

Introduction to Biology. Lecture 13

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September 24, 2012

Outline

1 Where we are?

- Mitosis

2 Life in late Precambrian

- Cryogenian period and Snowball Earth
- Ediacarian period and multicellularity
- First animals



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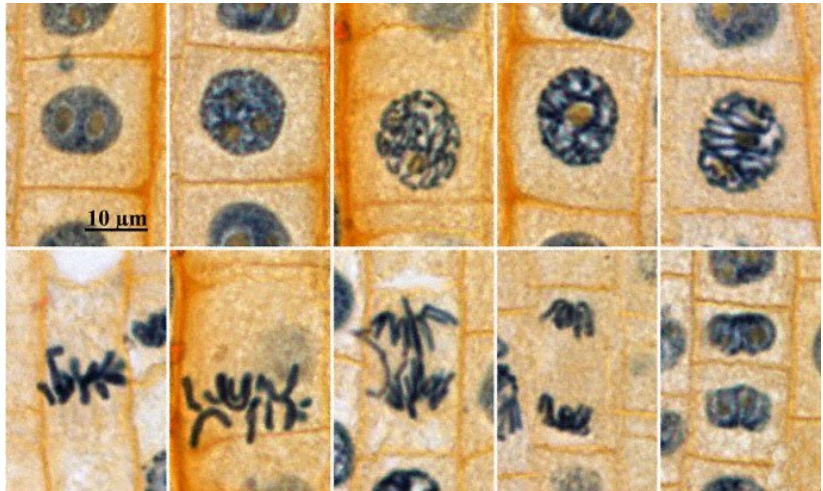
Where we are?

Mitosis

Stages of mitosis

- Prophase
- Metaphase
- Anaphase
- Telophase

Which stage?

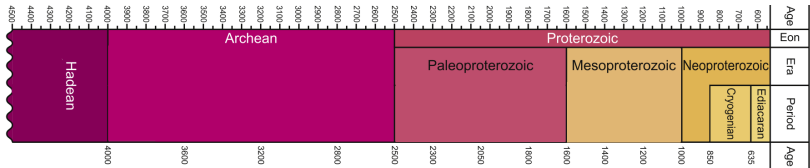


Life in late Precambrian

Cryogenian period and Snowball Earth



Time scale for Precambrian



PRECAMBRIAN



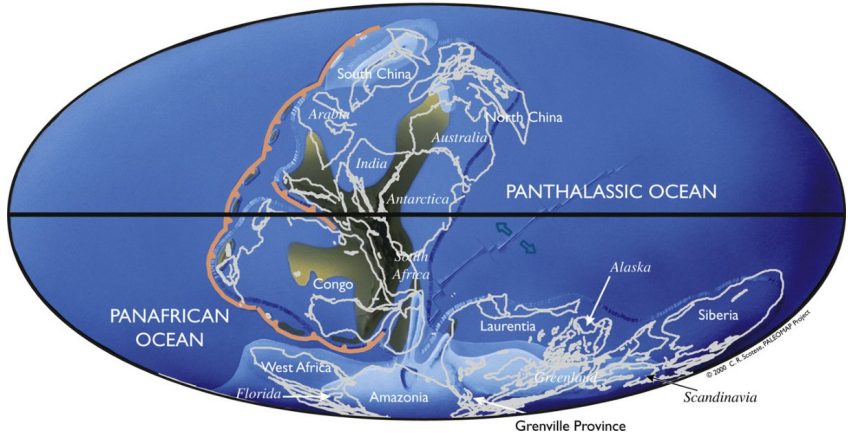
Rodinia—the first super-continent

- Tectonic plates formed (and will form) one continent several times
- 650 Mya this continent—Rodinia was formed right over the South Pole



Cryogenian continents which formed Rodinia

650 Ma Cryogenian



Rodinia: view from South Pole

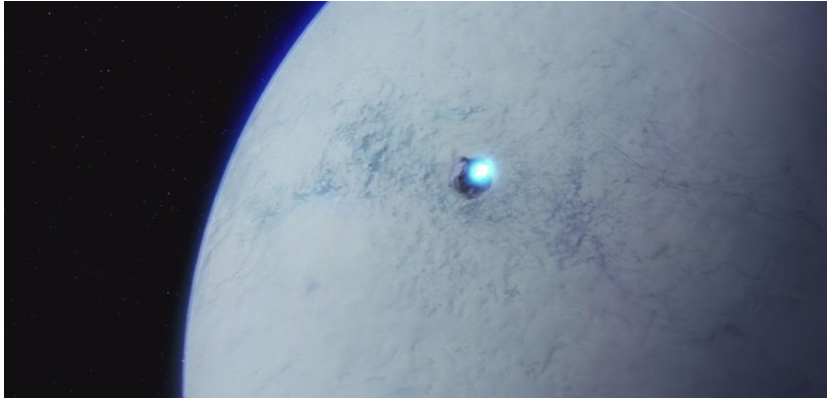


Marionan glaciation: Snowball Earth

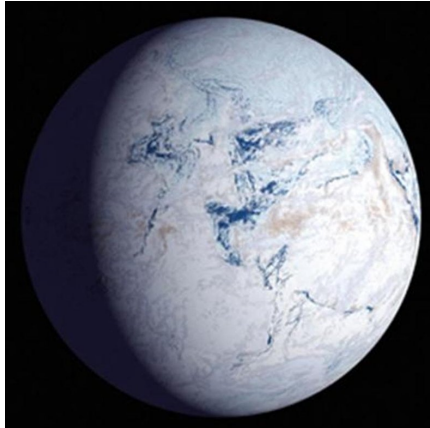
- First global glaciation was started because ice started to concentrate over the pole and increase Earth albedo (this is the positive feedback)
- And because the configuration of continents blocked the equatorial warm current
- And because concentration of oxygen was high but greenhouse gases (like CO_2)—small
- As a result, from time to time Earth was completely covered with ice sheet 1 km tall!



Star Wars Hoth—ice planet



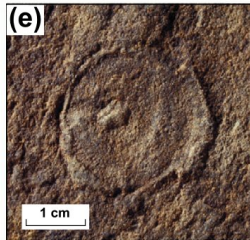
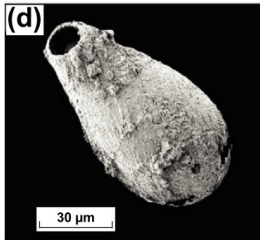
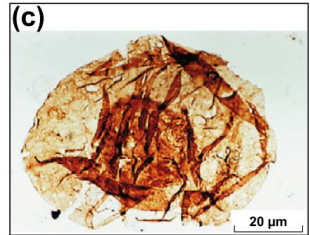
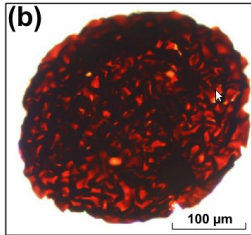
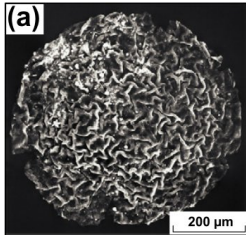
Snowball Earth



The evidence of Marinoan glaciation: diamictite layers everywhere on Earth



Cryogenian fossils

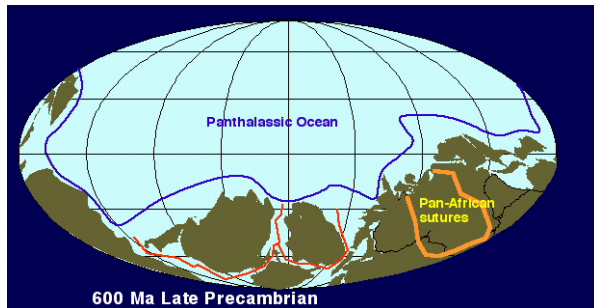


Life in late Precambrian

Ediacarian period and multicellularity



Rodinia breaks



Ediacarian continents

600 Ma Ediacaran

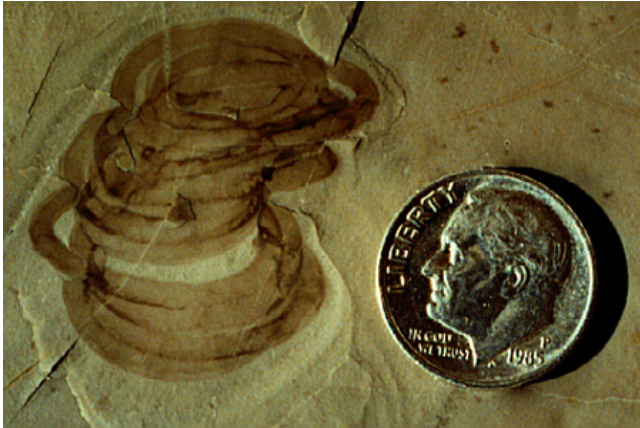


First multicellular life

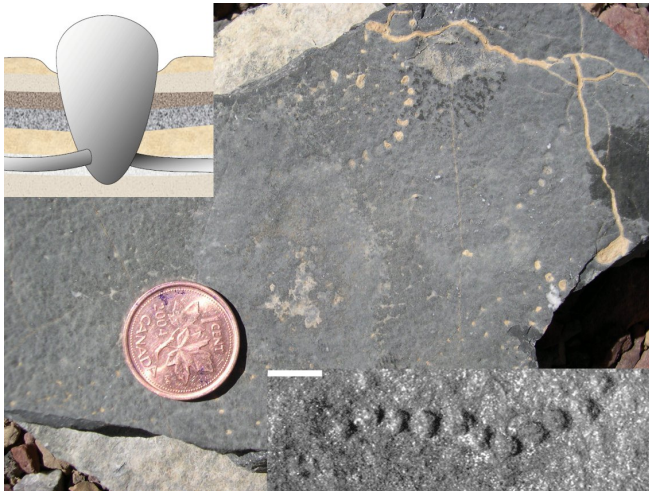
- Apart from enigmatic *Grypania* and *Horodyskia*, multicellular eukaryotes were not known before Ediacarian
- From the beginning of Ediacarian, multicellular Lantian algae were known, and then—fabulous “Ediacara garden”, the fauna of animals without skeleton



Grypania—the first alga?



Horodyskia and its interpretations



Multicellularity and origin of death

- Multicellular assemblages were probably originated from incompletely divided cells
- Initially, those assemblages were only benefit from their size
- Then, they started to use a division of labor: differentiated into somatic and generative cells
- Wheres generative cells are specialized for multiplication and will continue to “live” in next generations, somatic bodies ought to die
- Unicellular living organisms are still potentially immortal



Lantian (China) macroscopic algae

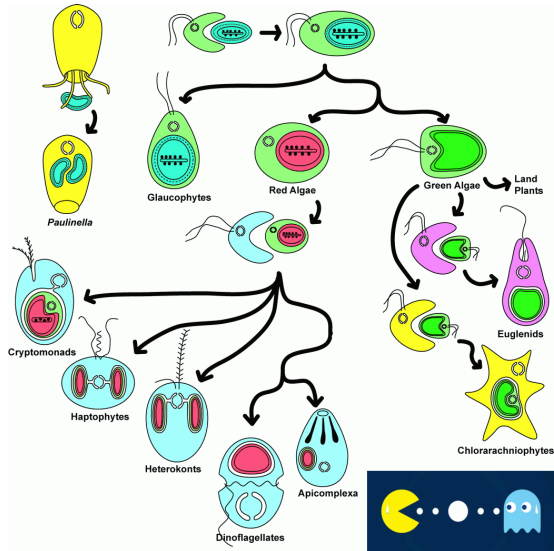


What are algae?

- Eukaryotes which are capable for photosynthesis with chloroplasts
- All chloroplasts were symbiotic (cyanobacteria in the past), and some even secondary symbiotic (other alga in the past)



“Pacman game” of algae origin



Life without animals

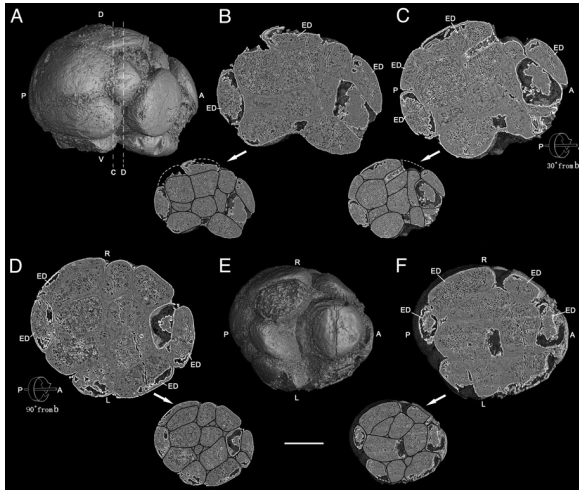


Life in late Precambrian

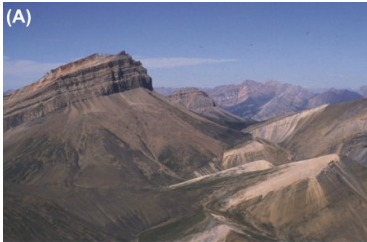
First animals



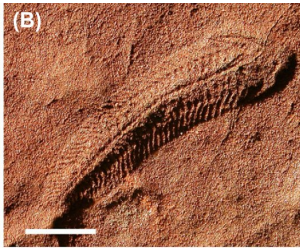
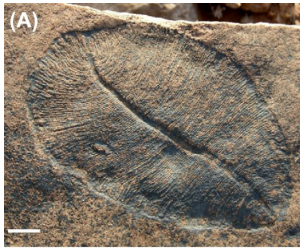
Doushantuo (China) “embryos”—first animals?



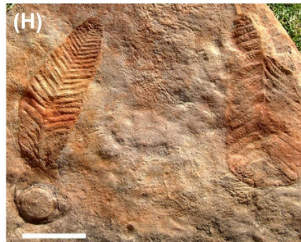
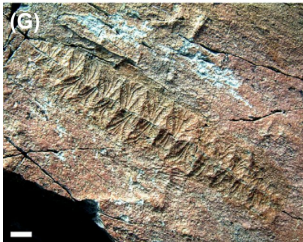
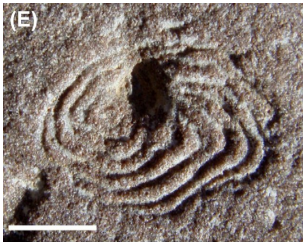
Finding Ediacara biota



Ediacara Garden: *Dickinsonia*, *Spriggina* etc.



Ediacara Garden: *Eoandromeda*, *Charniodiscus* etc.

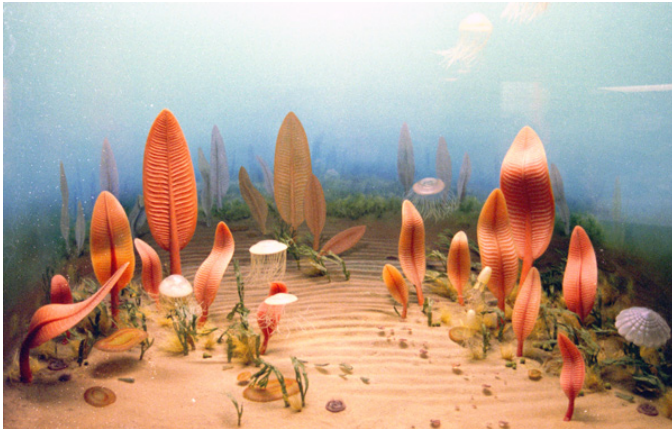


Extant sea pen (Pennatulacea soft corals)



[illegible]

Ediacara “garden”—no predators *of macroscopic size*, nobody had skeleton



Origin of tissues—the most important event in late Precambrian

- Tissues are assemblages of similar cells doing the similar job
- Tissues are one level more over the eukaryotic cells
- Multicellular animals also have multiple tissues whereas multicellular algae and cyanobacteria are still on pre-tissues level of complexity
- Multi-tissued body is a great achievement, except for cancer...



Summary

- In Cryogenian, Marinoan glaciation covered the whole Earth
- In Ediacarian, multicellular and then multi-tissued eukaryotes appeared



For Further Reading



[Ediacara biota.](http://en.wikipedia.org/wiki/Ediacara_biota)

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