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Geological Doomsday Scenarios Waiting to Happen Or TEOTWAWKI



Our Blue - Green Earth (Courtesy of NASA)

3rd Stone from the Sun (Hendrix and Chandler, 1967)

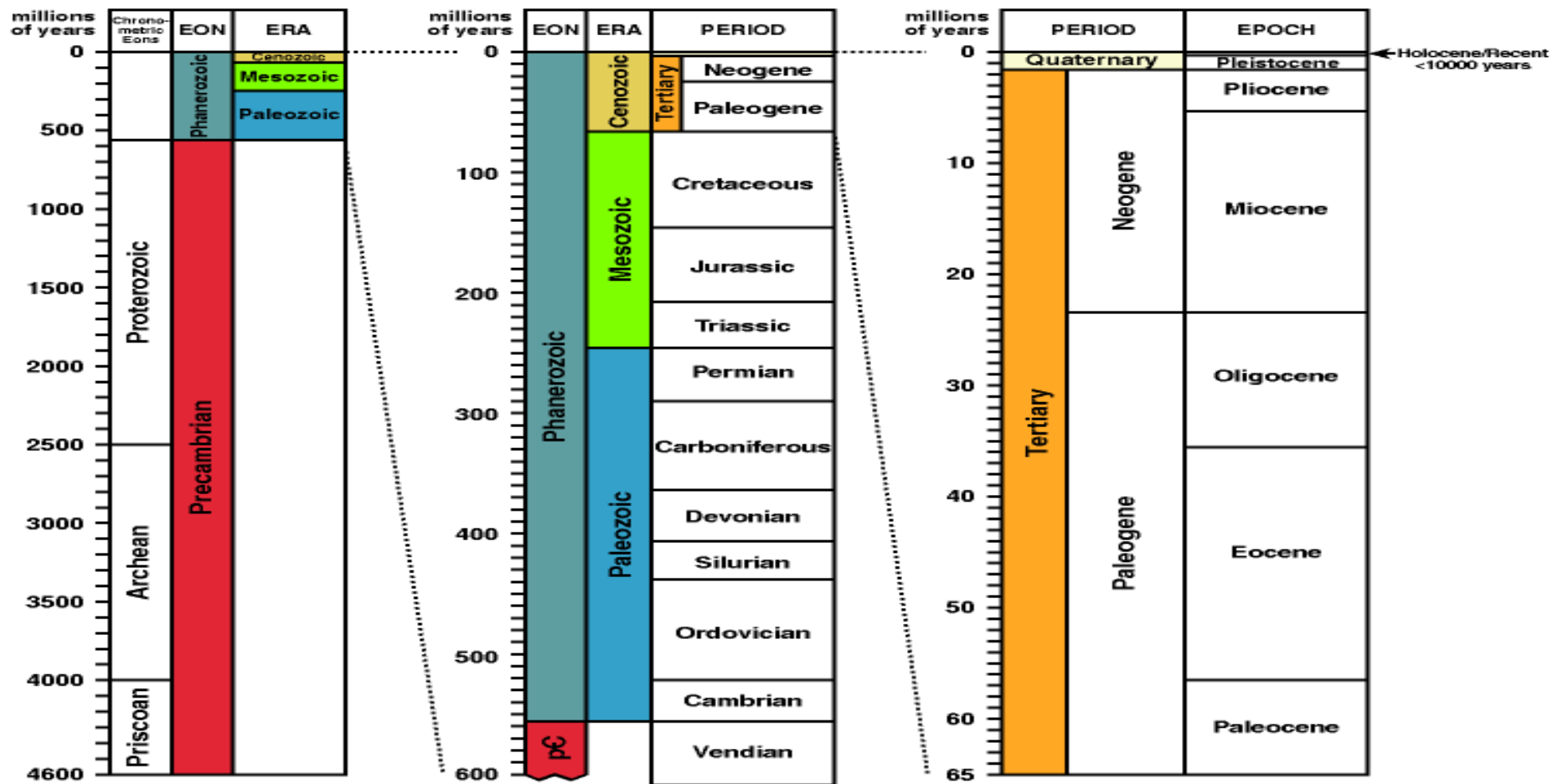


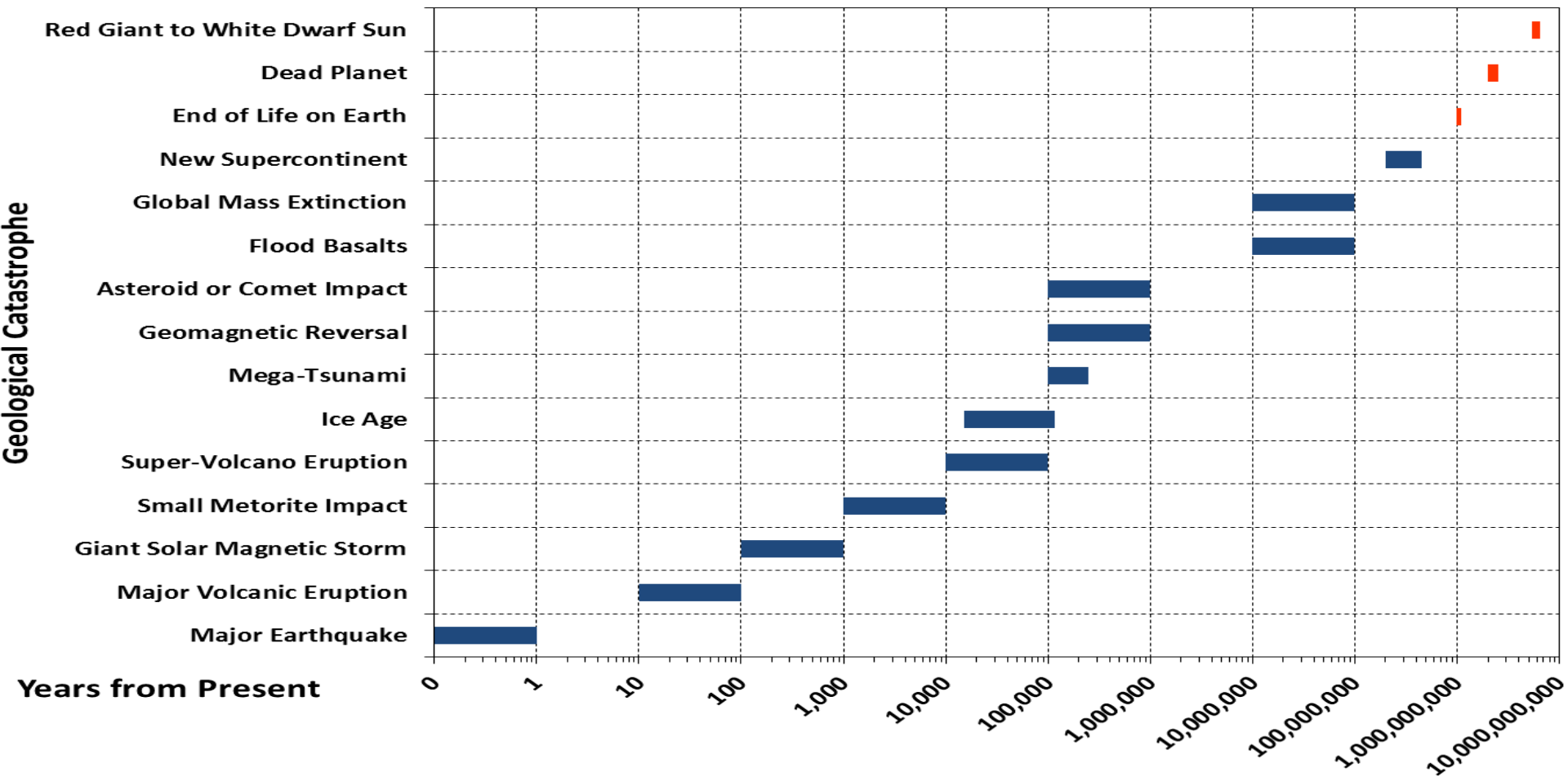


The Earth

4.5 Billion Years Old :

- Thru Out Its History
- Created an Environment That Either
- Allows Life to Thrive or Causes It to Die







Within 10^0 = One Year : Major Earthquakes

- Earthquakes > 7.0 at 15 Times per Year
- Widespread Structural Damage
- May Cause Significant Loss of Life
- Tsunamis if Offshore or Near Coast
- 900,000 Deaths since 1990



Major Earthquake > 8.0

(Courtesy of USGS)





Within $10^1 - 10^2 = 10$ to 100 Years Major Volcanic Eruption

- 1500 Active Volcanos; 50 per Year Erupt
- Significant Loss of Life
- Human Displacement
- Temporary Climate Change
- Famine
- Disruption of Air Travel



Major Volcanic Eruption

(Courtesy USGS)





Within $10^2 - 10^3 = 100$ to 1000 Years Giant Solar Magnetic Storm

- One Solar Super Storm per 500 Years
- Radiation and High Energy Particles
- Massive Power Outages
- Disrupt / Destroy Worldwide Communications
- 1859 : Telegraphs Failed / Fires; Subtropic Auroras
- 1989 : Hydro-Quebec Power Grid Failed



Solar Magnetic Storm

(Courtesy NOAA and MSNBC)

GOES-15 SXI CS Raw 0x1c120200
NOAA/SWPC 12BIT
Boulder, CO 1x1

2011/02/16 16:06:15 UTC TM 0.500s





Within $10^3 - 10^4 = 1000$ to 10,000 Years Small Meteorite Impact

- Meteorite > 50 m Diameter Every 1000 Years
- Explode in Lower Atmosphere
- Massive Destruction over 1000s of Km^2
- Over Populated Area = Significant Loss of Life
- 1908 Tunguska, Siberia



Small Meteorite Impact

(Courtesy of 1927 Leonid Kulik Expedition and NASA)





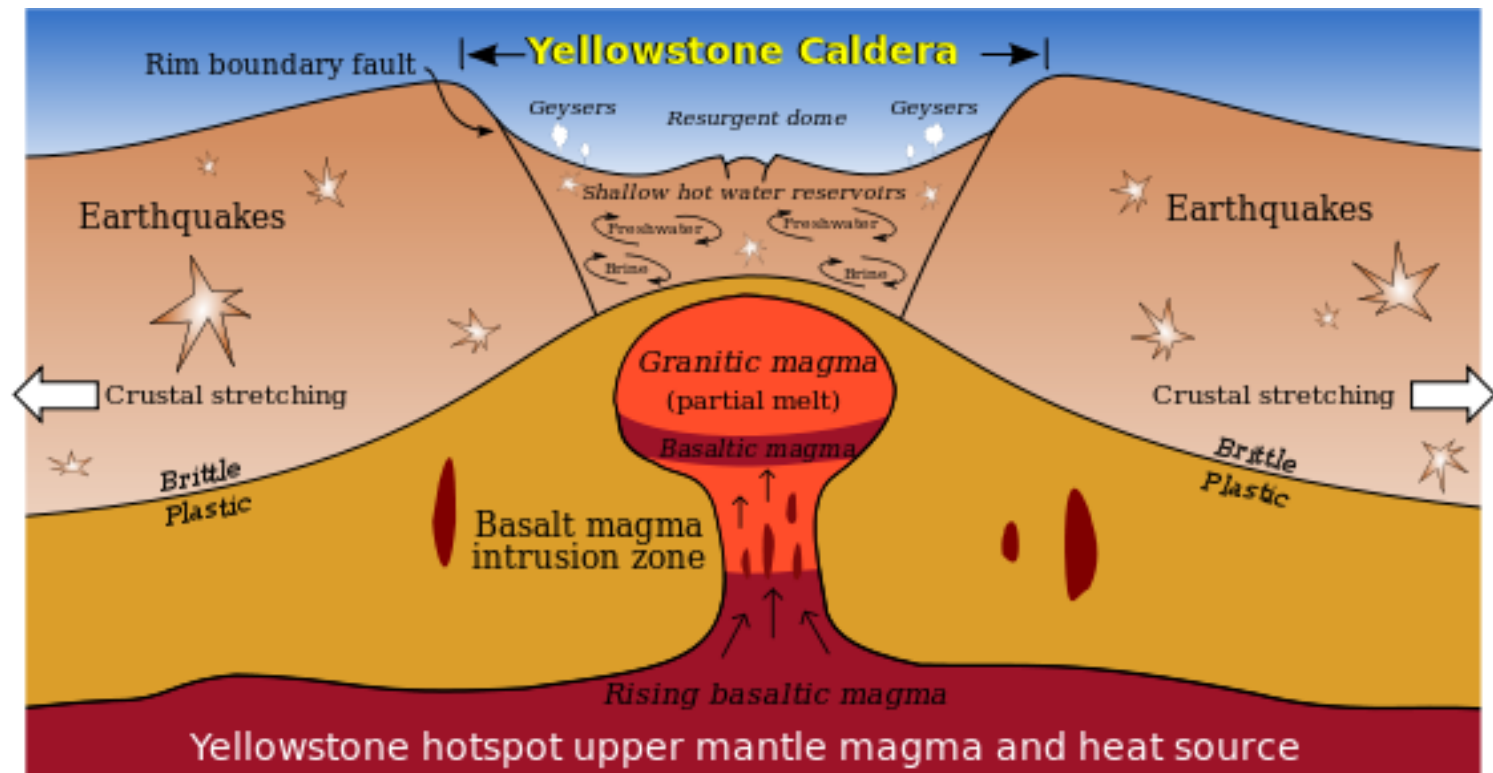
Within $10^4 - 10^5 = 10,000$ to 100,000 Years Super - Volcano Eruption

- Eruption of Apocalyptic Magnitude
- Mantle Hot Spots : NZ, Sumatra, WY, Iceland
- 26,500 ; 74,000 ; 254,000 ; 640,000 Years Ago
- Massive Landscape Destruction
- Catastrophic Loss of Plant & Animal Life
- Severe Climate Change & Mass Extinctions



Super - Volcano Eruption

(Courtesy NPS.gov)





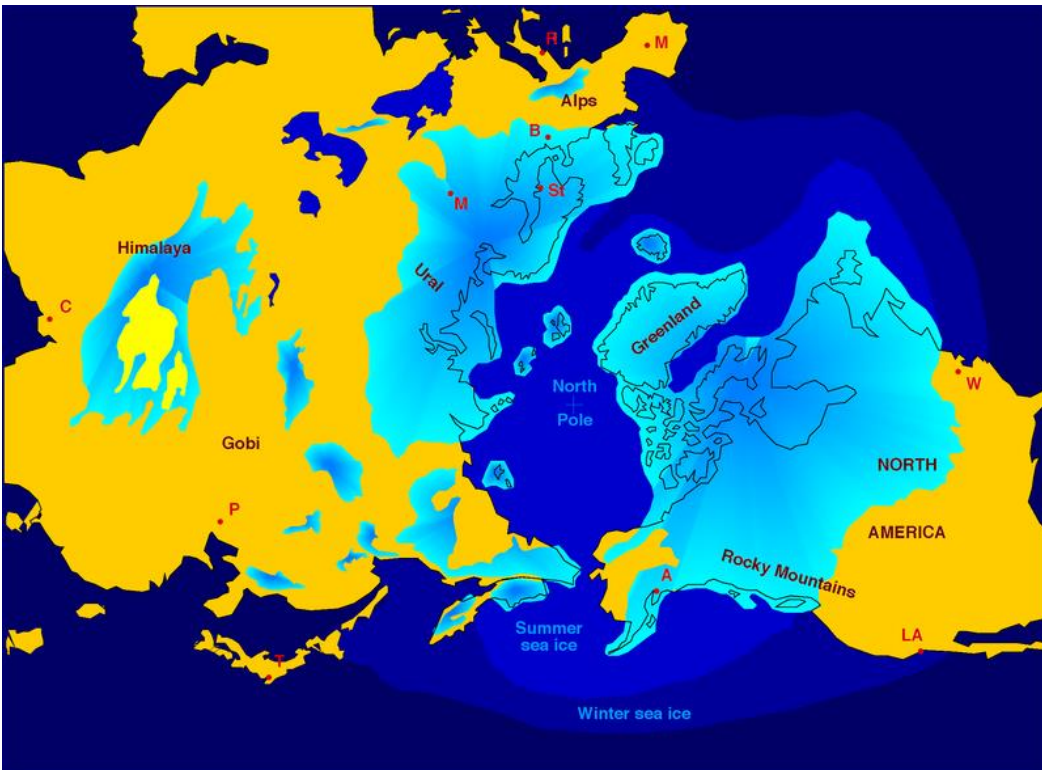
Within $10^4 - 10^5 = 10,000$ to 100,000 Years Ice Age

- Quaternary Period: 2.6 m.y. = Multiple Ice Ages
- First Hominids in Fossil Record
- Glacial Cycles : 40,000 - 100,000 Years
- Interglacial Period Began 10,000 Years Ago
- Modern - Day Man & Spread of Civilization
- Ice = 10 % Land ; 15,000 Years to Next Cycle



Quaternary Ice Age

(Courtesy USGS)





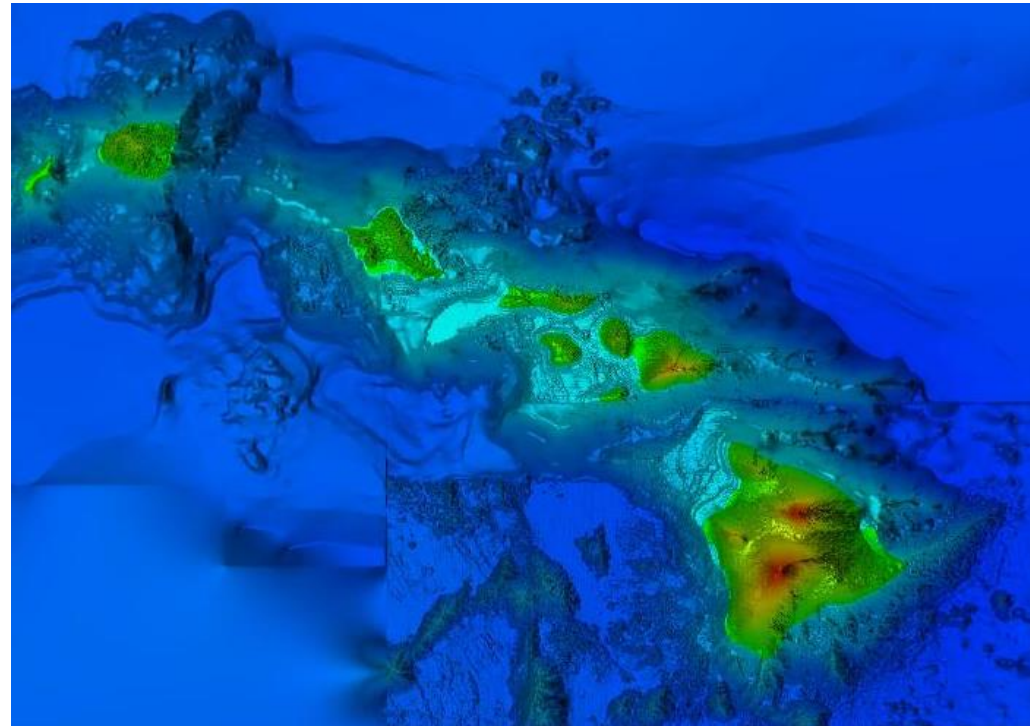
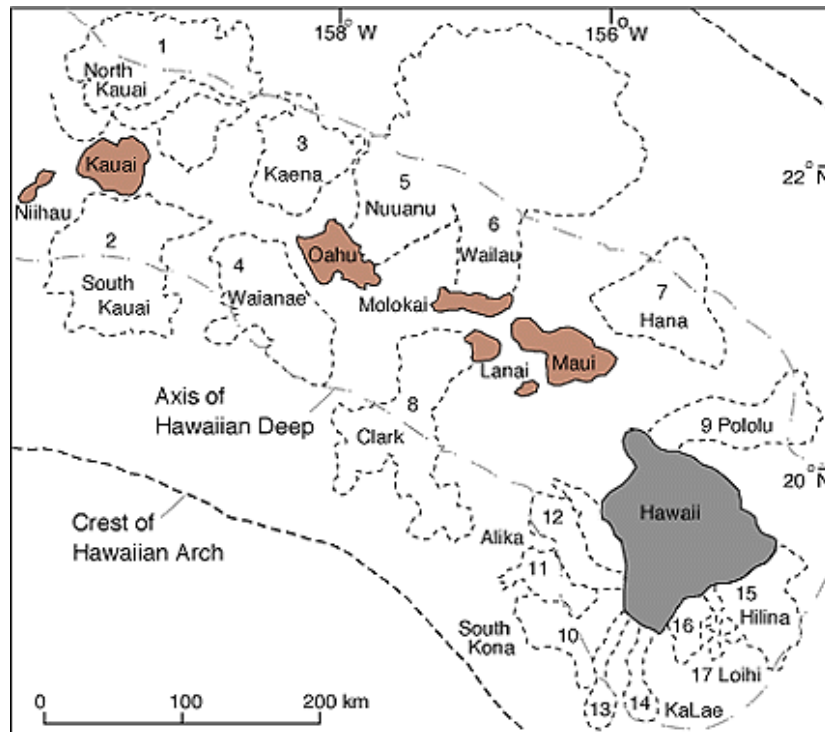
Within $10^5 - 10^6 = 100,000$ to 1,000,000 Years Mega-Tsunami

- Massive Landslide or Impact Event
- Waves 100 to 300 m High
- Hawaiian Islands: 70 Events in Last 20 m.y.
- Coastlines Worldwide Inundated
- Complete Infrastructure Destruction
- Immeasurable Loss of Life



Mega - Tsunami

(Courtesy Univ of Hawaii-Hilo and Univ of Arizona)





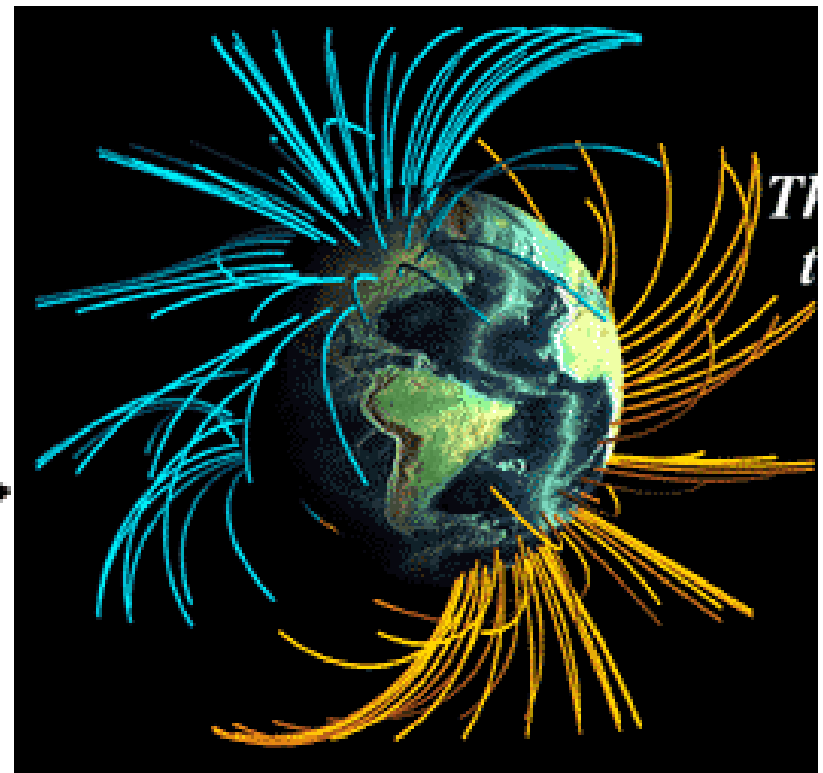
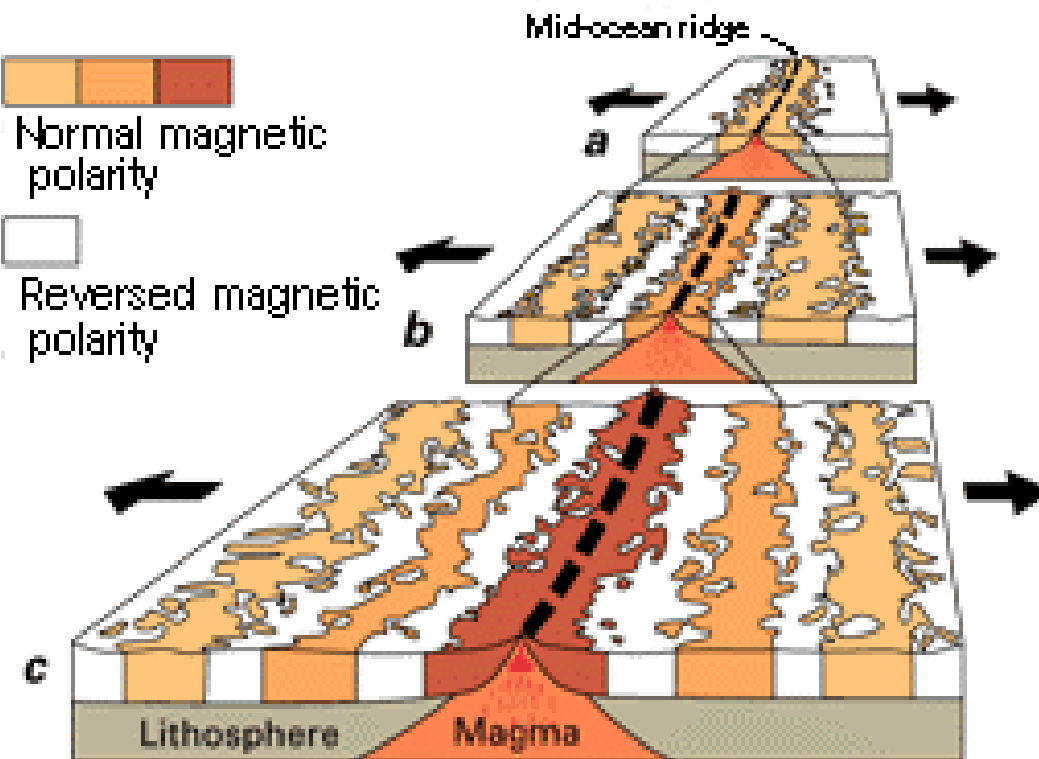
Within 10^5 - 10^6 = 100,000 to 1,000,000 Years Geomagnetic Reversal

- Positions of Magnetic N & S Change
- Occur on Average Every 450,000 Years
- Last Reversal : 780,000 Years Ago
- Reversal Process : 1000 to 10,000 Years
- Havoc in Navigation & Communications
- Significant Extinctions



Geomagnetic Reversal

(Courtesy USGS and PSC.edu)





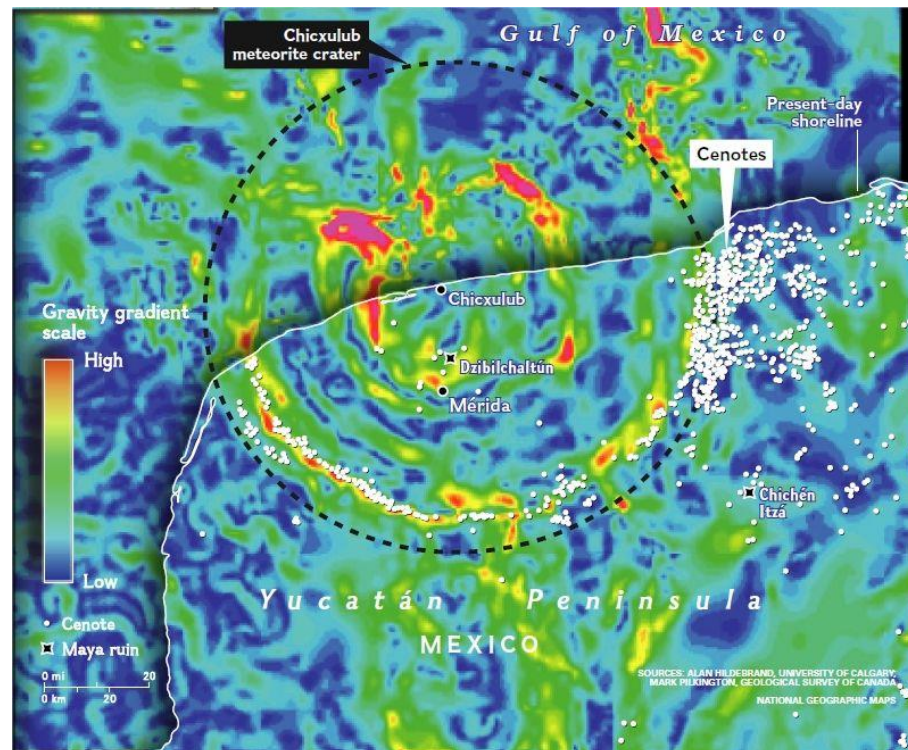
Within $10^5 - 10^6 = 100,000$ to 1,000,000 Years Asteroid or Comet Impact

- Asteroids > 1 km Every 500,000 Years
- Asteroids > 5 km Every 20 m.y.
- Last Asteroid Impact > 10 km at 66 m.y.
- Cretaceous - Paleocene Mass Extinction
- Age of the Dinosaurs / Age of the Mammals
- 7000 Near-Earth Asteroids; 85 Near-Earth Comets



Mass Extinction 66 m.y. Meteorite Impact

(Image Courtesy of Alan Hildebrand and Mark Pillington)





Within 10^7 - 10^8 = 10,000,000 to 100,000,000 Years
Flood Basalts

- Mantle Hot Spot Eruptions
- Voluminous over a Few Million Years
- Noxious Gases & Extreme Climate Change
- Siberian Basalts = Permian-Triassic Extinction
- Colombia Plateau; Dekkan Traps; Ongong, Java
- Iceland = Mantle Hot Spot & Spreading Center



Mass Extinction 252 m.y. Flood Basalts





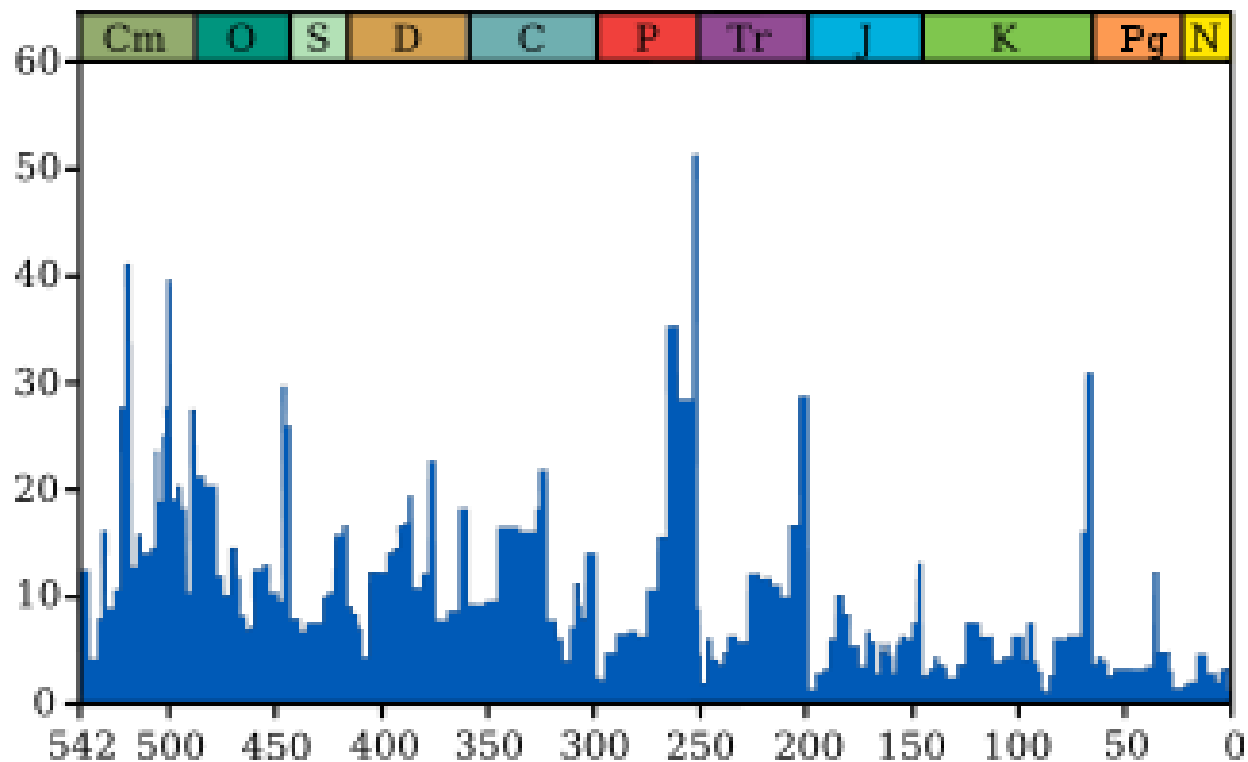
Within 10^7 - 10^8 = 10,000,000 to 100,000,000 Years Global Mass Extinction

- Since Cambrian Period : Five times in 500 m.y.
Percentage of Species That Went Extinct :
- Ordovician - Silurian 85 %
- Late Devonian 75 %
- Permian - Triassic 95 %
- Triassic - Jurassic 50 %
- Cretaceous - Paleogene 65 %



Global Marine Genera Extinctions

(Courtesy Raup & Seploski, Science, 1982)





Within 10^8 - 10^9 = 100,000,000 to 1,000,000,000 Years
New Supercontinent

- Pangaea Ultima : 200 to 250 m.y.
- Mediterranean Sea & Atlantic Ocean Consumed
- Americas, Europe, & Africa Collide
- Australia Joined to Antarctica
- Wild Fluctuations of O_2 & Temperatures
- Global Mass Extinctions



$10^9 - 6.5 \times 10^9 = 1.0 \text{ Billion to } 6.6 \text{ Billion Years}$

- 1.0 - 1.1 Billion Years : No Surface Water or Life
- 2.0 - 2.5 Billion Years : No More Radioactive Fuel
- 5.4 Billion Years : Sun Fuses All H to He in Core
- Morphs into Red Giant Star
- 6.5 Billion Years : Consumes 3 Inner Planets
- 6.6 Billion Years : Sun Burns Out = White Dwarf



Dead Earth = Mars

(Image Courtesy of NASA Mars Rover)





Red Giant Sun

(Courtesy: Vistapro Landscape Imagery; Rendered by Jeff Bryant)





And That's All Folks

It's the End of the World as We Know It (REM, 1987)

(Image Courtesy of NASA)





What Will We Do? Where Will We Go?
Another Blue – Green Planet !!





Monday Morning Musings from Mickey the Mercenary Geologist





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