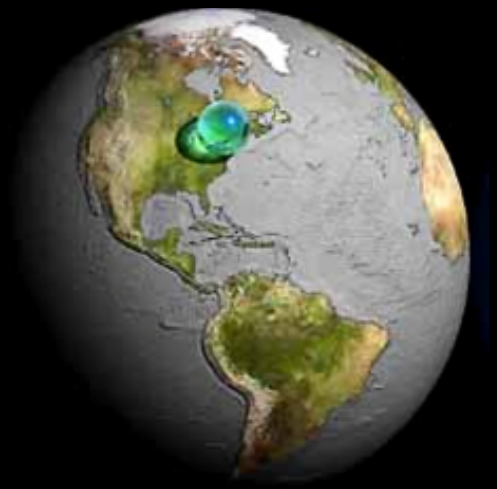
Evolution of the Biosphere

Okala Practitioner Chapter 17

The Biosphere

The biosphere consists of the thin twelve-mile thick layer, comprised of the Earth's crust (the lithosphere), the thin layer of atmosphere and the thinner yet layer of the waters (the hydrosphere).



The volume of all water on the Earth compared to the volume of rock.

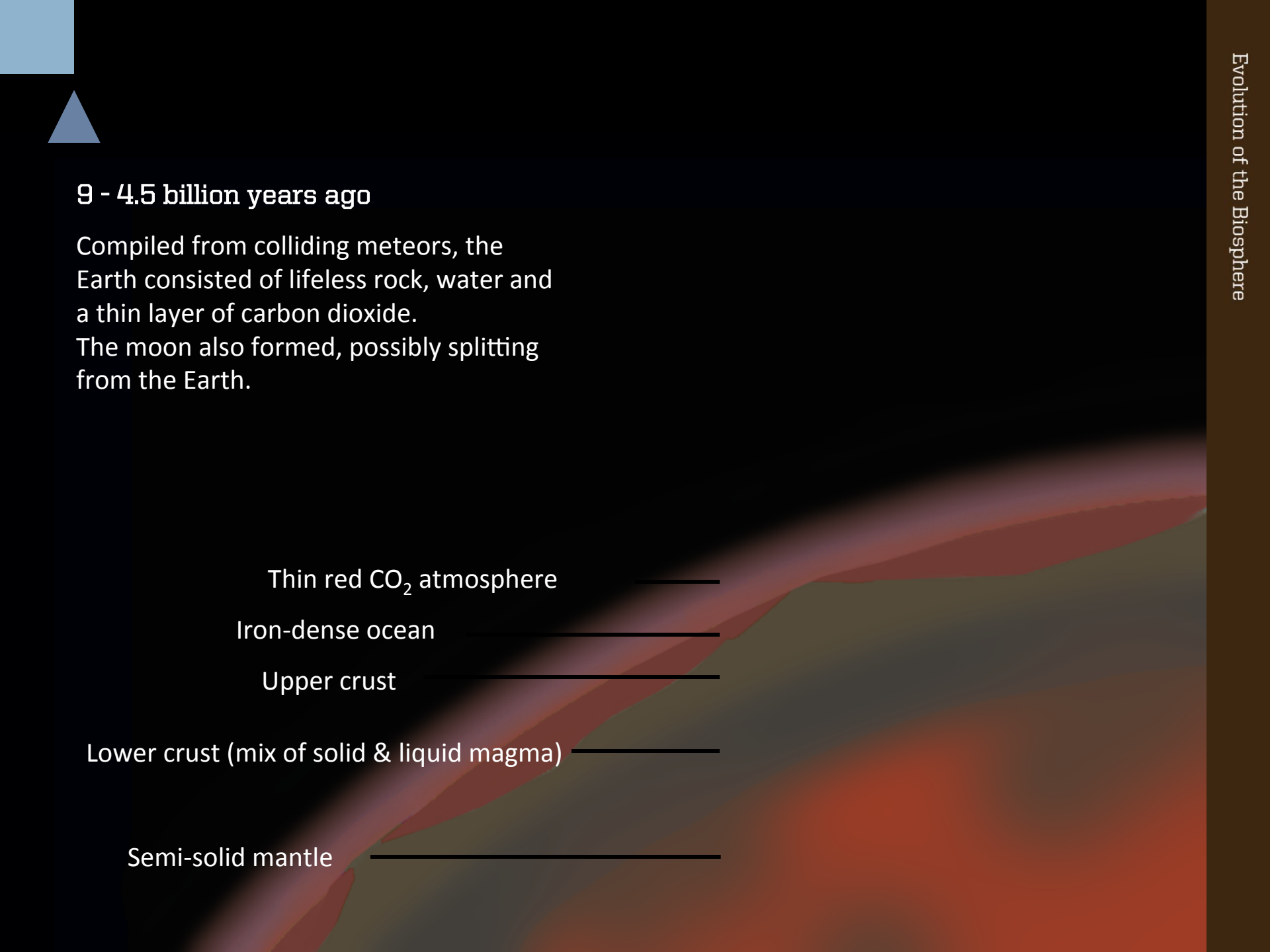
The volume of all air on the Earth compared to the volume of rock.

Evolution of the Biosphere

The biosphere has evolved gradually over roughly five billion years. The following sequence summarizes this evolutionary process.

9 - 4.5 billion years ago

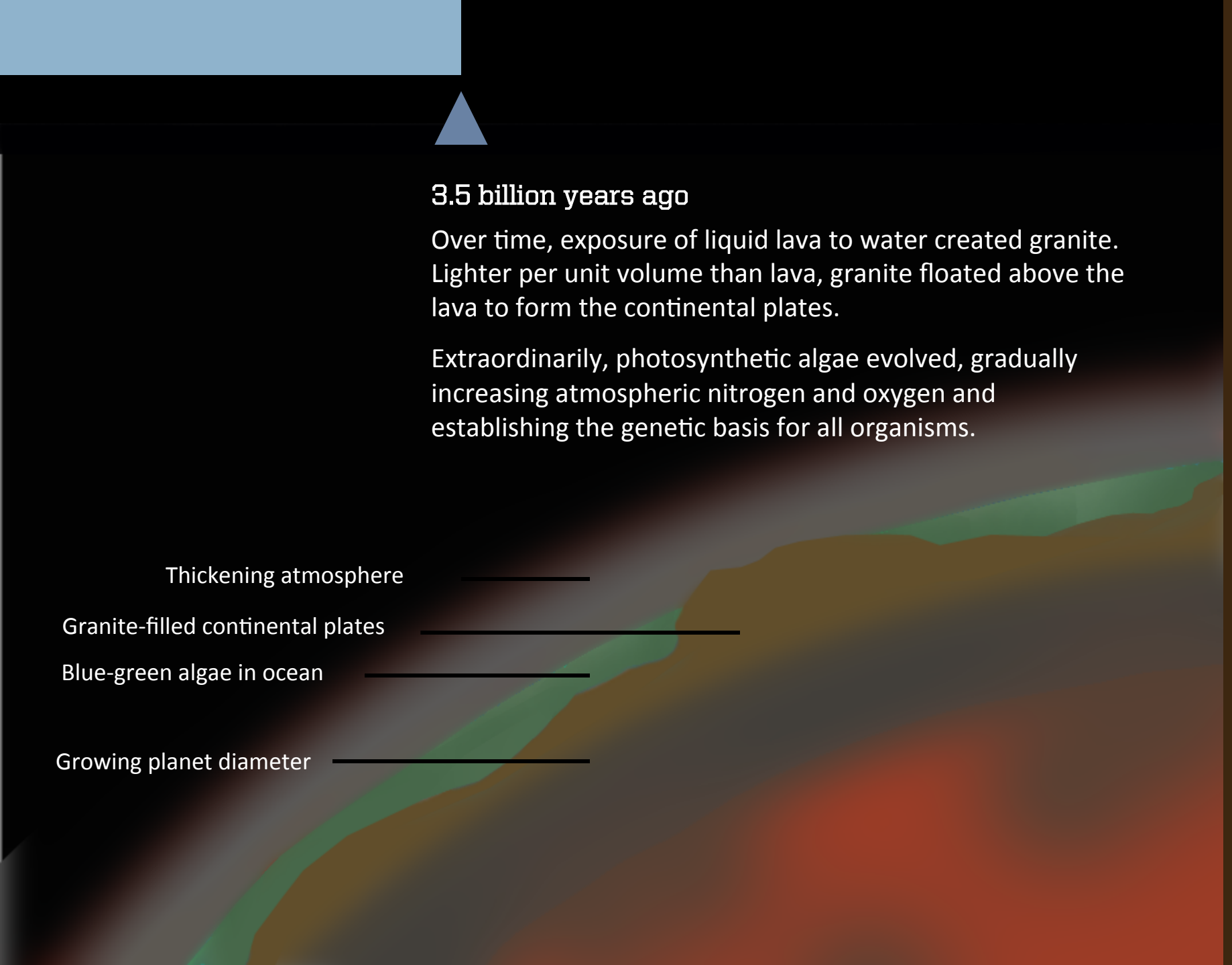
Compiled from colliding meteors, the Earth consisted of lifeless rock, water and a thin layer of carbon dioxide.
The moon also formed, possibly splitting from the Earth.



3.5 billion years ago

Over time, exposure of liquid lava to water created granite. Lighter per unit volume than lava, granite floated above the lava to form the continental plates.

Extraordinarily, photosynthetic algae evolved, gradually increasing atmospheric nitrogen and oxygen and establishing the genetic basis for all organisms.

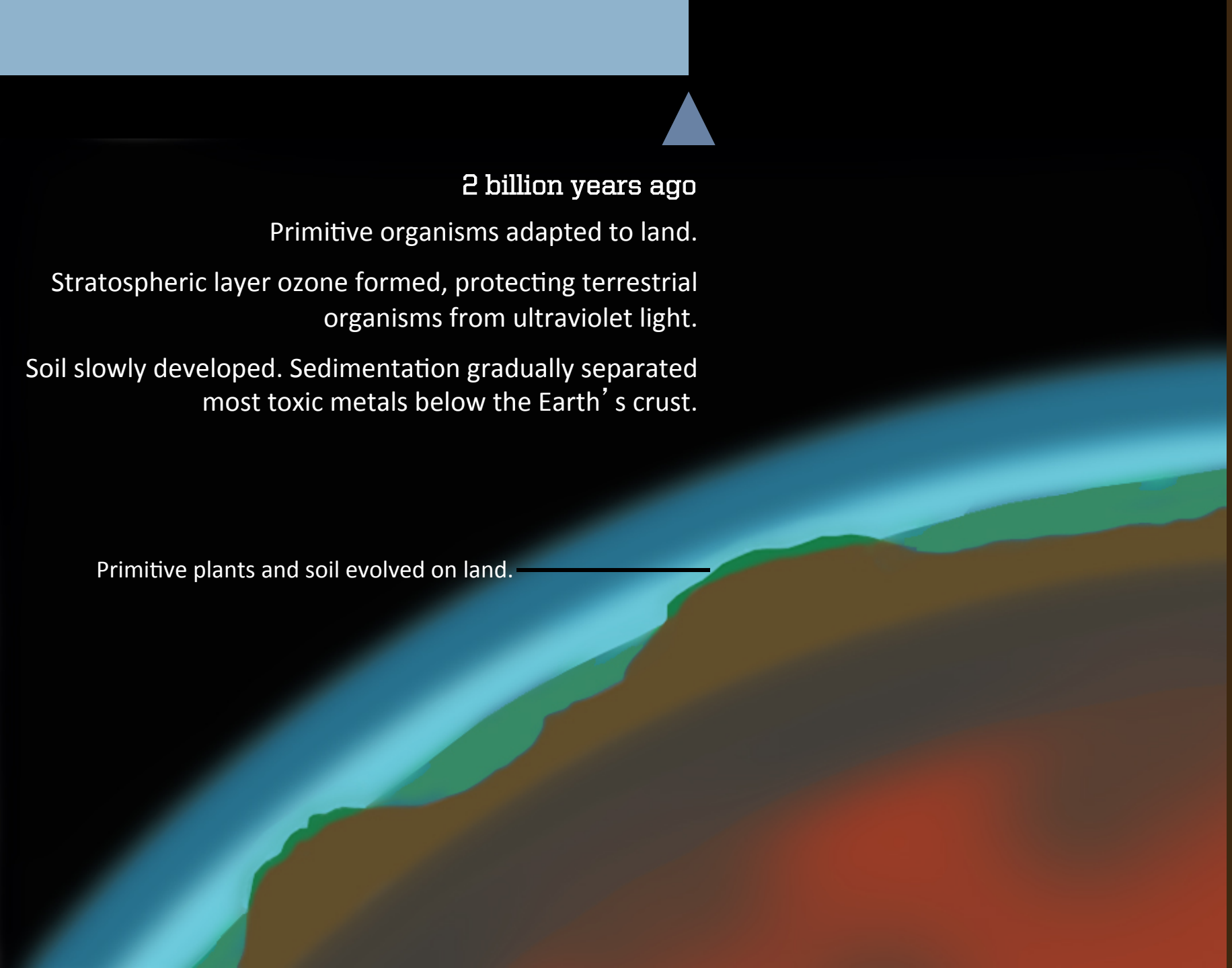


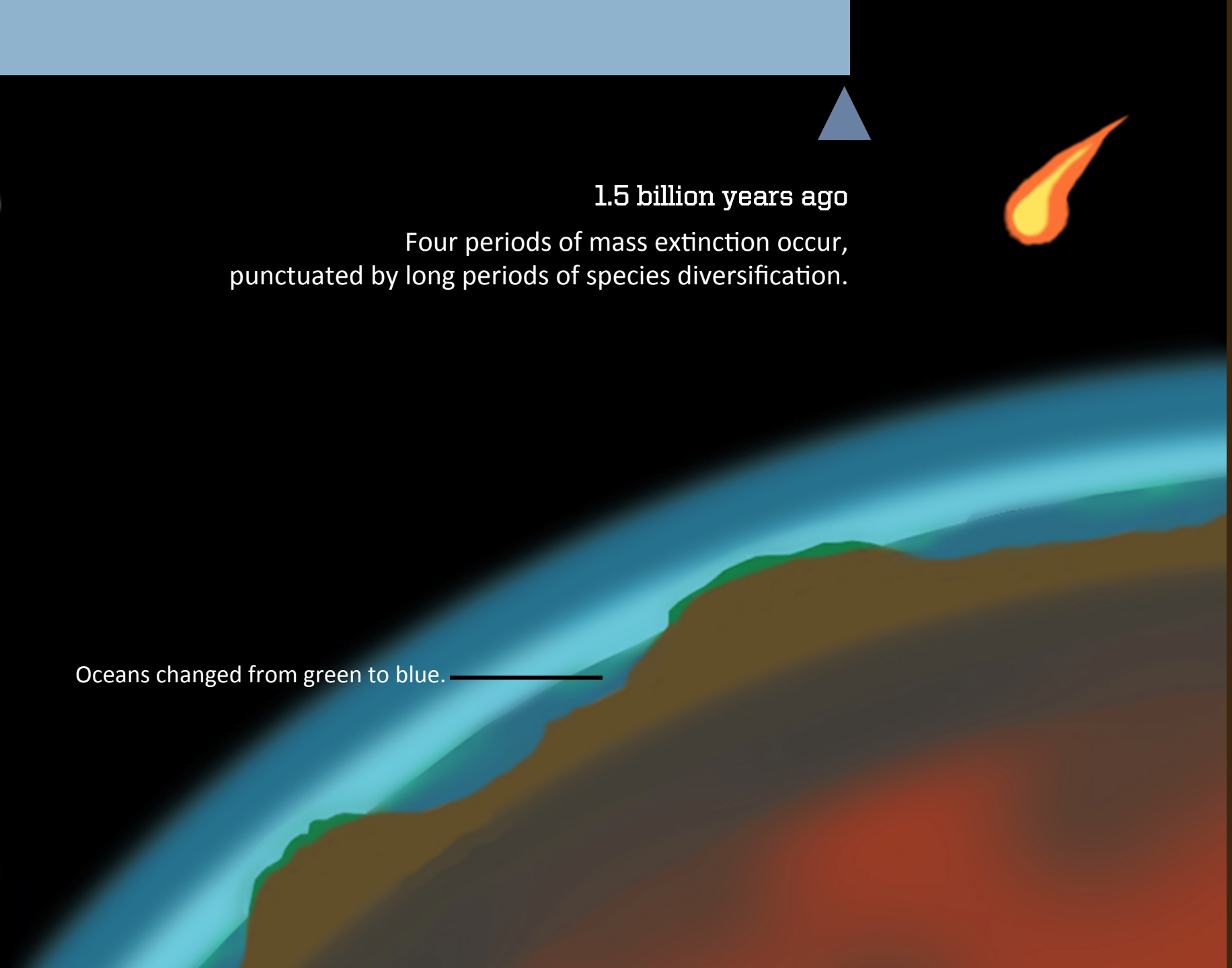
2 billion years ago

Primitive organisms adapted to land.

Stratospheric layer ozone formed, protecting terrestrial organisms from ultraviolet light.

Soil slowly developed. Sedimentation gradually separated most toxic metals below the Earth's crust.





1.5 billion years ago

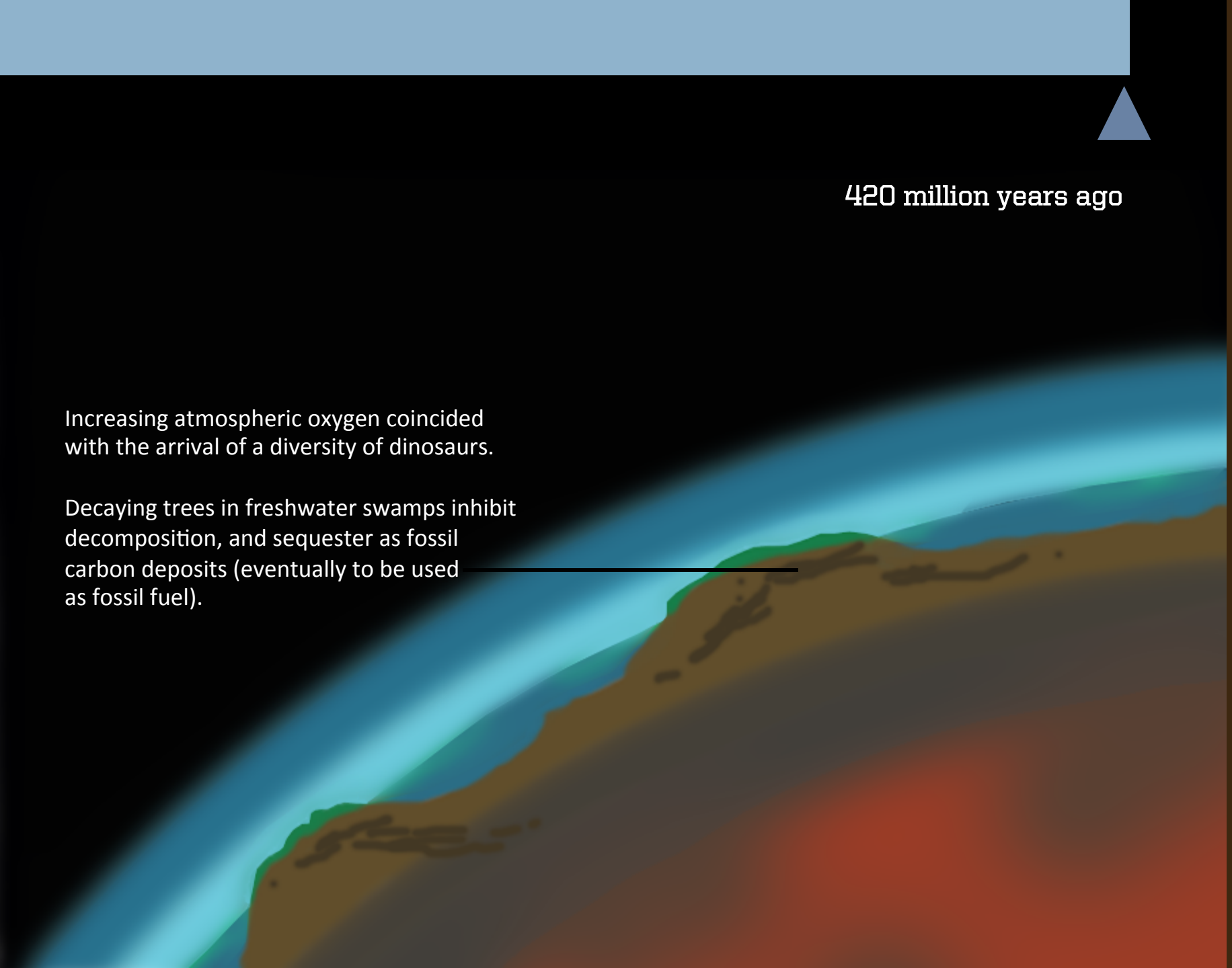
Four periods of mass extinction occur, punctuated by long periods of species diversification.

Oceans changed from green to blue.

420 million years ago

Increasing atmospheric oxygen coincided with the arrival of a diversity of dinosaurs.

Decaying trees in freshwater swamps inhibit decomposition, and sequester as fossil carbon deposits (eventually to be used as fossil fuel).

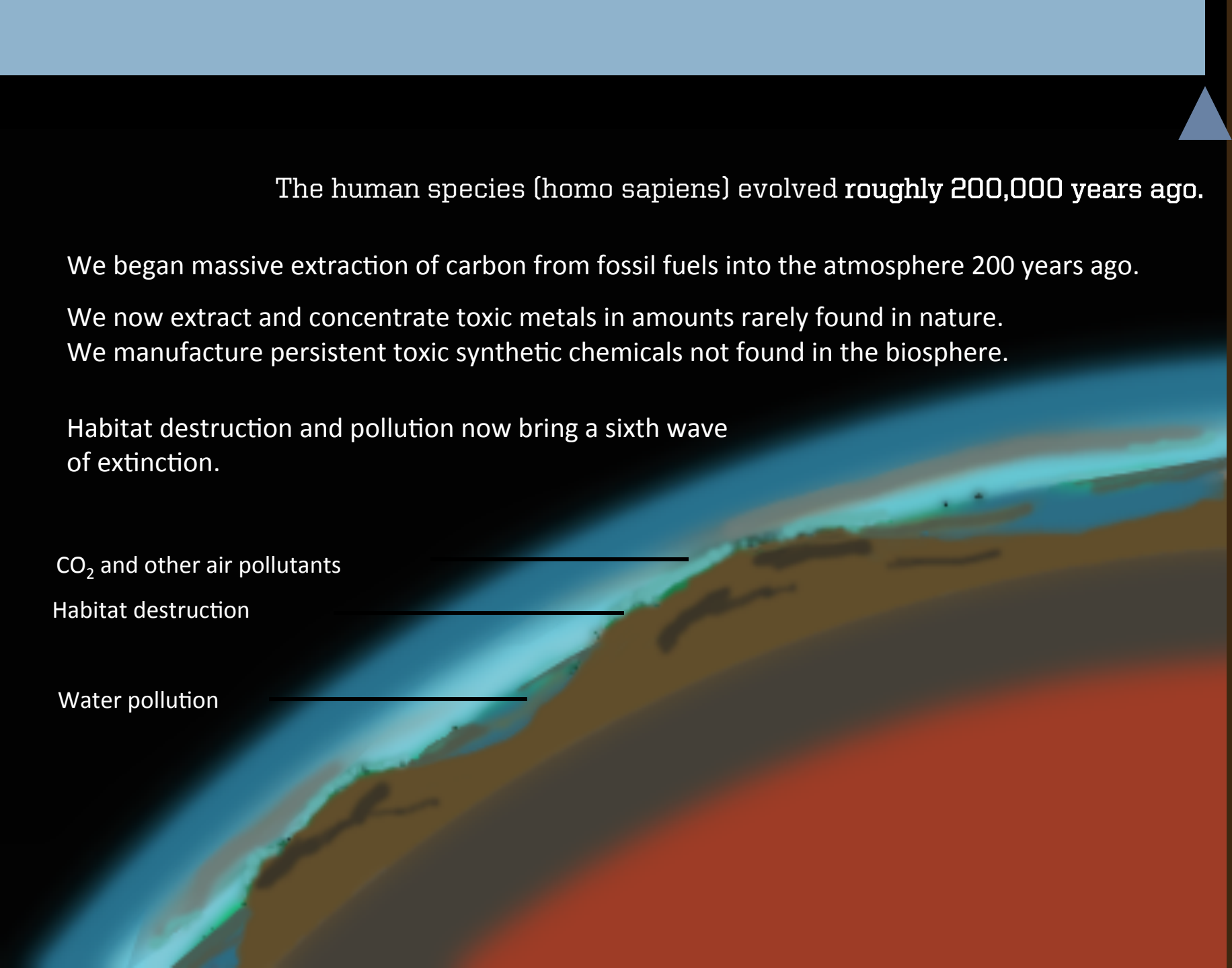


The human species (homo sapiens) evolved **roughly 200,000 years ago.**

We began massive extraction of carbon from fossil fuels into the atmosphere 200 years ago.

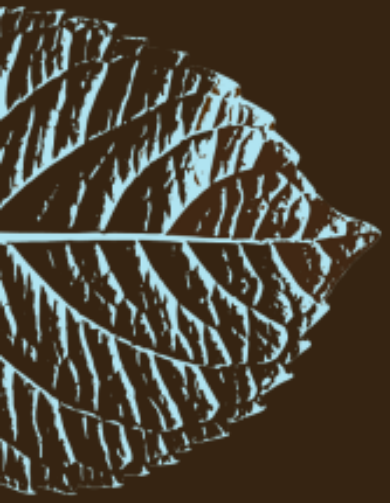
We now extract and concentrate toxic metals in amounts rarely found in nature.
We manufacture persistent toxic synthetic chemicals not found in the biosphere.

Habitat destruction and pollution now bring a sixth wave of extinction.



Summary: Evolution of the Biosphere

1. The biosphere is unique in the universe. No other living planets have yet been found. The biosphere evolved over a rather incomprehensible period of five billion years.
2. The release of fossil carbon (CO_2) significantly damages the Earth's climate and emission of toxic metals from the Earth's crust significantly damage ecological and human health.
3. The Earth passed through five major periods of species extinction. It now passes through another major period of extinction because of human activities. Humans now consume and systematically destroy the biosphere in a relatively small period of time.



Okala Practitioner

Integrating Ecological Design

This presentation is part of an educational presentation series that supports teaching from the *Okala Practitioner* guide.

Okala Practitioner and these presentations were created by the Okala Team to disseminate fact-based knowledge about ecological design to the design disciplines and business.

Unless provided in the presentations, Information sources are found in the *Okala Practitione*r guide.

The Okala Team:

Philip White IDSA	Associate Professor, Arizona State University
Louise St. Pierre	Associate Professor, Emily Carr University of Art + Design
Steve Belletire IDSA	Professor, Southern Illinois University Carbondale

The Okala Team initiated the collaboration with the US EPA and the Industrial Designers Society of America (IDSA) in 2003. The team developed Okala Practitioner with support from Autodesk, IBM, Eastman Chemical and the IDSA Ecodesign Section.

Okala Practitioner is available through amazon.com.

More information and the free Okala Ecodesign Strategy App are found at Okala.net.