Critical Events in the History of Life

Pleistocene-Recent (1.6 Ma-Present)	- Melting of L. Pleist. ice caps (15,000-9,000 yrs. ago) - Big extinction of mammals and birds (40,000-0 yrs. ago) - Spread of advanced humans to all parts of world and rise to dominance (40,000 yrs. ago to present) - Start of Pleistocene glaciation, N. Hemisphere (~1.6 Ma)
Cenozoic (last 65 mill. yrs.)	- North and South America collide at edge allowing animal migrations N and S (Pliocene, ~2.5 Ma) - Appearance of homonids and humans in Africa (~5 Ma) - India collides with S. Asia raising Himalayas (~30 Ma) - Climatic cooling into Icehouse glaciation (40 Ma-Present) - Big radiation in mammals and birds, continued radiation in angiosperms and insects
Cretaceous (140-65 Ma)	- Big extinction (dinosaurs, pterosaurs, most marine reptiles, ammonoids, rudistids) at end of Cretaceous - First appearance and big radiation of angiosperms (flowering plants), radiation in pollinating insects, E. Cret. - Highest sea levels since Early Paleozoic, rapid spreading
Triassic-Jurassic (252-140 Ma)	- First birds (L. Jur), first mammals? (Jurassic) - moderate extinction in marine and terrestrial environment (end of Triassic) - Breakup of Pangaea (L. Trias.-Jur.), increased spreading - Dinosaurs first appear and become dominant (L. Trias.) - First flying reptiles (pterosaurs, L. Trias.) - Recovery from P-Tr extinction in marine metazoans
Carboniferous-Permian (365-252 Ma)	- Biggest marine extinction (>50% of families) in Phanerozoic fossil record at end of Permian, big sea-level drop - Formation of Pangaea (3rd supercontinent, Penn.-Perm.) - Big glaciation (M. Penn.-E. Perm.), mostly in S. Hemis. - Coal swamps and forests (Penn.-Perm.) in Tropics - First reptiles with amniote egg (lay on land), Penn.
Silurian-Devonian (445-365 Ma)	- Moderate marine extinction (last three stages of L. Dev.) - First vertebrates on land (tetrapod amphibians, L. Dev.) - Land plants become common, first seeds, trees (E. Dev.) - First invertebrates on rapidly spreading continents (Sil.)
"Ordovician Radiation"(490-445 Ma)	- Brief glaciation in middle of Greenhouse interval at end of Ordovician + large but short-lived marine extinction - All-time peak in marine metazoan class diversity - Stromatolites rare after E. Ord., only in marginal areas - Many classes of marine metazoans appear, along with first fish and first land plants near end of Ordovician
"Cambrian Explosion" (540-500 Ma)	- Beginning of good fossil record, few members of many marine phyla appear suddenly, first metazoan skeletons, trilobite dominance, first metazoan reefs, first vertebrates - Oceans at 97% of present volume?, rising sea levels - Remnants of Rodinia breakup collide to form Gondwana

Latest Proterozoic (700-540 Ma)	- First metazoans in fossil record (soft-bodied Ediacara Fauna) & first metazoan trace fossils, ~600-550 Ma - Big drop in stromatolite diversity and abundance - World-wide? glaciation ("Snowball Earth") ~600 Ma - Breakup of Rodinia supercontinent, rapid plate spreading, ~700 Ma
Mid-Late Proterozoic (~1,000 Ma)	- Projected time for origin of metazoans (multicellular animals), but little or no fossil evidence this far back - Peak in stromatolite diversity and abundance - Rodinia forms from most continents, 2nd supercontinent? - Fully oxidizing atmosphere (20% O_2 & ozone layer like today?), red beds common - Oceans at 95% of present volume? - Columbia forms from early continental blocks ~1,500 Ma, 1st supercontinent??, breaks up soon after, ~1,300 Ma
Early Proterozoic (~2,000 Ma)	- First eucaryotic cells (symbiotic combination of procaryotes?), unicellular protistans and photosynthetic algae - Steep rise in O_2 in atmosphere - beginning of oxidizing atmosphere and red beds - Oceans near 90% of present volume? - Earliest evidence of glaciation (tillites - ~2,200 Ma) - Plate tectonics in operation?, earliest continental cores grow in size and collide (~3,000 Ma) - Deposition of siliceous banded iron formations (BIF) mostly from 3,000-2,000 Ma, major iron ores today
Early Archean (~3,500 Ma)	- First stromatolites (domal, layered structures built by photosynthetic blue-green algae), O_2 released as waste product, but most oxidizes Fe & little gets to atmosphere - First evidence of life (single celled procaryotes, bacteria), depletion of oceanic organic matter - Oceans near 50% of present volume? - Oldest surviving oceanic crust (komatiites) & continental crust (small areas of greenstones, tonalites), ~3,800 Ma - Oldest surviving mineral grains (zircons) ~4,100 Ma
Origin of Earth (~4,600 Ma)	- Buildup of organic matter from meteorites and chemosynthesis in early shallow oceans - Beginning of photodissociation (O_2 from H_2O) in upper atmosphere and slow accumulation there - Light gasses in atmosphere (H_2, He) lost to space - Outgassing produces slowly growing oceans (H_2O) and primitive reducing atmosphere - Formation of earliest cool, thin, oceanic crust - Heavy meteorite bombardment for first 500-600 mill. yrs. - Differentiation of core and mantle (first 30-60 mill. yrs.) - Formation of Earth along with Sun & rest of solar system