

Biogeography. Lecture 4

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Outline

Basics of physical geography

Basics of climatology

Palaeogeography

Geological time

Plate tectonics



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Basics of physical geography

Basics of climatology

Palaeogeography

Geological time

Plate tectonics

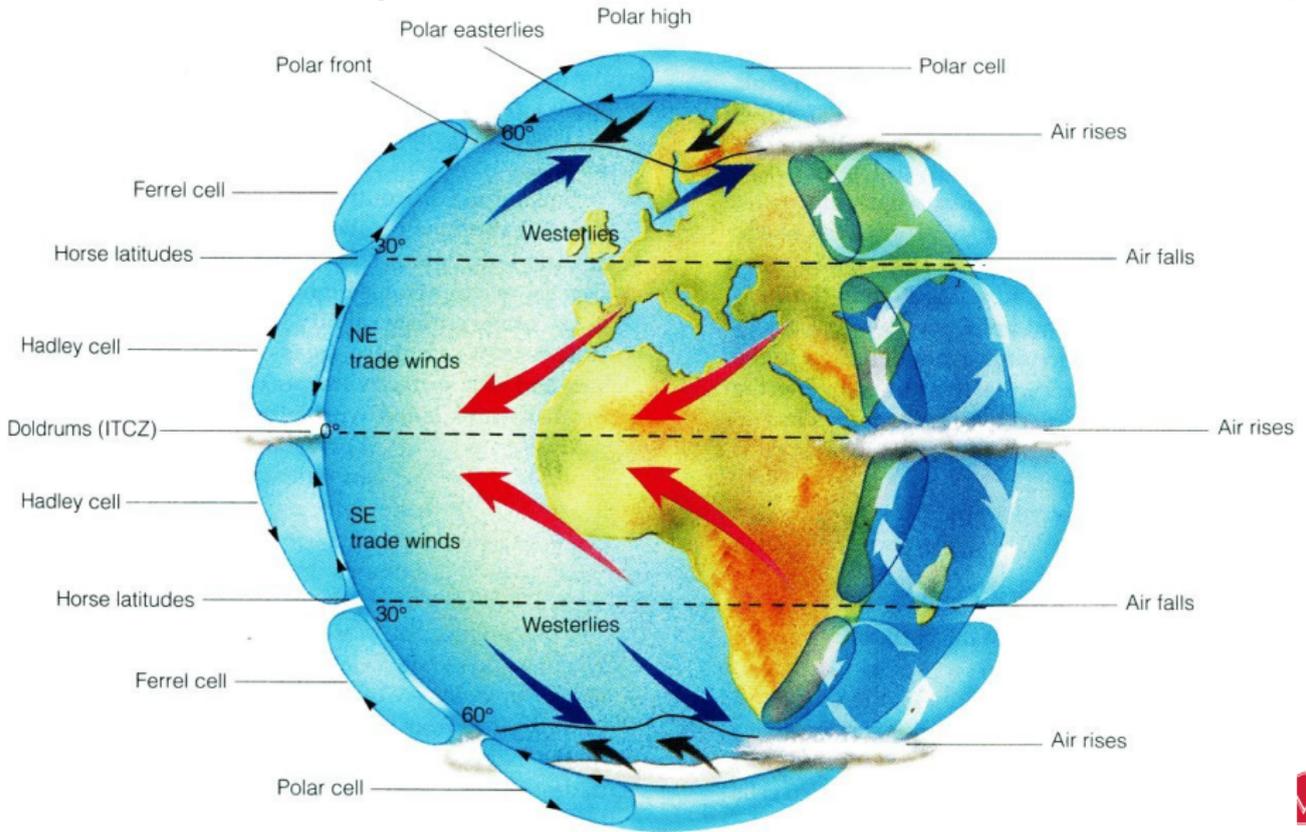


Basics of physical geography

Basics of climatology



Idealized atmospheric circulation on Earth (with labels)



Seasons

- ▶ Temperature seasons: axial, not orbital effects
- ▶ Tropical wet seasons (monsoons) are related with temperature seasons and circulation



Climates

- ▶ Geographical zones: arctic, temperate and tropical
- ▶ Koeppen climates: A, tropical; B, dry; C, mild mid-latitude; D, cold mid-latitude; and E, polar

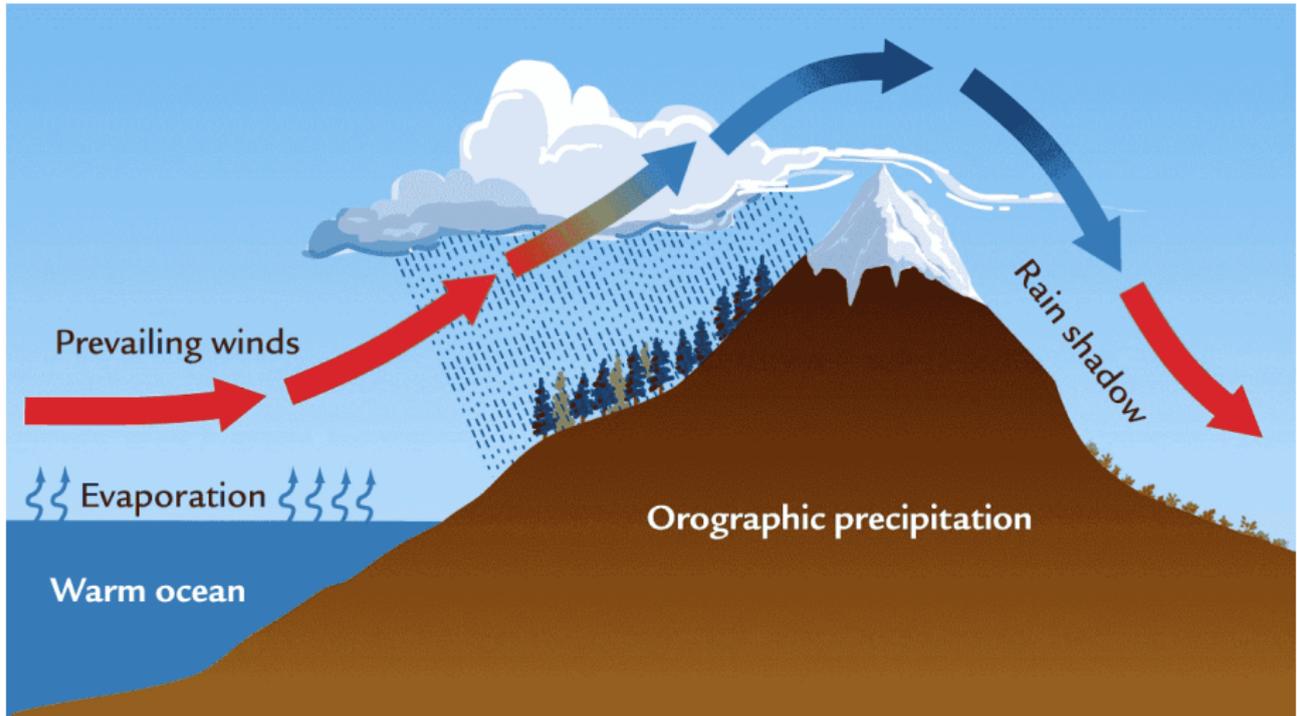


Climate and altitude

- ▶ Sea warming and rain shadow
- ▶ Altitudinal zones: lowland, montane, subalpine, alpine and snow



Sea warming and rain shadow

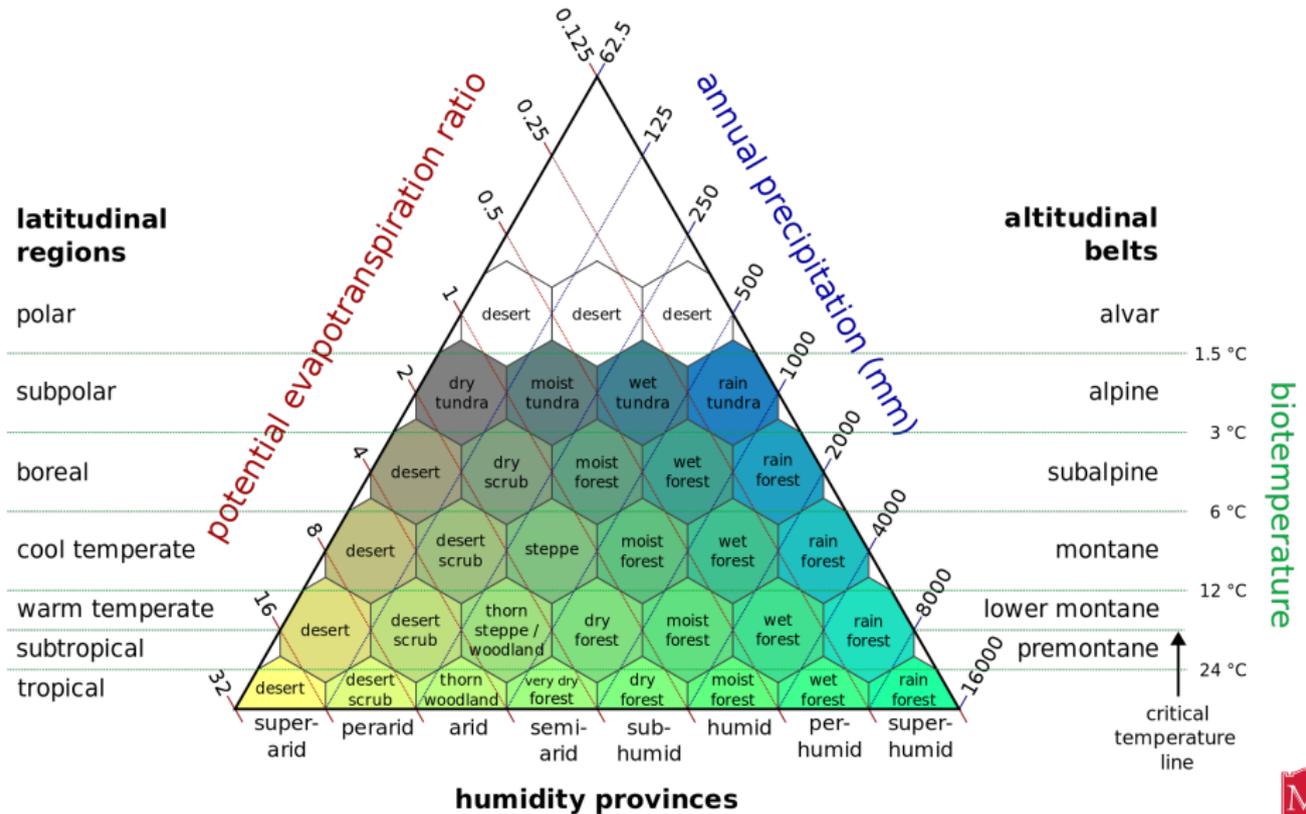


Climate and life

- ▶ Life zones are basing on temperature and precipitation
- ▶ Ideal continent



Holdridge life zones



biotemperature



Palaeogeography

Geological time



First attempts to calculate age of Earth

- ▶ Helmholtz (1853) calculated that if Sun is shrinking to obtain the energy, then the age of Earth should not exceed 18 My (millions of years, 18,000,000 years)
- ▶ Lyell (1830) calculated that if the speed of sedimentation was the same in the past, then age of Earth should be approximately 200 My



Use of radioactivity

- ▶ In 1896, Becquerel discovered radioactivity. It was found that some atoms are constantly breaking into smaller ones, sometimes with very slow speed
- ▶ Consequently, it is possible can calculate the age of mineral from the concentration of radioactive elements

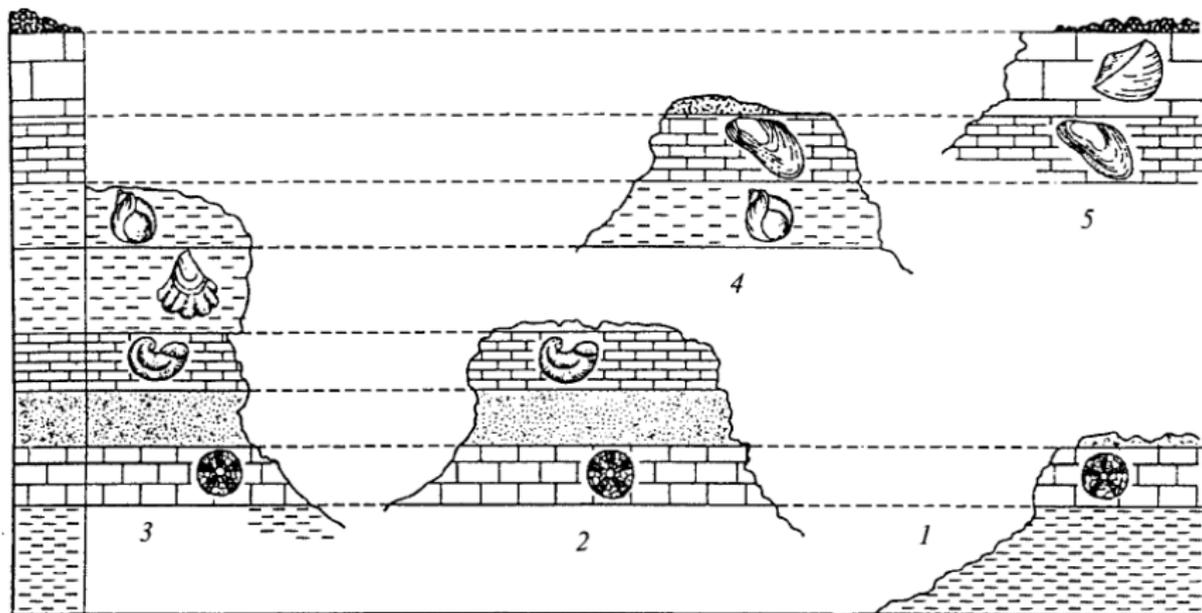


Stratigraphy

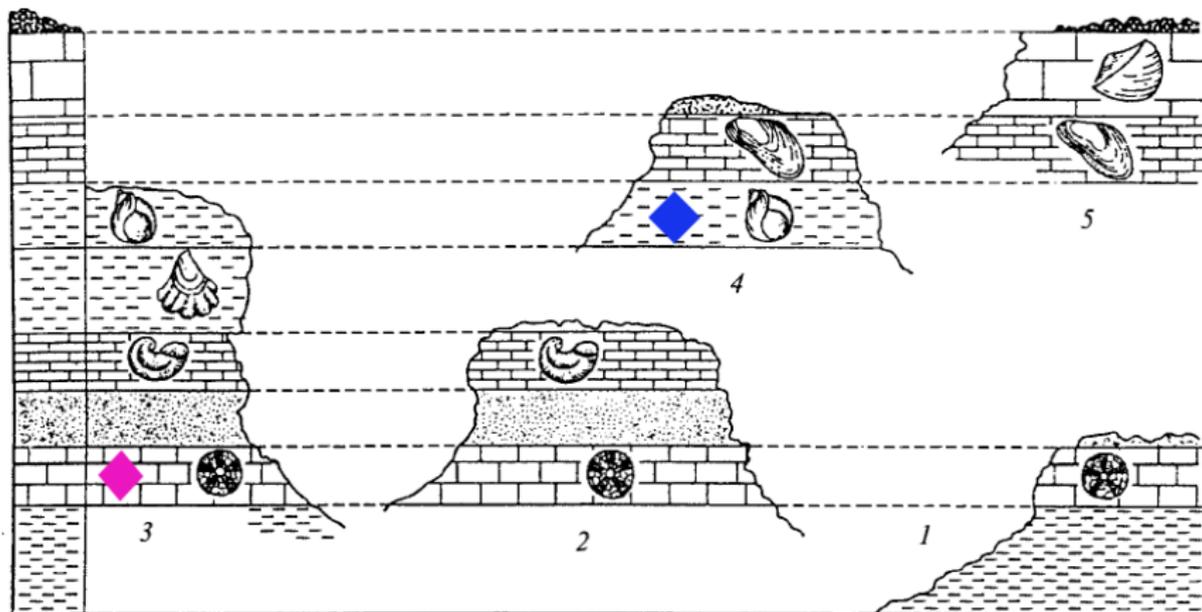
- ▶ Upper layers are younger than lower
- ▶ Two layers contained similar species of fossils have the same time of origin



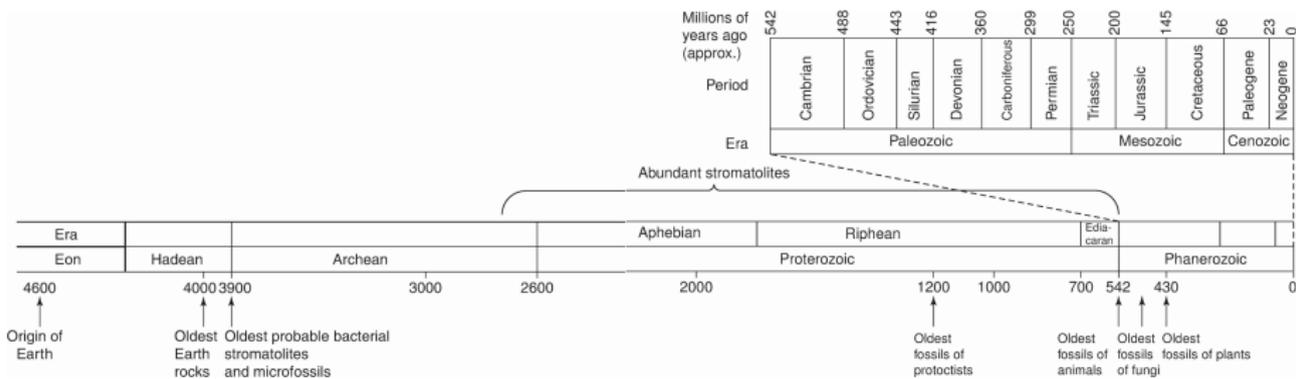
How stratigraphy works



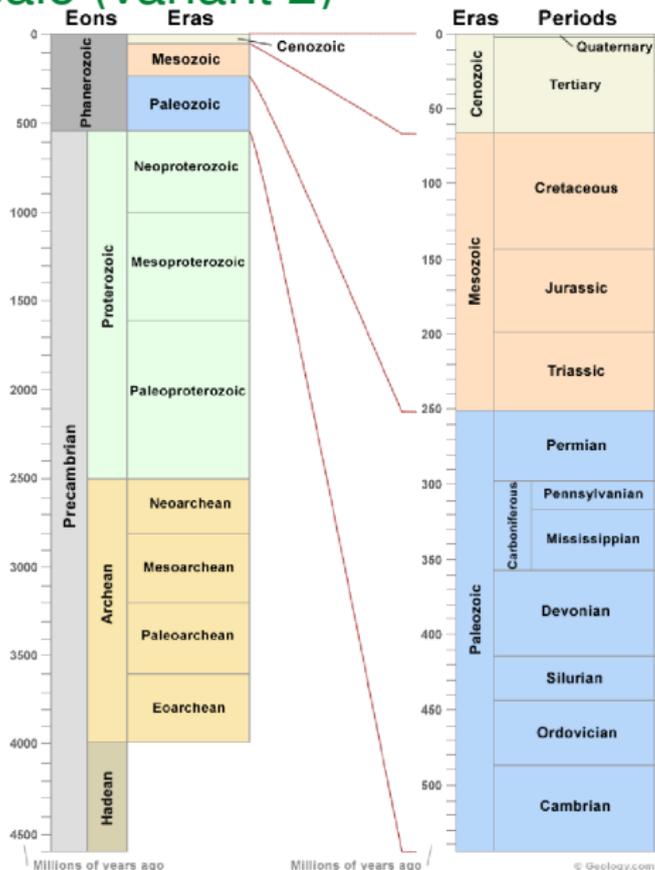
Stratigraphy and radioactivity work together



Geological scale



Geological scale (variant 2)



Palaeogeography

Plate tectonics



Continental drift

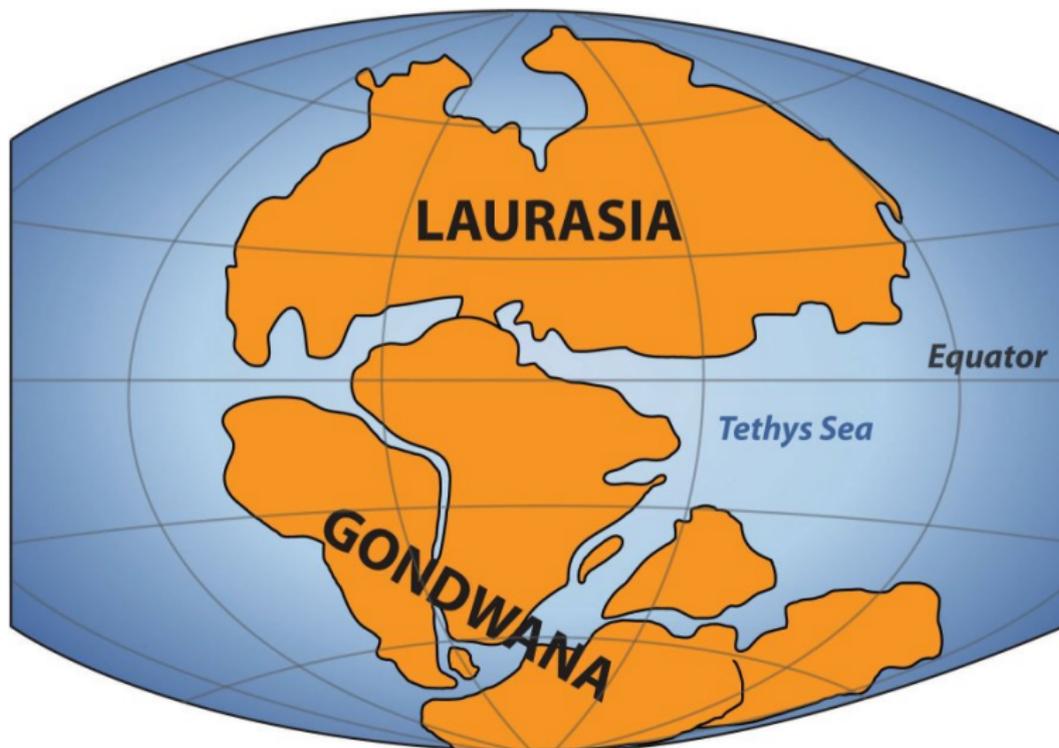
- ▶ In 1921, Alfred Wegener invented the idea that South America and Africa were parts of one big continent—Gondwana.
- ▶ According to Wegener, in the end of Paleozoic era, there were two big continents—Gondwana and Laurasia separated by Tethys ocean
- ▶ Before that, all continents were united in one—Pangaea surrounded by one big ocean.



One of Vegener's arguments



Laurasia and Gondwana



Pangaea



Mantle convection

- ▶ The driving force of floating continents is a **mantle convection**
- ▶ In ocean ridges, new ocean cortex is constantly forming and expanding
- ▶ In ocean trenches and continental ridges, different plates are colliding and often forming mountains



Summary

- ▶ Temperature seasons: axial, not orbital effects
- ▶ Tropical wet seasons (monsoons) are related with temperature seasons and circulation
- ▶ Geological time is calculated on the basis of both relative (stratigraphy) and absolute (radioactivity) methods
- ▶ Continents of Earth are constantly changing their position due to the mantle convection (“plate tectonics”)
- ▶ In the past (Permian period) all continents formed super-continent Pangaea, which then broke into Laurasia and Gondwana



For Further Reading



A. Shipunov.

Biogeography [Electronic resource].

2014—onwards.

Mode of access:

http://ashipunov.info/shipunov/school/biol_330



Major circles of latitude.

http://en.wikipedia.org/wiki/Circle_of_latitude



Atmospheric circulation.

[http:](http://en.wikipedia.org/wiki/Atmospheric_circulation)

[//en.wikipedia.org/wiki/Atmospheric_circulation](http://en.wikipedia.org/wiki/Atmospheric_circulation)

