| Was this rock deposited in a turbulent, high-energy environment or a quiet, low-energy environment? | Quiet<br>Low-energy   |
| What is the primary component that composes this soft, porous rock?                                 | Microscopic organisms - microfossils<br>Foraminifera, calcareous plankton, coccolithophores |

11.) Both of these samples have some subtle differences but are classified as the same type of sedimentary rock.

|   |  |                                       |
|---|--|---------------------------------------|
| Composition:  | Clastic<br>Primarily sand  |                                       |
| Texture & Other Properties:   | Poorly sorted<br>Mix of sand grains w/ silt and mud                        |                                       |
| Rock Classification:  | Graywacke  |                                       |
| Sedimentary Structures (if any):  |  | Sedimentary Environments:<br>Deep sea |
| Are these rocks texturally mature or immature?  | Immature   |                                       |
| What dense, sediment-choked torrents are frequently associated with the deposition of this type of rock?  | Turbidity currents   |                                       |
| If these samples were collected from a single graded bed deposit, which samples would represent the upper and lower sedimentary deposits of the sequence? | <b>Upper Deposit:</b><br>Sample B<br><br><b>Lower Deposit:</b><br>Sample A |                                       |

12.) Sample A

|                                  |                              |   |
|----------------------------------|------------------------------|---|
| Composition:                     | Chemical<br>Crystalline      |   |
| Texture & Other Properties:      | Fizzes on contact with HCl   |   |
| Rock Classification:             | Micrite (chemical limestone) |   |
| Sedimentary Structures (if any): |                              | Sedimentary Environments:<br>Carbonate bank<br>Lagoon |



| 12.) Sample B  |  |
|--|--|
| Composition:   | Chemical<br>Oolitic  |
| Texture & Other Properties:  | Ooids<br>Fizzes on contact with HCl  |
| Rock Classification:   | Oolitic limestone  |
| Sedimentary Structures (if any):   | Sedimentary Environments:<br>Carbonate bank  |
| Sample C   |  |
| Composition:   | Chemical<br>Microcrystalline   |
| Texture & Other Properties:  | Banded appearance<br>Fizzes on contact with HCl  |
| Rock Classification:   | Travertine   |
| Sedimentary Structures (if any):   | Sedimentary Environments:<br>Hydrothermal environments (hot springs, geysers)<br>Karst environments (natural springs, caves) |
| What common rock forming mineral is present in these rocks that also functions as a cementing agent?       | Calcite  |
| Which sample would most likely be found in a sedimentary deposit which contained oscillatory ripple marks? | Sample B (oolitic limestone)   |
| Which sample was most likely a freshwater deposit?   | Sample C   |

| 13.)   |  |
|--|--|
| Composition:   | Chemical<br>Microcrystalline                           |
| Texture & Other Properties:  | Conchoidal fracture<br>Hard (H > 5.5)                  |
| Rock Classification:   | Sample A: Chert<br>Sample B: Jasper<br>Sample C: Flint |
| Sedimentary Structures (if any):   | Sedimentary Environments:<br>Deep sea                  |
| What specific marine dwelling organisms may be responsible for the origin of this rock?  | Siliceous phytoplankton (diatoms, radiolaria)          |
| These samples are a microcrystalline variety of what mineral?  | Quartz   |
| Which sample most likely owes its color to organic materials and low-oxygen (anoxic) conditions? Which sample most likely owes its color to the presence of iron oxides? | Anoxic: Sample C<br>Iron Oxide: Sample B               |

| 14.)  |   |
|---|---|
| Composition:  | Chemical  |
| Texture & Other Properties:   | Rust-red color and streak<br>Soft, earthy                         |
| Rock Classification:  | Ironstone   |
| Sedimentary Structures (if any):  | Sedimentary Environments:<br>Various: desert, lakes, rivers, etc. |
| Name this sedimentary mineral (You may find it helpful to reference <i>Laboratory Manual in Physical Geology 9th edition</i> by Richard Busch & Dennis Tasa, pg 127-139). | Hematite  |
| Did this sedimentary deposit form in an oxygen-rich (oxic) or oxygen-poor (anoxic) environment?   | Oxygen-rich (oxic)  |

15.) Sample A

|                                  |   |
|----------------------------------|---|
| Composition:                     | Chemical<br>Oolitic                         |
| Texture & Other Properties:      | Ooids<br>Fizzes on contact with HCl         |
| Rock Classification:             | Oolitic limestone                           |
| Sedimentary Structures (if any): | Sedimentary Environments:<br>Carbonate bank |

Sample B

|                                  |  |
|----------------------------------|--|
| Composition:                     | Biochemical<br>Coral fragments                         |
| Texture & Other Properties:      | Visible fossil fragments<br>Fizzes on contact with HCl |
| Rock Classification:             | Fossiliferous limestone (calcarenite)                  |
| Sedimentary Structures (if any): | Sedimentary Environments:<br>Reef<br>Carbonate bank    |

Classify both of these samples using [Folks Classification system](#) (may be required in some sections of GOL 106).

A: Oomicrite

B: Biosparite