Supercontinents and Superplumes

in the Precambrian

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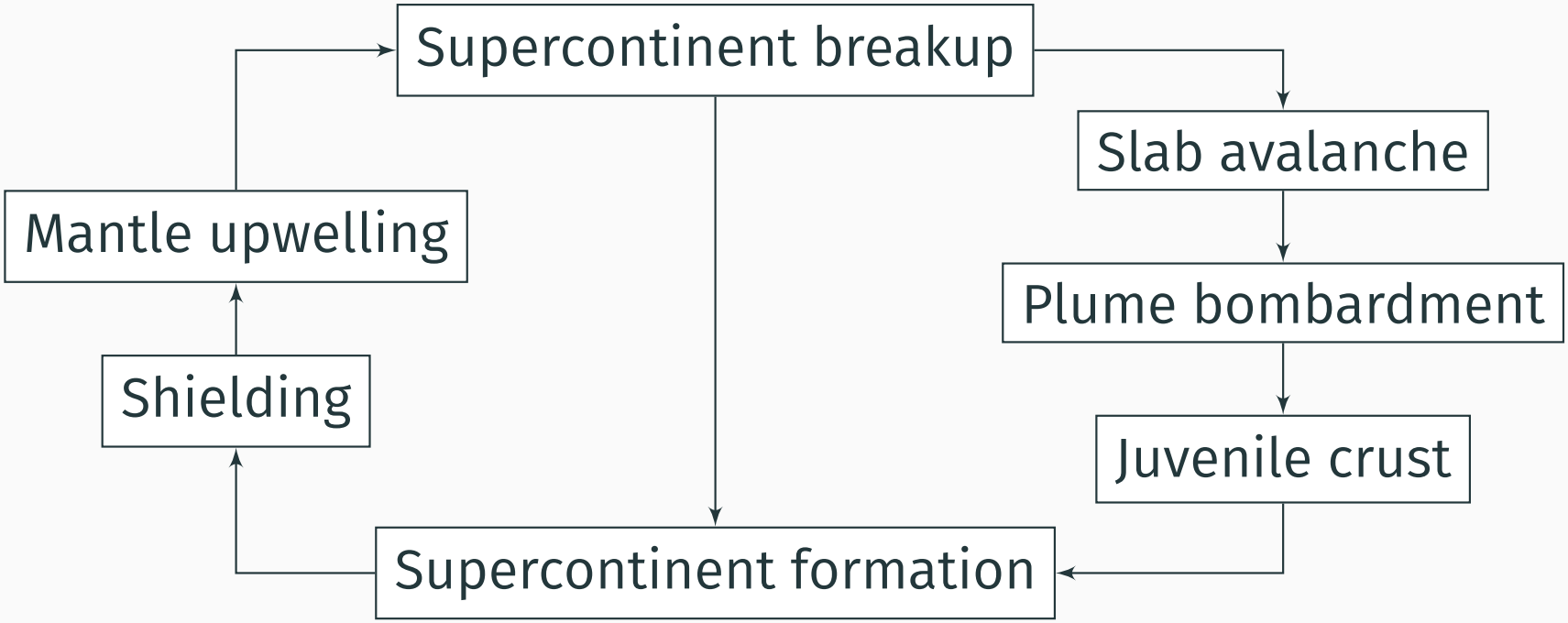
Supercontinents



A supercontinent is the assembly of most or all of Earth's cratons to form a single large landmass.

Superplumes

A mantle plume is an upwelling of abnormally hot rock within the Earth's mantle.

A superplume event is a short lived mantle plume event during which several plumes rose to the base of lithosphere.

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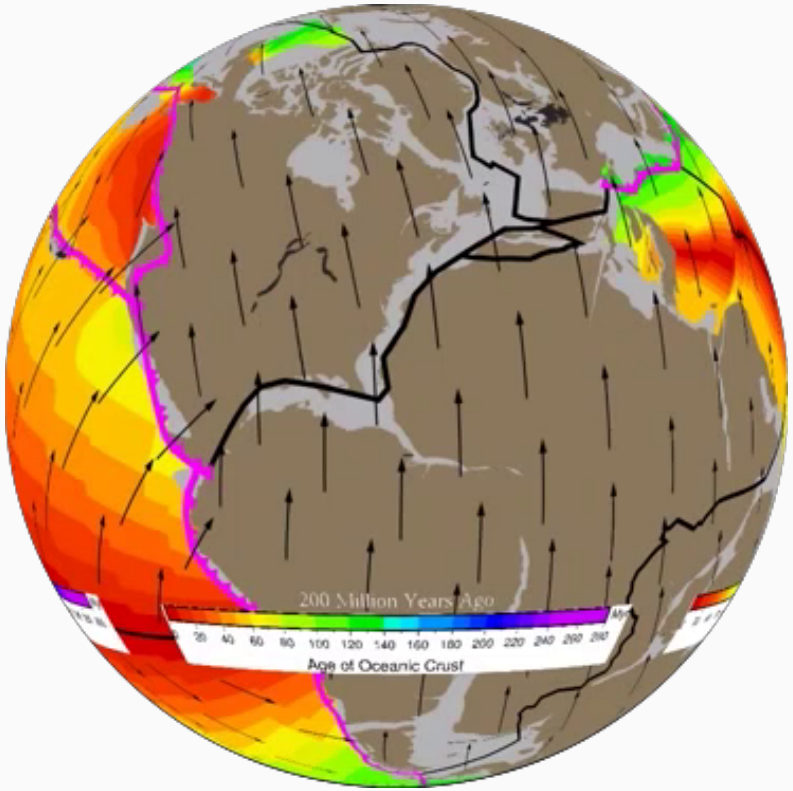
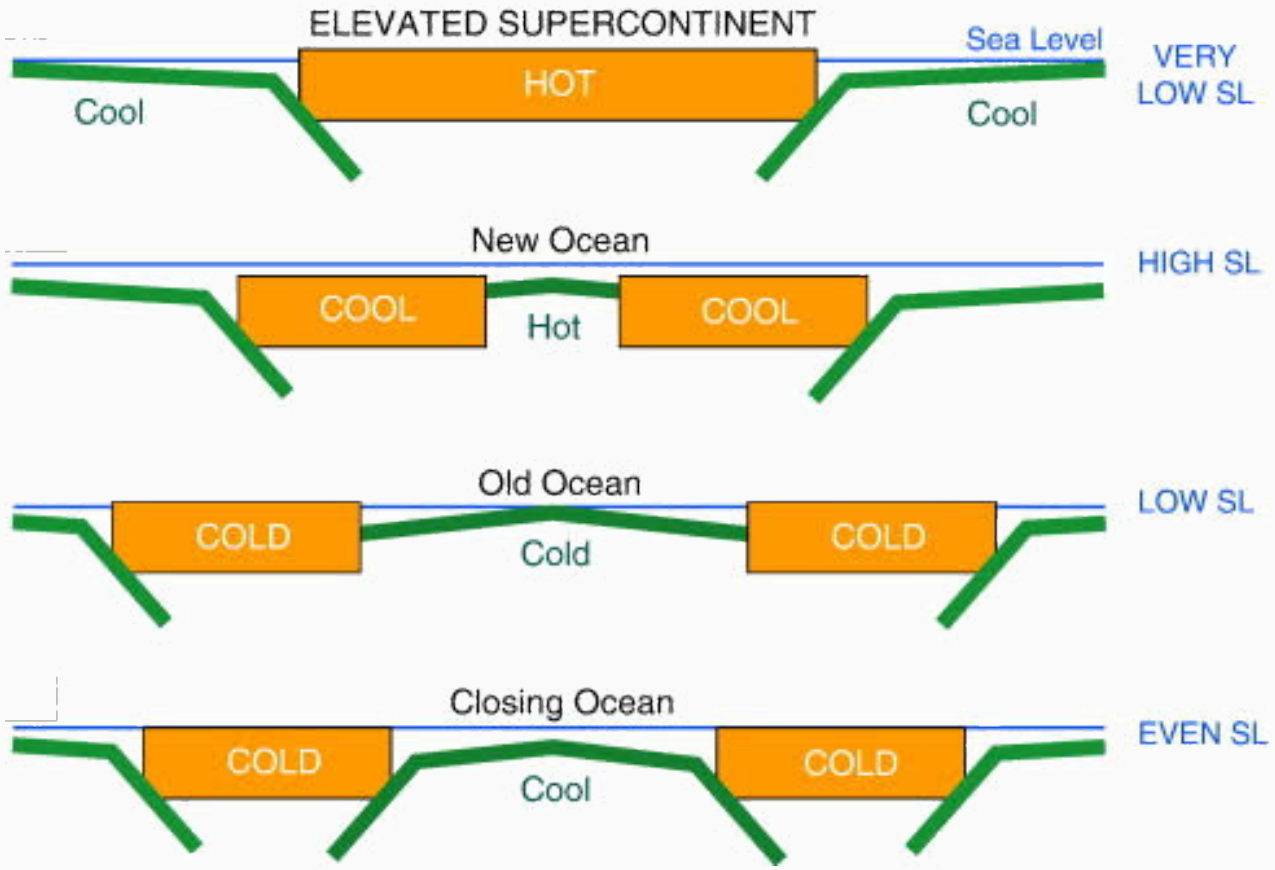
Short lived = less than 100 million years

Plate spreading



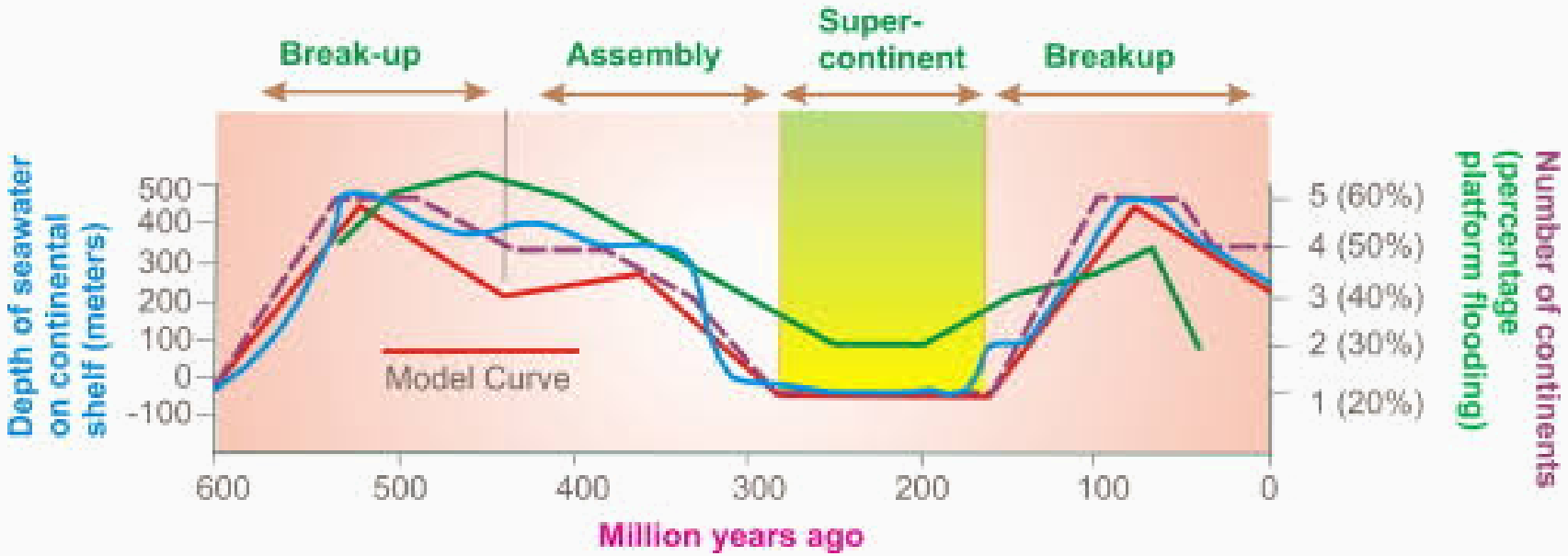
Superplumes increase plate tectonic activity, hence the *plate spreading* rate increases tremendously.

Sealevels



supercontinent $\Longrightarrow$ lots of old seafloor $\Longrightarrow$ low sea level

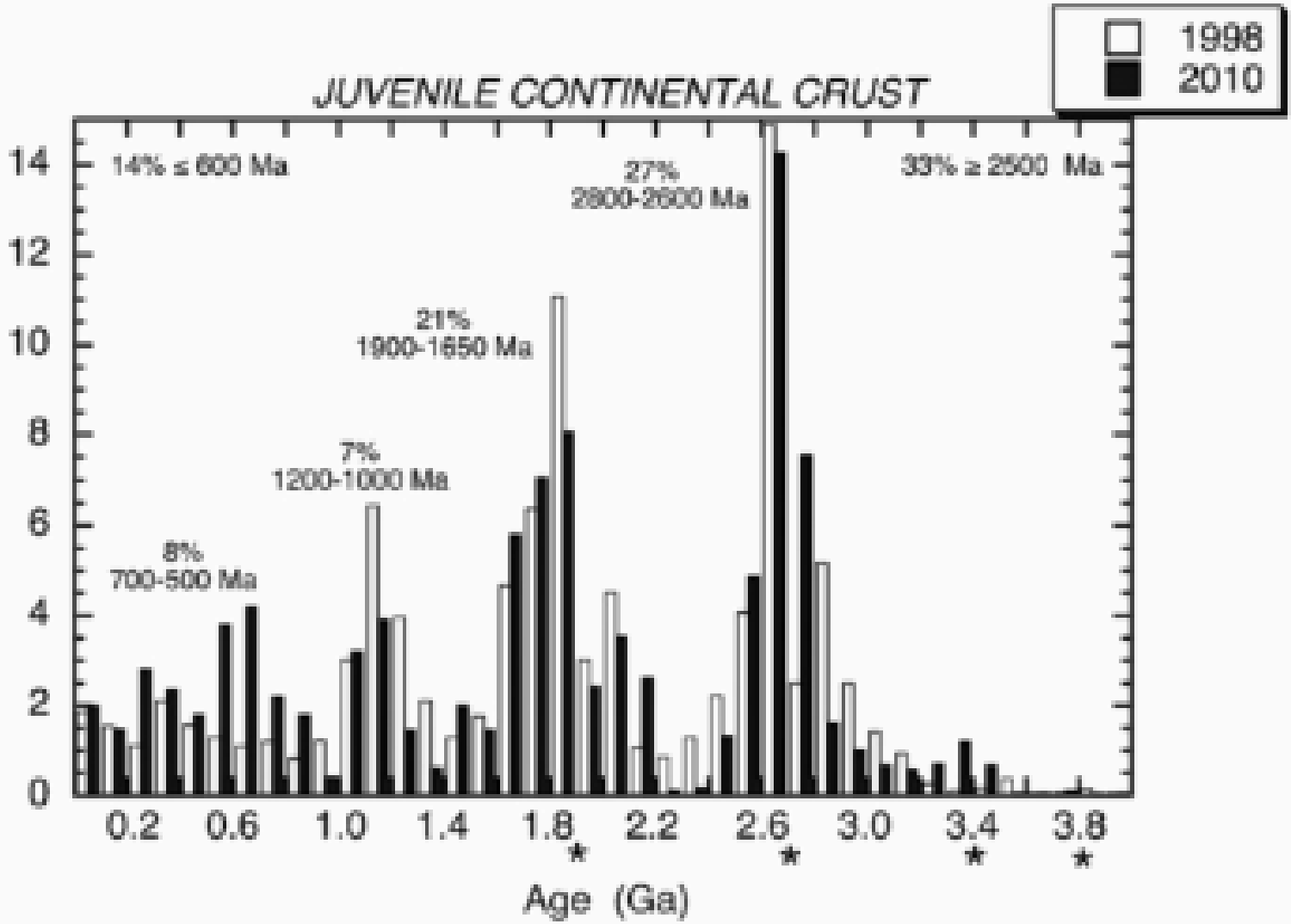
Supercontinent cycle *vs* sealevel



Evidence for superplume events

- Increase in *surface temperature*.
- Deposition of black shale sediments with *elevated* $\delta^{13}C$ in sea water.
- Increased production of *juvenile crust*.
- Rise in *sea level*.

Juvenile crust



Carbon reservoirs

Pool	Quantity (gigatons)
Atmosphere	720
Biosphere	2,000
Oceans	3,840
Fossil fuels	4,130
Lithosphere	75,000,000

Supercontinent cycle *vs* carbon cycle

Supercontinent breakup

- Tectonic plates get *subducted* with lots of carbon deposits.
- *Volcanism* at mid-oceanic ridges releases CO_2.
- Continental rift systems also release CO_2.

Supercontinent cycle *vs* carbon cycle

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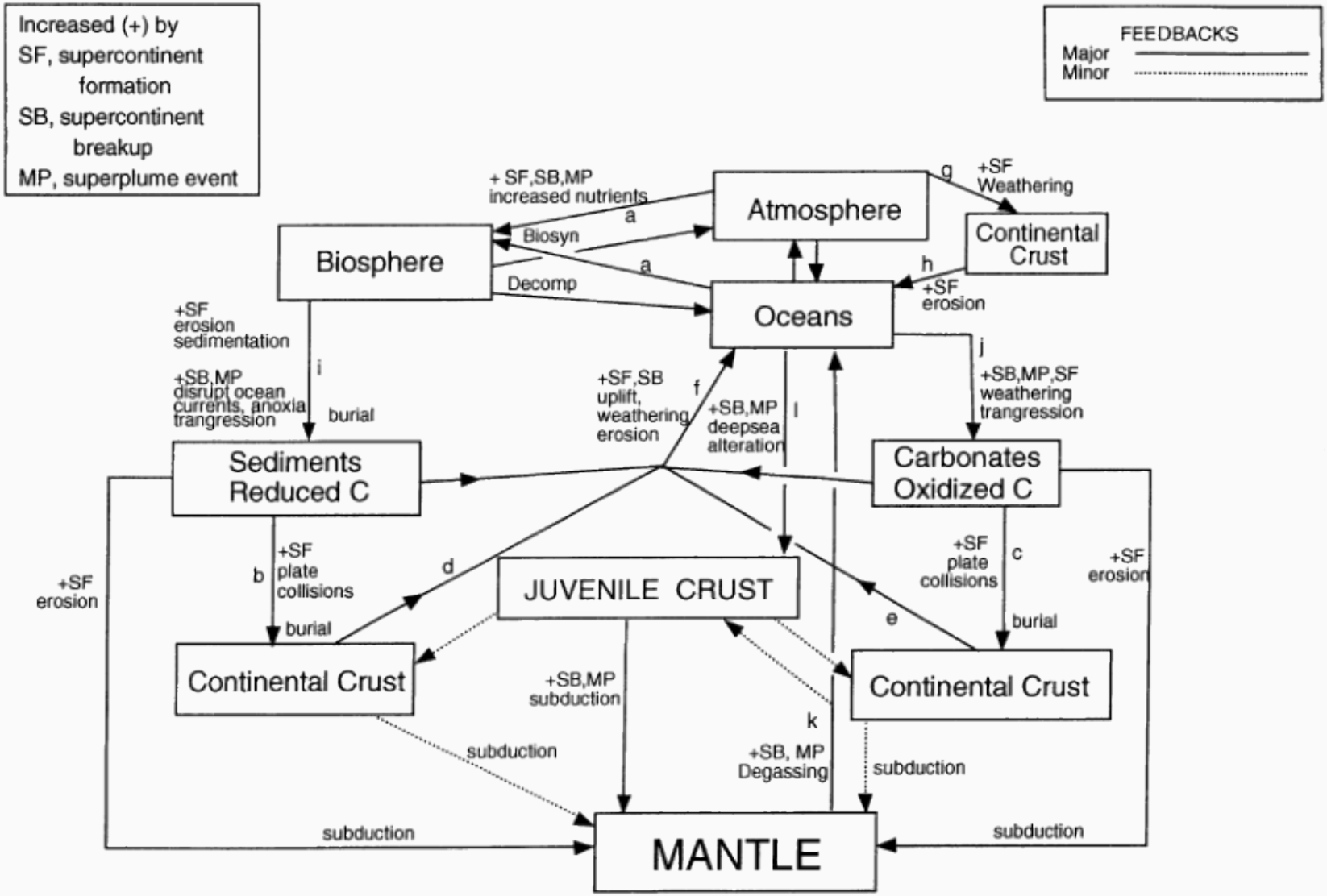
Supercontinent formation

- *Collision of plates* destroys rocks containing carbonates.
- *Surface area* of the supercontinent increases, hence weathering of rocks lowers CO_2 levels.

Supercontinent cycle *vs* carbon cycle

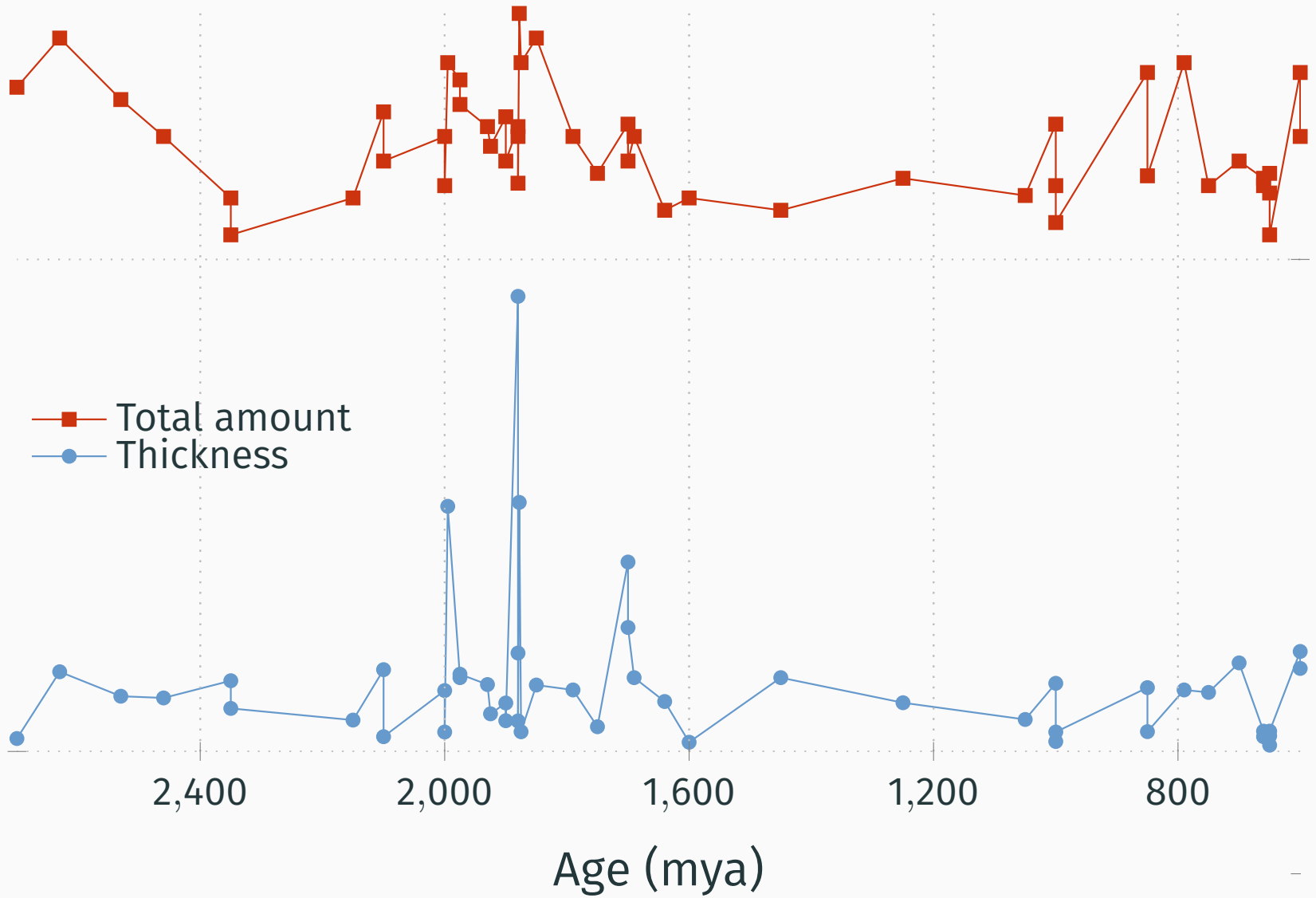


Black shale

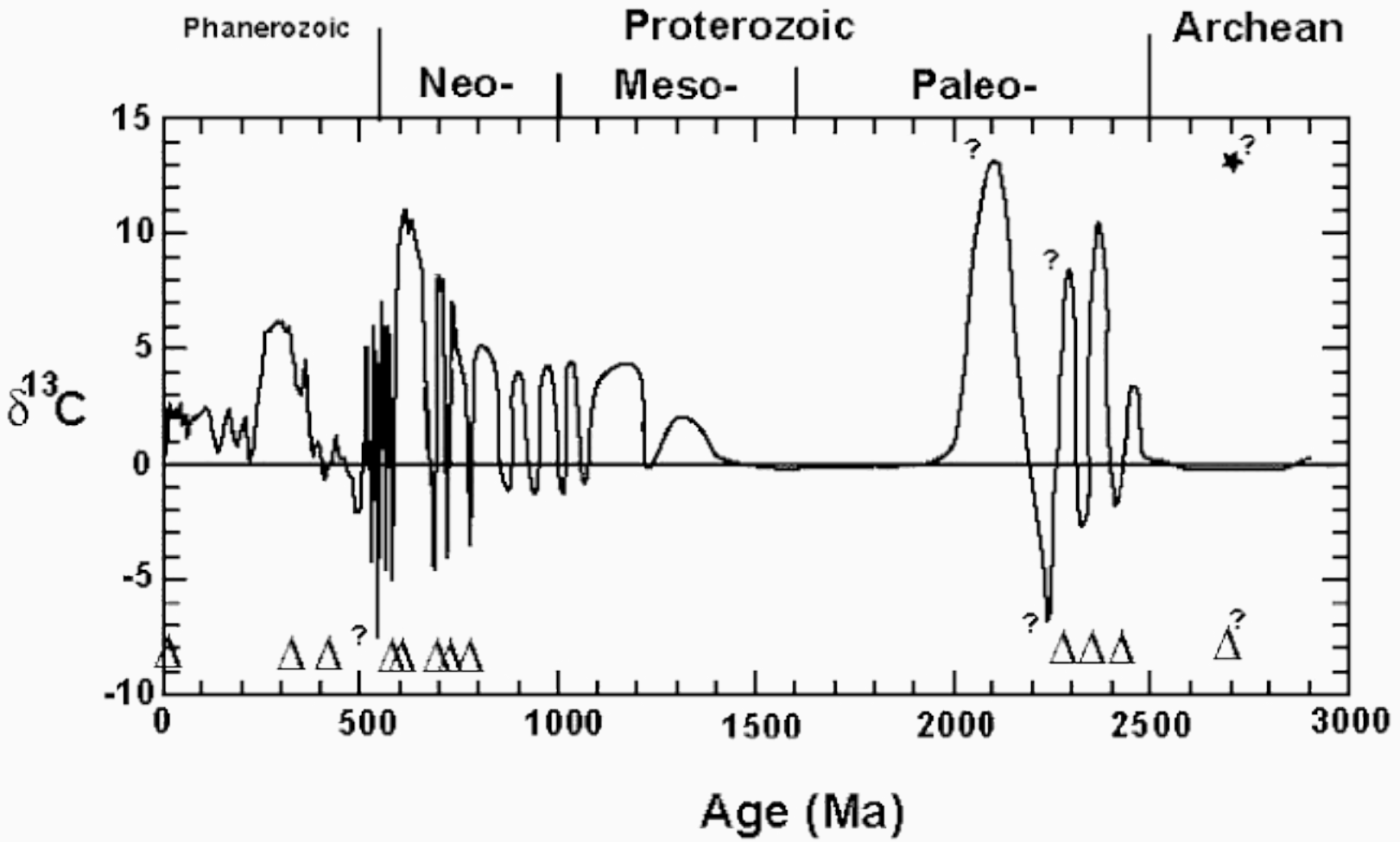
Black shale is a fine grained, sedimentary rock.

It is formed in *anoxic* and *reducing* environments.

Black shale deposits in the Precambrian



$\delta^{13}C$ in black shale



Thank you!

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Questions?