GY 402: Sedimentary Petrology

Lecture 11:
Mature Siliciclastic Environments

Instructor: Dr. Douglas W. Haywick
Last Time

1. Recap major types of sediment & sedimentary rock
2. Recap important grain parameters
3. Cement versus matrix
4. Mature sediment/sedimentary rocks
Major Sedimentary Rock Types

- Siliciclastic
- Volcaniclastic
- Carbonates (evaporites/chemical, non-skeletal, skeletal)
Siliciclastic Sedimentary Rocks

“Mature” rocks
(mineralogically stable)
Enriched in quartz and clay minerals

Important Parameters

Grain rounding

[Diagram showing the transition from angular to well-rounded grains with increasing transport distance]

Immature → Increasing transport distance → Mature
Grain sorting

Important Parameters

Low energy

increasing energy of deposition

High energy
Important Parameters

Grain size

Coarse \rightarrow 1.0 \text{ mm} \rightarrow \text{Fine} \rightarrow \text{Very Fine}

High energy \rightarrow \text{Decreasing energy of deposition} \rightarrow \text{Low energy}
Mature Siliciclastic Petrography

- Quartz-rich (quartz arenites)
- Generally well rounded grains
- Poorly sorted to well sorted
- Gravel to clay sized grains

Image: Grains of varying sizes and colors, labeled with a scale of 250 μm.
Matrix versus Cement

**Matrix:** fine-grained* material *deposited simultaneously with larger particles*. Generally appears as darker-coloured detritus between grains

**Cement:** a chemical precipitate between grains formed from pore-water *long after deposition*. 
# Matrix versus Cement

<table>
<thead>
<tr>
<th><strong>Matrix</strong></th>
<th><strong>Cement</strong></th>
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</thead>
<tbody>
<tr>
<td>Heterogeneous</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>Chemically impure</td>
<td>Chemically pure</td>
</tr>
<tr>
<td>Drapes over grains*</td>
<td>Lines pores*</td>
</tr>
<tr>
<td>Predates cements</td>
<td>Specific fabrics</td>
</tr>
<tr>
<td>Generally dark in color*</td>
<td>Multiphased</td>
</tr>
<tr>
<td></td>
<td>Zoned</td>
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</tbody>
</table>

* Can be confusing
Hand specimens

Mature siliciclastic sandstones
(quartz arenite)

Liesengang banding, clay and iron oxide cement

Quartz and chalcedony cement

Limonite cement
Thin-section Photomicrographs

Quartz (overgrowth) cement

Quartz overgrowth cement

125 μm
Today’s Agenda

1. Factors promoting beach development
2. Beach profiles
3. Beach facies & sedimentary sections
Factors controlling beach development
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- Steady supply of sand to the shoreline, by river, delta or longshore drift
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32,000 km of shoreline meet these requirements; best studied beaches are along the US eastern and Gulf coasts
Wave action

Wave action

Overall beach dynamics

Longshore drift

Overall beach dynamics

Hydrodynamic zones

Sedimentary Facies

Beach Facies

Facies distribution on beaches is a ballet between shoreline advance (progradation) and retreat.

**Beach change = construction-destruction**
Beach Facies

Galveston Island; a prograding beach

Beach Facies & Structures

Beach Facies

Sea level as a control on beach development

Upcoming Stuff

Homework
1) Read the online paper for Thursday’s activity
2) Midterm exam linked to paper due Thursday Feb 14th
3) Work on your group grain size project due Thursday March 2nd

This Week’s Lab
Mature sedimentary rocks (Lab 4) (Due Thursday; 5:00 PM)

Online Lecture: nothing this week

Thursday Activity:
Activity 4, Critical review reading exercise discussion
GY 402: Sedimentary Petrology

Lecture 11: Beaches (Nearshore Environments)

Instructor: Dr. Doug Haywick
dhaywick@southalabama.edu

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