

GEOL 102 Historical Geology
Exam 1 Review

History of Historical Geology

Uniformitarianism vs. Catastrophism; Neptunism vs. Plutonism

Actualism

Discovery of Geologic Time

Rock Cycles

Major classes of rocks, how they form, and the bases for their classifications:

Igneous: volcanic/extrusive/aphanitic vs plutonic/intrusive/phaneritic; ultramafic → mafic → intermediate → felsic

Metamorphic: regional vs. contact; metamorphic grade & metamorphic facies (concepts – not definitions or examples)!

Sedimentary: detrital (= clastic = siliciclastic), biogenic, chemical; strata

Detrital Sedimentary Cycle: Source → Weathering → Transport (Rounding/Sorting) → Deposition → Lithification

Sedimentary Structures: mudcracks, raindrop marks, ripples & crossbeds (wave, current, trough)

Sedimentary Environments

Know the types of lithologies & structures produced by:

Nonmarine: Paleosol, Lacustrine, Paludal, Glacial, Desert, Fluvial

Coastal: Deltaic, Barrier Island-Lagoon, Sabkha

Marine: Reefal, Carbonate Bank, Siliciclastic Shelf, Turbidites, Oozes

Facies concept

Transgressions (onlap sequences) & Regressions (offlap sequences)

Sources of coastline changes: progradation, tectonic, eustatic, isostatic

Walther's Law

Geologic Time

Relative vs. numerical ("absolute") time

Principles of Stratigraphy: Original Horizontality, Superposition, Lateral Continuity, Cross-Cutting Relationships, Inclusions, Fossil Succession

Geopetal indicators

Unconformities: Disconformities, Angular Unconformities, Nonconformities

Radiometric dating: standard method, isochron method, radiocarbon, fission track

Other methods: transgression-regression, eustatic sea level changes, marker beds, stable isotope, magnetostratigraphy, astrochronology

Lithostratigraphy

Supergroup

Group

Formation

Member

Bed

Lithostratigraphic Grammar: Morrison Formation, Karoo Supergroup, Keyser Limestone, etc.

Intertonguing

Isochrony vs. diachrony

Biostratigraphy

Index fossils: properties & uses; First Appearance Datum & Last Appearance Datum; Zone

Other Methods of Stratigraphy

Magnetostratigraphy (Chron); Sequence Stratigraphy (Sequence)

Geologic Column

Chronostratigraphy (Rock)

Eon

Erathem

System

Series

Stage

Geochronology (Time)

Eon

Era

Period

Epoch

Age

Geologic Column Grammar: e.g., Jurassic System (rock) vs. Jurassic Period (time), Upper Jurassic Series (rock) vs.

Late Jurassic Epoch (time)

GSSPs and GSSAs

Plate Tectonics

Evidence for moving continents: distribution of fossil plants & animals, sediment patterns, glacial patterns, etc.

Continental drift vs. land bridges/sunken continents: models & predictions

Polar wander, Sea-floor spreading, paleomagnetism: evidence for moving surface

Cross-sectional structure and mineralogy/lithology of Earth: esp.: oceanic vs. continental crust; crust vs. mantle;

lithosphere vs. asthenosphere

Plate Tectonics: plate boundary types (transform, divergent, convergent); microplates

Orogenesis

Cycles of mountain building

Anatomy of a mountain range: trench, accretionary wedge (mélange), forearc basin, metamorphic belts, igneous arc,

foreland basin (flysch & molasse), fold & thrust belt

Continent-continent collisions, ophiolites

Examples in the modern world

Wilson (Supercontinent) Cycles

Geochemical Cycles

Energy sources for geology: solar, gravity, internal heat

Reservoirs (sources and sinks) and fluxes; residence time

Positive vs. negative feedback

Paleoclimate: components to make climate (insolation, greenhouse gases, position of continents/oceans, albedo)

Examples of how plate tectonics drives geochemical cycles and climate: volcanoes; chemical weathering;

sedimentation and soils; position of the continents; rise and fall of mountain ranges; rise and fall of the seas

Use of $\delta^{13}\text{C}$ as indicator of past productivity; $\delta^{18}\text{O}$ as indicator of paleotemperature

Fossils & Fossilization

Body fossil vs. trace fossils

Fossilization potential

Common hard part mineralogies

Taphonomy & modes of preservation: unaltered, permineralized, recrystallized, replaced, carbonized, impression

Transported (allochthonous) vs. in situ (autochthonous)

Lagerstätten

Ecology

Major life habits (producers, consumers, decomposers), suspension feeding

Plankton vs. Nekton vs. Benthos (infaunal vs. epifaunal; motile vs. sessile)

Evolution

Properties of life

DNA: its role as genetic code; alleles; variations; mutations

Evolution: diversity of living things is product of descent with modification

Natural Selection: differential survival and reproduction of variants in a population resulting in change of phenotypes of the descendants:

- Variations in all population, some of which is heritable
- More are born into populations than can possibly survive
- Traits which allow organism to survive and reproduce will be selected for, and will show up in increasing frequency over many generations

Evolution \neq Simple-to-complex; Evolutionary fitness = reproductive success

Common ancestry Homologies Analogies Adaptations Vestigial structures

Sexual selection Lineage Divergence Correlated Progression

Adaptive radiation Niche Partitioning Hybrids Convergence

Extinction Mass extinction Living fossils Transitional fossils

Heterochrony: Paedomorphosis vs. Peramorphosis Evo/Devo

Macroevolutionary change from macroecological change

Taxon (taxa): basics of Linnean taxonomy

Cladistics & difference of taxonomic philosophy with Linnaean

Cladogram: be able to read one

Derived vs. primitive vs. reversed vs. convergent characters

Monophyletic, Paraphyletic

Minimum Divergence Time