GEOL 102: Historical Geology Exam 1 Review

History of Historical Geology

Uniformitarianism vs. Catastrophism; Neptunism vs. Plutonism Actualism Discovery of Geologic Time Discovery of Continental Drift, Sea-Floor Spreading, Plate Tectonics Discovery of Evolution Be familiar with the contributions of: Nicholas Stano, James Hutton, Charles Lyell, William "Strate" Smith, Lo

Nicholas Steno, James Hutton, Charles Lyell, William "Strata" Smith, Lord Kelvin, Alfred Wegener & Alexander du Toit, Harry Hess, J. Tuzo Wilson, Charles Darwin & Alfred Russel Wallace

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 \rightarrow Weathering \rightarrow Transport (Rounding/Sorting) \rightarrow Deposition \rightarrow 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

<u>Biostratigraphy</u> Index fossils: properties & uses; First Appearance Datum & Last Appearance Datum; Zone

<u>Other Methods of Stratigraphy</u> Magnetostratigraphy (Chron); Sequence Stratigraphy (Sequence)

Geologic Column						
Chronostratigraphy (Rock)		Geochronology (Time)				
Eonthem		Eon				
Erathem			Era			
System				Period		
Series					Epoch	
	Stage				-	Age

Geologic Column Grammar: e.g., Juassic 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; homeostasis

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 of fall of the seas

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)

<u>Evolution</u> 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 Progre	ession			
Adaptive radiation	Niche Partitionin	g Hybrids	Converg	ence			
Extinction	Mass extinction	Living fossils	Transitional fossi	ls			
Heterochrony: Paedomorp	hosis vs. Peramor	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, Paraphyleti	ic						

Minimum Divergence Time