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GEOL 117 Class #11: OCEAN SEDIMENTS

Introduction

Marine sedimentary provinces

Importance of particle size

Lithogenous sediments

Turbidity currents

INTRODUCTION

Ocean sediments are our best record of Earth history

Ocean sediments are somewhat like a book of earth history-

- every detail says something about past events on the earth.

Many sedimentary rocks can be found on land today

Sedimentation patterns:

Layers -- oldest at bottom, youngest at top

Thickness

very little on mid-ocean ridges

up to 10,000 m beneath continental rises

average = 500 m

Sedimentation rates

Deep ocean (avg.): 0.5 - 1.0 cm/1000 yr

Continental margins: 10 - 50 cm/1000 yr

River mouths may have greater rates

Major differences in sediments, Continental Margins vs. Deep Ocean Basins:

<i>Area</i>	<i>Sediment Type</i>	<i>Sediment Source</i>
Continental margin	Neritic	Mostly Land (Terrigenous)
Deep Ocean Basins	Pelagic	1) Biogenous 2) Wind-borne 3) Meteorite

Sediment types- named for the sources of the materials:

<i>Type</i>	<i>Source</i>	<i>Examples</i>
Lithogenous	Eroded Rock, Volcanoes Airborne Dust	Sands, Muds, Red Clay
Biogenous	Living Organisms	Plants, Corals, Shells, Oozes
Hydrogenous	Chemical precipitation	Mn Nodules, Phosphate Minerals, Evaporites
Cosmogenous	Space	Micro-meteorites

Particle sizes of marine sediments

Particle diameter, mm, for the size classes:

Gravel > 2

Sand 0.06 - 2

Silt 0.004 - 0.06

Clay < 0.004

(Note: "Mud" = silt + clay)

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Proportions of different particle sizes in a sediment depends on:

- (1) distance from sediment source
- (2) mechanism of transport from source to deposition

Particles Sizes in Sediment- Interpretation

- (1) Larger --> sink faster
- (2) Faster-moving water holds coarser sediment and more of it.
- (3) Rapid currents or stronger waves transport coarse + fine seds.
- (4) Slow currents/waves transport only fine sediments.

So....

Coarsest Particles: beaches, near-shore, inner shelf –
"fast" currents, strong waves, "high energy"

Finest: quieter places

Sediment "sorting": How well are coarse and fine particles "sorted out" from each other?

"Well sorted" - - uniform particle size (e.g., beach sand)

"Poorly sorted" - - wide range of particle sizes

Sorting occurs during transport and the continued action of moving water (e.g.,
"winnowing" of fine particles from sand by wave action and currents)

- well sorted => sediments subjected to a certain level of turbulence for a long time
- poorly sorted => abruptly deposited

LITHOGENOUS SEDIMENTS = rock-derived

Type 1) Terrigenous sediments

~75% of all marine sediments (by mass)

Mostly stay on continental margins

Atlantic: Large aprons on deep-sea floor (continental rises)

Pacific Ocean: Trapped by trenches; little transported to deep-sea floor

Terrigenous sediments are created by erosion:

Continental rocks broken up by:

"Weathering" => fragments which become...

Sediment particles, which are transported by:

- streams, rivers
- wind
- glaciers

To eventually become:

Ocean sed's, mostly on Continental Margins

Turbidity current:

Dense slurry ("avalanche") of poorly sorted, suspended sediment

Continental slopes steep enough to cause these

Sediment deposited as current slows

- Largest particles settle first (poorly sorted)
- Finer particles settle next
- Finest particles (mud) settle last

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Result -- a "graded bed" characteristic of turbidity-flow deposits ("turbidities")

.....
..... Finest sediment particles
oooooooooooo
oooooooooooo
OOOOOOOO
OOOOOOOO Coarsest sediment particles

Type 2) "Red Clay" -- dust + volcanic ash
 Transported to open ocean by winds + water currents
 Settles eventually
 Dominant only in deep areas where other types absent.