**Panel 2: EARTH and LIFE (4.567 Ga to now)**

**LIFE on EARTH**

- **Stage 1**: Deposition of sedimentary iron formations (Bekker et al., 2010)
- **Stage 2**: Oxygen (Holland 2006)
- **Stage 3**: Eons
  - Hadean
  - Archean
  - Proterozoic
  - Phanerozoic

**Whole-Earth Evolution**

- Continental crust
- Rocky silicate mantle
- Liquid iron-nickel core
- Solid Fe-Ni inner core

**Earth and Life**

- Sun, Earth, Solar System formed (4.567 Ga)
- Oxygen % of atmosphere

**Evolutionary relationships based on DNA**

- From Hedges and Kumar, 2009, The Timetree of Life

- LUCA (Last Universal Common Ancestor)
- Viral ancestry
- Eukaryotes
- Opistokonts
- Eubacteria
- Archaea

**Snowball-Earth episodes (global glaciations)**

- Makganyene (~2.25 Ga)
- Marinoan (0.635 Ga)
- Sturtian (0.710 Ga)

**Impacts on Earth**

- Vredefort
- Sudbury
- Acraman
- Archean impact-spherule layers (source craters not known)

**Molecules to Life**

- Origin of Earth and Solar System at 4,567 Ma
- Eubacteria
- Archaea
- (cells with nucleus and organelles such as mitochondria)
- Endosymbiosis leading to mitochondria
- Plants (animals + fungi)
- Fungi
- Eumetazoa (animals with tissues organized into germ layers)
- Protostomata (arthropods, molluscs, and relatives)
- Deuterostomata (vertebrates, echinoderms, and relatives)
- Radiata (corals, jellyfish)
- Ambulacria (echinoderms, hemichordates)
- Chordates (animals with a notochord, the embryological precursor of the vertebral column)
- Vertebrates (animals with backbones or spinal columns)

**Stage 1**

- Deposition of sedimentary iron formations (Bekker et al., 2010)

**Stage 5**

- Large fossils

**Stage 2**

- Oxygen (Holland 2006)

**Stage 3**

- Eons
  - Hadean
  - Archean
  - Proterozoic
  - Phanerozoic

**Stage 4**

- Eons
  - Hadean
  - Archean
  - Proterozoic
  - Phanerozoic

**Stage 5**

- Large fossils

**Panel 3**

- Snowball-Earth episodes (global glaciations)
- Makganyene (~2.25 Ga)
- Marinoan (0.635 Ga)
- Sturtian (0.710 Ga)

**Impacts on Earth**

- Vredefort
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- Deposition of sedimentary iron formations (Bekker et al., 2010)

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- Large fossils