

GEOL 332 Final Exam Study Guide

Review the digital presentations, the labs, and the quizzes to help prepare for the exam and to answer these questions. Turn in answers to these questions (typed) when you take the lab final to get 15 extra credit points! (there are lots of questions). Retake the quizzes and turn those in too.

Science

What is the scientific method (what are the steps)? What is the difference between an observation, an hypothesis, and a theory?

Description, Entrainment, Transport, and Deposition

Sediment Description: What is composition? What is texture? What is structure? What are processes that lead to rounding? Sorting? What are the Wentworth (1922) ranges in size for particles smaller than gravel (mm)? Describe skewness. Describe sorting. What is a particle size distribution? What are roundness, sphericity, and mineralogy indicators of? Why? What is the difference between a volume % and a cumulative % plot? What is the difference between unimodal and bimodal? Can you plot an example of each using a volume % and a cumulative % plot?

Define: grains, porosity, cement, and matrix. What is the difference between matrix supported and grain supported? Why would a sedimentary deposit be one or the other?

Sediment Motion: How do sedimentary environments control the sediment that is eroded/entrained, transported, and deposited? How does the Bernoulli Effect cause grains to move?

What is the difference between laminar and turbulent flow? What is the Reynolds Number and how can the R# be used to differentiate laminar from turbulent flow?

What is the Froude number? What is the difference between subcritical and super critical flow?

What are the three different modes of transport (as bedload and suspended load)?

The Hjulstrom diagram: on the quiz, can you fill in the blanks on your own? Turn in this with your answers.

Structure: What is a bedform? How are they created? What are the 3 layers within a flow? What is the difference between hydraulically smooth and hydraulically rough? What are streamlines? What is the separation and attachment points? How do these control sedimentation, erosion, and bedform migration? What is the difference between a ripple, a dune, and a draa? How are bedforms different for wave and current sediment transport (e.g. which are symmetrical, sharp crested)? What is the difference between planar and trough cross-bedding/lamination? How do climbing ripples form (i.e. what is a necessary condition)? How are anti-dunes formed? Standing waves?

How are sole marks formed (what are the two main categories and how are they different)?

What are facies? Give some examples of different types of facies.

Clastic Sedimentary Rocks

Conglomerates: how are they composed? What is the difference between Orthoconglomerates and Paraconglomerates? What is the difference between an Oligomict and a Petromict? What can fabric tell us about sediment transport? What are the two textural components of a conglomerate?

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Sandstones: how are they composed (what are the major components)? What are some ways to use statistics to identify particles from different sedimentary environments (can you plot at least one example of these)? What contributes to textural maturity? What is the “Toblerone” classification system? Can you label the quiz version of this diagram? How is the QFL ternary diagram used?

Clays: What is the difference between a clay mineral and a clay sized particle? What are the two types of clay layers? Describe the molecular arrangement of these two types (T and O) of clay layers. What are the three main groups of clay minerals that we discussed in class (there are other ways to group clay minerals)? Describe why these minerals are grouped in each of these 3 groups (relate the clay layers and how their configurations control how these clay layers can be modified. E.g. which clay mineral is shrink swell and why?) Can you use the Folk (1954) mudstone classification ternary diagram?

Carbonates: what is the CCD? Which is more soluble: aragonite or calcite? Which is more acidic: the Atlantic or the Pacific Ocean? Describe the Dunham classification system of classifying carbonate rocks. Can you fill out the Dunham quiz?

Weathering: what types of weathering lead to clastic sedimentary rocks? What about biochemical sedimentary rocks?

Lithification: What is the process of lithification? What is diagenesis? What are some ways that grains respond to pressure during diagenesis? How do the solubility of quartz/amorphous-silica and calcite compare? What are the first order controls on solubility? How is Liesegang banding formed? How are concretions formed?

Terrestrial Environments

Alluvial Systems: What are three types of transport in alluvial fans (how does sediment transport)? How might there be an upward coarsening sequence in an alluvial fan setting? How are deposits from these three types of transport differentiated? Where do alluvial fans form?

Fluvial Systems: What are the three end-member forms of river channels? What factors control these forms? What is sinuosity? Describe the landforms in each of these channel forms. How is sediment transported in meandering and braided channels? Could you distinguish the difference between stratigraphic sequences for meandering and braided channel systems (depositional architecture)?

What is stream power and what are the major factors that control it? What is a terrace and how is it formed? What is the floodplain? What is the bank? What is bankfull discharge? What is discharge?

What controls sediment transport in a river (e.g. where does sediment transport and where does sediment deposit and why)?

Lacustrine Systems: what controls deposition in a lake? What controls the particle size distribution? What controls stratification in a lake?

What are some types of saline lakes? What might lead to interbedded clastic and evaporite layers in a lake?

Aeolian Systems: What are the main factors that control winds on Earth? What are the 4 main types of aeolian dunes? How are these related to sand supply and wind direction? What are the forces/effects that control the direction of wind surrounding low and high pressure systems? What direction does

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wind flow surrounding a low or a high pressure system in the northern hemisphere? Which direction does wind flow (from high to low or from low to high pressure)? What are the major atmospheric circulation cells? What is the polar front? What is thermohaline circulation (use the Atlantic Ocean as an example)? What is the source of energy for ocean circulation?

Carbonate Systems: Describe the different carbonate platforms and the types of carbonate sediment that are deposited in different parts of each of these platform types (i.e. describe the facies distributions on these carbonate platforms). What is a reef complex and what is the distribution of sediment types across a reef? What are three reef settings? Where might we find a sabkha, what is a sabkha, and what type of sedimentation might we find there?

What are the two models of evaporite deposition (describe their morphology and what types of sediments/rocks are deposited/formed)?

What is the primary factor that controls carbonate productivity (all about the baste)?

Marine Environments

What are the main marine depositional environments? What is the general particle size distribution of sediment types across these environments? How are tides generated? When are maximum and minimum tidal velocities within the tidal cycle? What causes herringbone cross-stratification? When are the cross-beds formed in the tidal cycle? When are the mud drapes formed?

Delta Systems: what is a delta? Where are deltas formed? What is the basis for the Toblerone delta classification system? What is the ternary diagram based upon (what are the three types of deltas and why)? What are the two main parts of a delta system? Within these two parts, what are some “elements” of delta systems? How might these elements be different in the different delta settings (see below re: “forcing factors”)?

What is a Gilbert delta, how is it formed? Does delta progradation lead to coarsening up or fining up and why? What are topsets, foresets, and bottomsets?

How do the following forcing factors control the distribution of sediment type (particle size) in the different delta “elements?” shallow vs. deep water; fine grained vs. coarse grained; river dominated, tide dominated, or wave dominated.

Could you interpret stratigraphic columns from different delta systems? What would well logs look like in a prograding, aggrading, and retrograding deltas?

Coastal Systems: What type of sedimentation occurs in shallow sandy seas? What particle size distribution (gradient) would one find in a shallow sandy sea? What type of structures are formed in shallow sandy seas (describe process)?

Describe the difference between Hyperpycnal and Hypopycnal flow.

What are the two types of shores and what are some processes required for their development? How does a marine terrace form?

Deep Sea Systems: What is a turbidity current? What is a turbidite? How is an hyperpycnite different? What are the Bouma divisions of a turbidite? What type of sediment transport is responsible for each

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division? What landforms promote turbidity current propagation? In what settings is turbidity current propagation hindered?

How do the following factors control sediment distribution of sediment into the deep sea: coarse sediment, sandy sediment, mixed sandy/muddy sediment, muddy sediment?

Geologic Time

What are the two types of geologic time based upon?

Time Type 1: What is the principle of superposition and what can this tell us about relative time? What is an unconformity and how are the different kinds of unconformities formed? What are cross cutting relations and what can they tell us about relative time? What are inclusions and what can they tell us about relative time?

What are different ways to correlate? What are timelines? What are sedimentary sequences? How do hiatuses form? How can sequences be used to (a) correlate and (b) inform us about the geologic history?

Time Type 2: What are isotopes, ions, and atoms? How do the major subatomic particles help define these objects? What is radioactive decay and why are some isotopes unstable (sea of instability)? What are the 5 major types of radioactive decay (how do they work)? What are the four principles/assumptions that numerical ages are based upon (required for the method to work)?

How does ^{14}C age control work? What are the processes that form ^{14}C ? Over what time period does ^{14}C age control work? How does the initial concentration of radiocarbon vary through time? What do we do to account for this?

Describe ^{210}Pb age control. How can sedimentation (depositional) rate help or hinder this method?

Describe dendrochronology. How far back in time has dendrochronology been used? What other age control methods have been calibrated with dendrochronology?

What are varves and how can they be used as an age control method? How far back in time have they been used and where? What is a process that cannot occur in a region where we are observing varves?

How can ice core records be used as an age control method? How far back in time have they been used and where?

What is Lichenometry and how can it be used?

What is paleomagnetism? What is the process that creates the geomagnetic field? How is the geomagnetic field preserved in sediments? What are: declination, intensity, and inclination? Describe secular variation of the magnetic field. How might one correlate paleomagnetic records?