Core Description – introduction to laboratory exercise #1

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Michi Strasser
ETH Zurich
CORE ON DECK!


http://www.youtube.com/watch?feature=player_embedded&v=wC9IDPvvze0
Visual core descriptions

- **Macroscopic** and **smear slide description** of each core recorded manually on visual core description (VCD) forms.
- Standard sedimentological observations **lithology, sedimentary structures, macrofossils, bioturbation, diagenesis, drilling disturbance, clast properties, and clast abundance.**
- Entry of information using the **DESClogik** program (https://sites.google.com/a/descinfo.org/desclogik-user/).
- A **summary description for each core.**
Sampling and describing sediments in a newly split core Credit: Integrated Ocean Drilling Program
<table>
<thead>
<tr>
<th>Exp 310</th>
<th>Site B</th>
<th>Core 30</th>
<th>Type R</th>
<th>Section 1</th>
<th>Corals</th>
<th>Accessory</th>
<th>Lithology</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cr−</td>
<td></td>
<td>Matahaida sand</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>C1−</td>
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<td>Coral, algae, microfossil</td>
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<tr>
<td>0</td>
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<td></td>
<td></td>
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<td>C2−</td>
<td></td>
<td>Branching</td>
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<tr>
<td>15</td>
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<td></td>
<td></td>
<td>C3−</td>
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<td>Thin sheet of reddish algae</td>
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<td>33</td>
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<td></td>
<td>Bk Coral (33)</td>
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<td>Growth position Thin coats of seaweed, Alginates, particulates</td>
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<td>C4−</td>
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<td>C6−</td>
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<td>C7−</td>
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<tr>
<td>SEDIM. STRUCT.</td>
<td>LITHOLOGY</td>
<td>LITHOLOGIC DESCRIPTION</td>
<td>COLOUR</td>
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<tr>
<td></td>
<td>0-90cm silty clay with</td>
<td>5y 3/2 olive grey,</td>
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<td></td>
<td>silt layers/horizons approx.</td>
<td>scattered, muddy and rocky</td>
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<td></td>
<td>10cm</td>
<td>clay layers</td>
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<tr>
<td></td>
<td>a large rock (approx. 75cm)</td>
<td>scattered granules between</td>
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<td></td>
<td>cross 1% silt interval</td>
<td>31.4-38cm</td>
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<td></td>
<td>muddy clasts between</td>
<td>37-78cm</td>
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<tr>
<td></td>
<td>75-78cm</td>
<td>abundant and scattered granules</td>
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<tr>
<td></td>
<td>50-90cm</td>
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</tbody>
</table>

**Remarks:**
- Length of section (cm): 100
- Total length of core (cm): 3/8
### Diagenetic features
- **Carbonate vein**
- **Silicate filled vein**
- **Silica cement**
- **Coated grains**
- **Carbonate concretion**
- **Pyrite concretion**
- **Silica concretion**
- **Pyrite cement**
- **Pyrite**

### Macrofossils
- **Bivalve**
- **Gastropods**
- **Sponge spicule**
- **Shell fragment**
- **Fish fragments/scales/teeth**
- **Wood**
- **Large foraminifer**

### Coring disturbance
- **Slightly disturbed**
- **Moderately disturbed**
- **Extremely disturbed**
- **Soupy**
- **Void**
- **Flow-in**
- **Fall-in**
- **Washed gravel**
- **Slightly fractured**
- **Moderately fractured**
- **Biscuited**
- **Highly fractured brecciated**
- **Highly fractured dilling slurry**

### Bioturbation Index
- 1
- 2
- 3
- 4
- 5
- 6

### Shipboard sampling
- **S** Smear Slide
- **B** Microbiology
- **P** Micropaleontology
- **I** Interstitial water
- **X** X-ray diffraction
- **M** Moisture/Density
- **C** Carbonate
- **I** Interstitial water
- **H** Headspace
- **T** Thin section
Visual core description

1st step:

- **Definition of lithological units**, beds, dominant and minor lithologies in a sediment core based on:
  - Lithology
  - Color
  - Sedimentary structures

2nd step:

- **Detailed description** of five major characteristics of each bed:
  1. Degree of coring disturbance
  2. Bed thickness and attitude (bed inclination)
  3. Nature of bedding planes / boundaries / transitions
  4. Internal sedimentary structures
  5. Color and lithology
Clayey sand

Homogenous clayey silt

Interbedded clayey silt with turbidites

Interbeed, laminated diatom ooze and homogenous nannofossil ooze
1. Degree of coring disturbance

- Important to note but sometimes difficult to distinguish from “natural” features

- 3 major types:
  - *Soupy beds at the top of a core*
  - *Bed flexures particularly towards the edges of a layer (sediment can e.g. be flexed upward when core is pulled out of the sediment)*
  - *Fractures in hard-rocks*

- Disturbance of core surface due to the core splitting process
2. Bed thickness and attitude

- Bed thickness:
  - Very thick bedded (>100cm)
  - Thick bedded (30-100cm)
  - Medium bedded (10-30cm)
  - Thin bedded (3-10cm)
  - Very thin bedded (1-3cm)

- Bed attitude:
  - Horizontal or inclined (important to note if “natural” or caused by drilling disturbance)

3. Nature of bedding planes

- Sharp versus gradational
- Erosional contact?
- Surface and sole marks
  - load marks, dessication cracks, ripple marks, etc.
4. Internal sedimentary structures (examples)

- None-homogenous, massive unit

- Grading:
  - Normal versus reverse grading
  - “Turbidite” layers

- Lamination:
  - Internal bedding $<1 \text{cm}$
  - horizontal or inclined laminae
  - thin ($<0.3 \text{cm}$) versus thick laminations ($>0.3 \text{cm}$)
  - Planar – wavy - lenticular
4. Internal sedimentary structures (examples)

- Bioturbation

Pemberton et al. 1992
CAT SCAN OF 10 CM OF WHOLE CORE WITH ABUNDANT BIOTURBATION

SVAIS PROJECT
WESTERN BARENTS SEA

ENI, SpA, Milano
5. Color and lithology

- Visual determination of sediment color by comparison with the Munsell Soil Color Chart (directly after opening of the core)

- Rough grain-size estimation of soft sediments

- Consolidation of sediments
  - unlithified (soupy, soft, firm)
  - semi-lithified (e.g, chalk)
  - lithified (hard-rocks)

- More detailed lithologic description and classification of sediments only with the help of “Smear Slides”
Classification scheme for terrigenous clastic sediments lacking a gravel component, Expedition 318 (after Mazzullo et al., 1988).

Exp 318
Bearing Sea
Ternary diagram for naming siliciclastic sediments, modified from Shepard (1954)

Exp 308
Gulf of Mexico
Classification scheme for terrigenous clastic sediments containing a gravel component, Expedition 318 (after Moncrieff, 1989).

<table>
<thead>
<tr>
<th>Percent gravel (&gt;2 mm) in whole rock estimated from core</th>
<th>Trace-&lt;1</th>
<th>1-5</th>
<th>5-30</th>
<th>30-80</th>
<th>&gt;80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine-grained sediment</td>
<td>Clay/Silt with dispersed clasts</td>
<td>Clay/Silt with common clasts</td>
<td>Clay/Silt with abundant clasts</td>
<td>Clayey/Silty conglomerate/breccia</td>
<td>Gravel/Conglomerate/Breccia</td>
</tr>
<tr>
<td>0</td>
<td>Sandy clay/silt with dispersed clasts</td>
<td>Clast-poor muddy diamict</td>
<td>Clast-rich muddy diamict</td>
<td>Sandy muddy conglomerate/breccia</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Clayey/Silty sand with dispersed clasts</td>
<td>Clast-poor sandy diamict</td>
<td>Clast-rich sandy diamict</td>
<td>Muddy sandy conglomerate/breccia</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Clayey/Silty sand with dispersed clasts</td>
<td>Sand with common clasts</td>
<td>Sand with abundant clasts</td>
<td>Sandy conglomerate/breccia</td>
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</tbody>
</table>
Classification scheme for sediments that are mixtures of pelagic biogenic and terrigenous clastic components, Expedition 318.
• A smear slide is a thin layer of unconsolidated sediment embedded on a glass slide for petrographic microscopic examination

• Smear slides are a useful tool to quickly assess the *compositional content* of clay-silty sediment samples

• Smear slides are a powerful method for rapidly evaluating tiny quantities of sediment (mineralogy, components, form, size) as the basis for *sediment classification*, and for ascertaining the presence of microfossils
Visual core description | "Smear slides"

Quarz

Plagioclase

Clay fraction

Composition/Quantification

IODP Exp. 320

Rothwell 1989
**Visual core description | "Smear slides"**

- **Diatoms**
  ![Diatoms Image]

- **Foraminifera**
  ![Foraminifera Image]

- **Calcareous nannoplankton**
  ![Calcareous Nannoplankton Image]
Example of visual core description (VCD) form. IW = interstitial water, WHC = whole-round core sample.
Hole U1337B Core 2H, interval 10.5-20.3 m (coral depth below seafloor)

Major lithologies: nannofossil ooze, nannofossil ooze with radiolarians, radiolarian ooze with diatoms, and diatom radiolarian ooze with nannofossils. Core consists of alternating lithologies between very pale brown (10YR 8/2) nannofossil ooze, dark grayish brown (10YR 4/2) nannofossil ooze with radiolarians, yellowish brown (10YR 5/4) radiolarian ooze with diatoms, and dark brown (10YR 3/3) diatom radiolarian ooze with nannofossils. Lithologies alternate gradually and are heavily mottled throughout entire interval.