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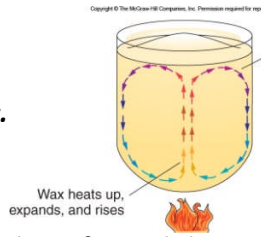

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

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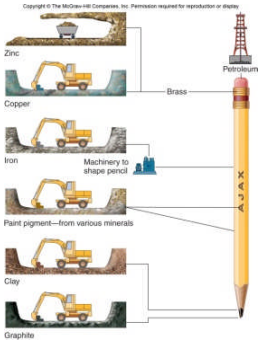

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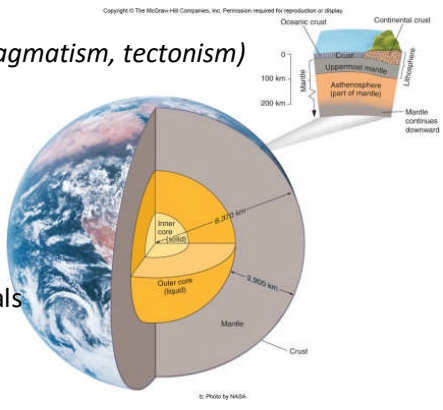

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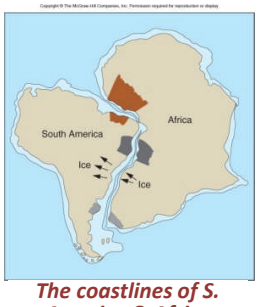
Theory of Plate Tectonics



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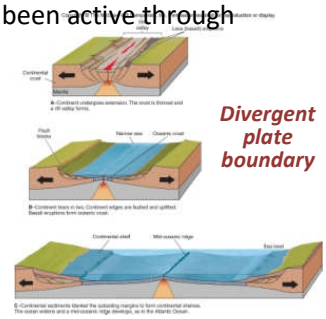

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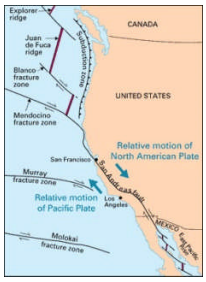

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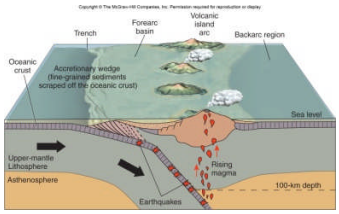

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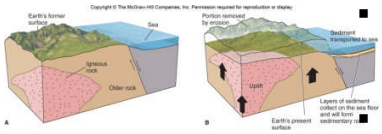

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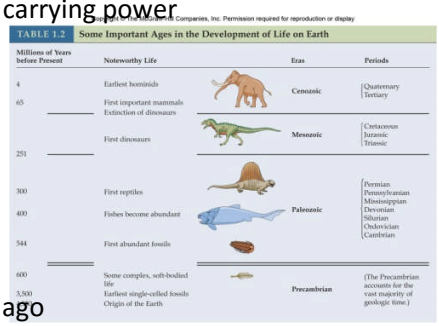

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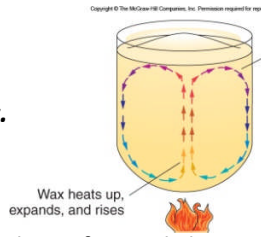

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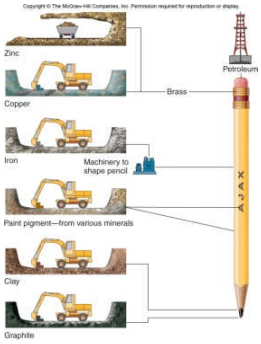

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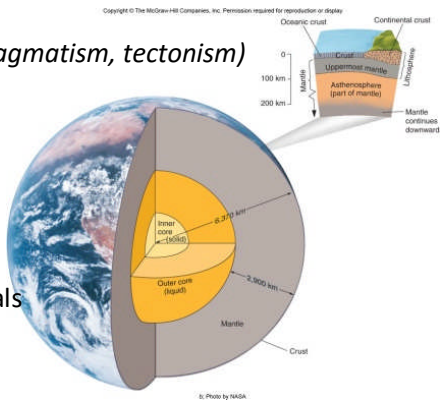

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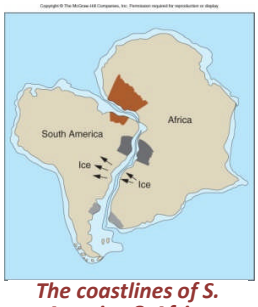

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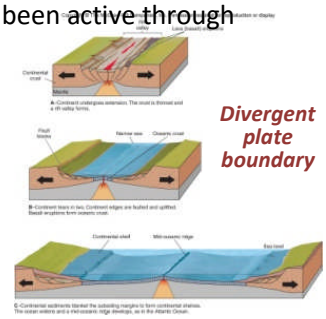

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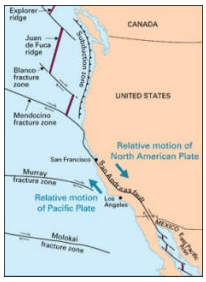

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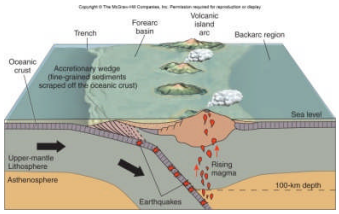

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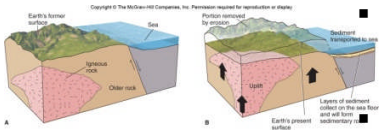

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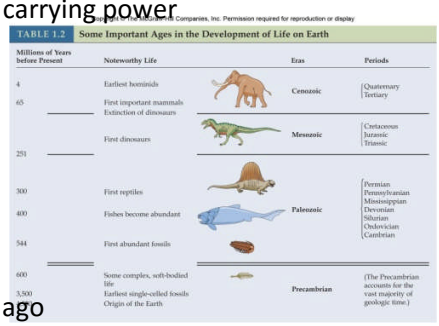

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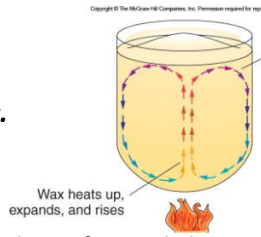

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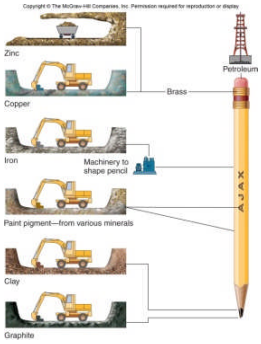

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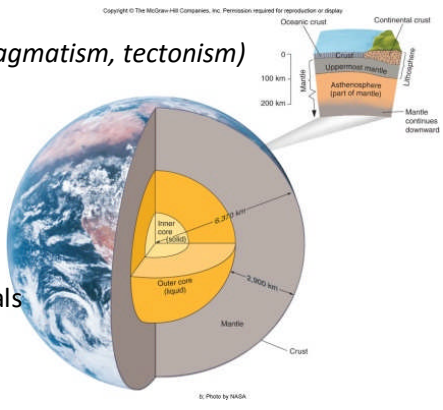

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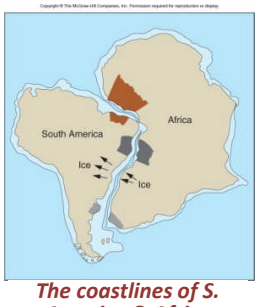

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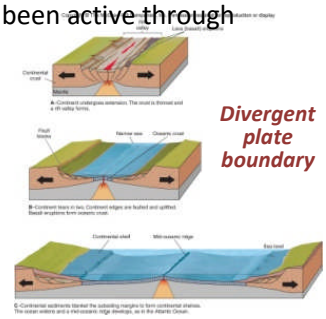

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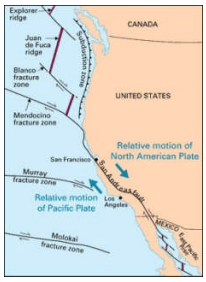

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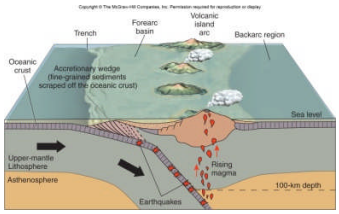

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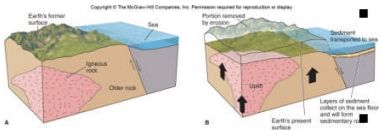

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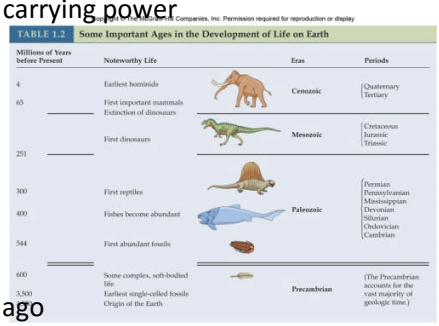

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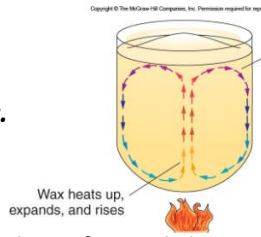

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

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- Geological hazards – Avoiding them
- Environmental protection
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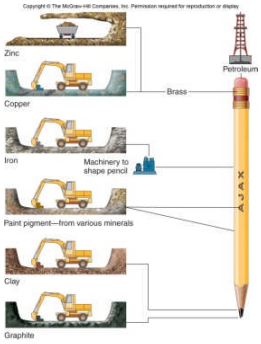

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Oil pipeline

- All manufactured objects depend on Earth's resources
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Earthquake damage

- **Earthquakes**
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Floods

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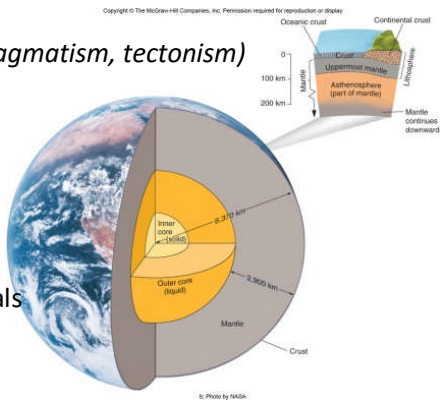

Earth's interior

- **Compositional Layers** *(defined by their composition)*
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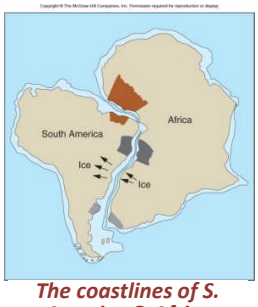
Theory of Plate Tectonics



The coastlines of S. America & Africa appeared to 'fit' together

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  - **Divergent boundaries**
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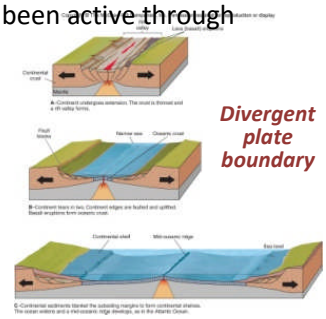

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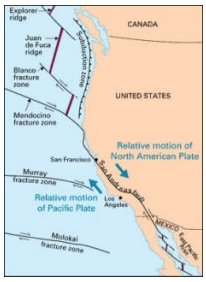

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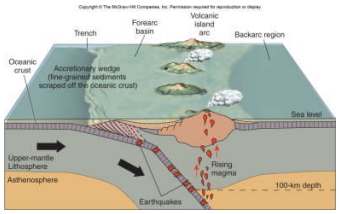

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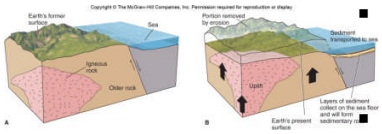

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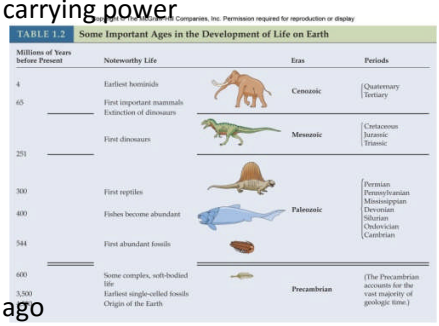

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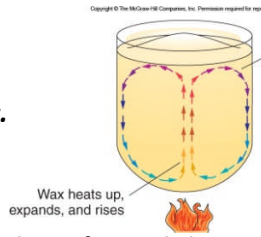

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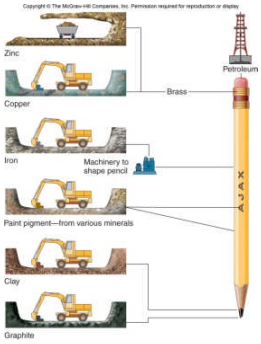

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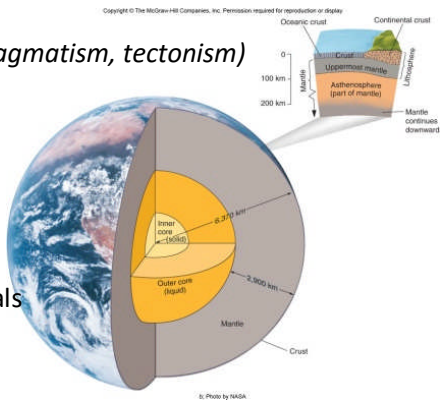

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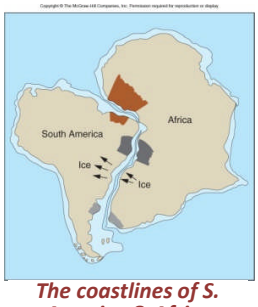

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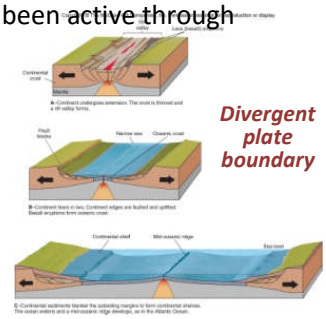

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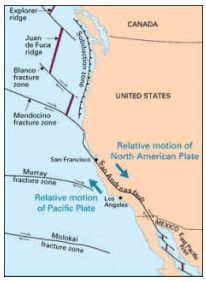

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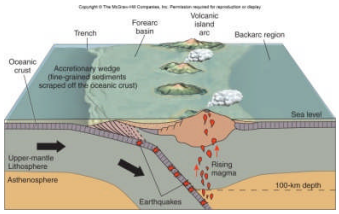

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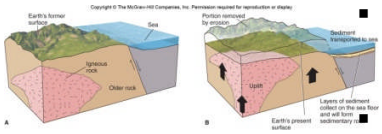

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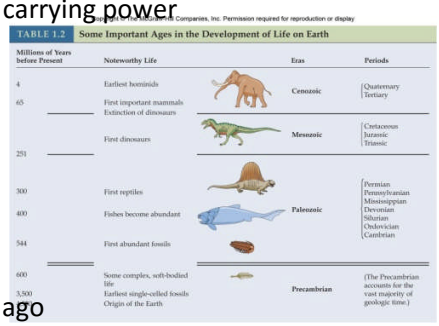

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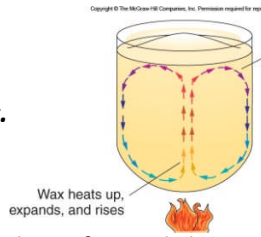

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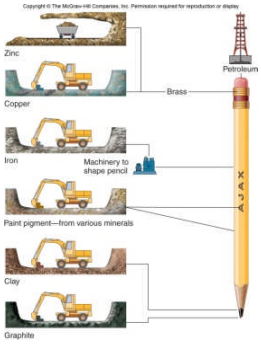

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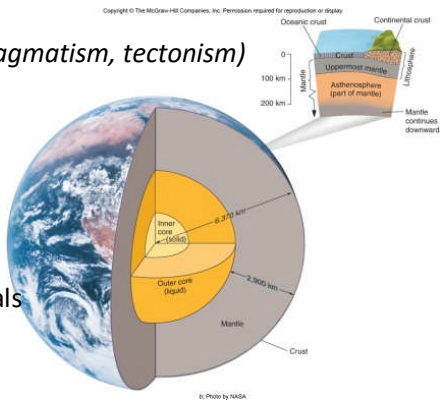

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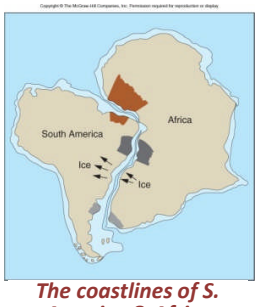

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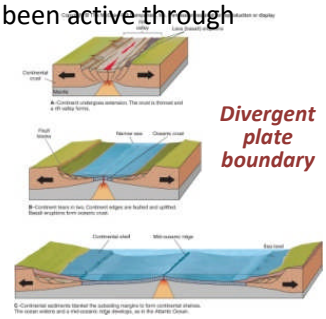

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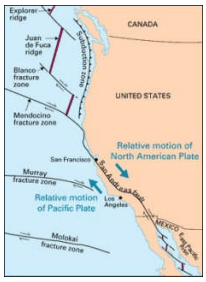

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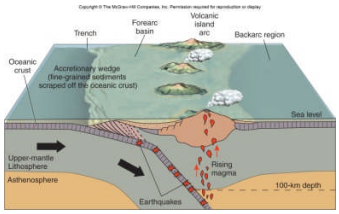

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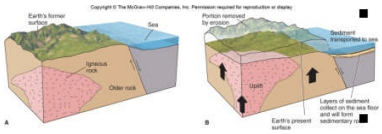

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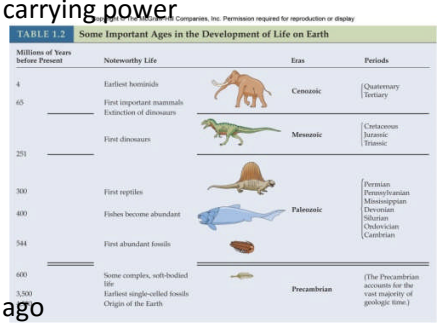

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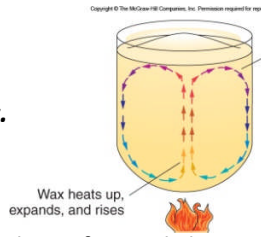

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

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- Geological hazards – Avoiding them
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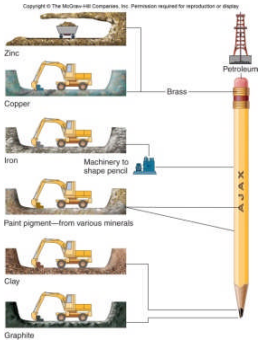

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Oil pipeline

- All manufactured objects depend on Earth's resources
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Earthquake damage

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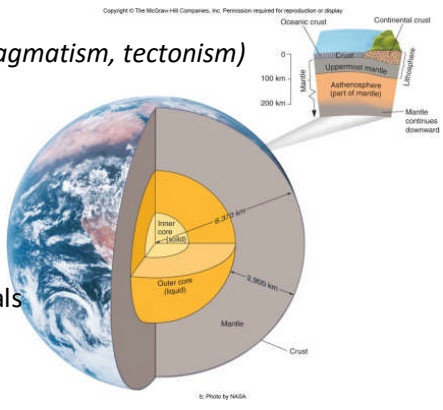

Earth's interior

- **Compositional Layers** *(defined by their composition)*
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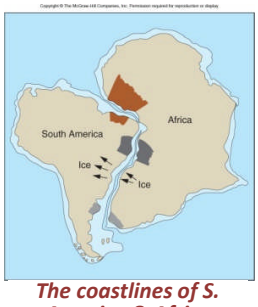
Theory of Plate Tectonics



The coastlines of S. America & Africa appeared to 'fit' together

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  - **Divergent boundaries**
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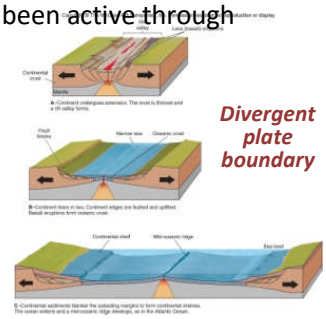

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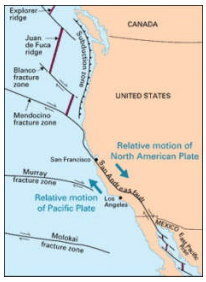

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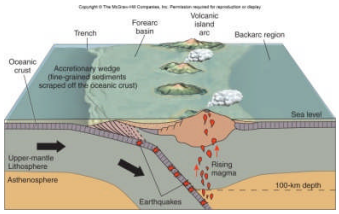

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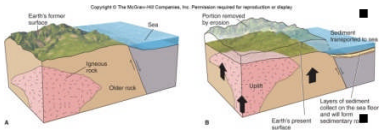

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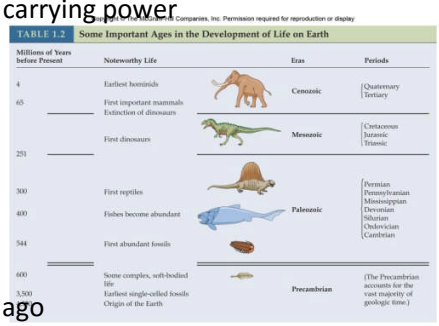

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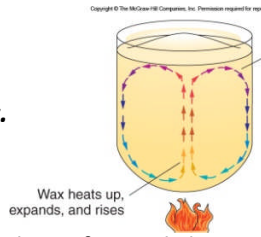

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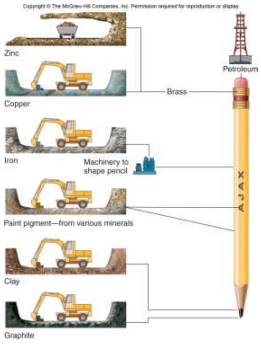

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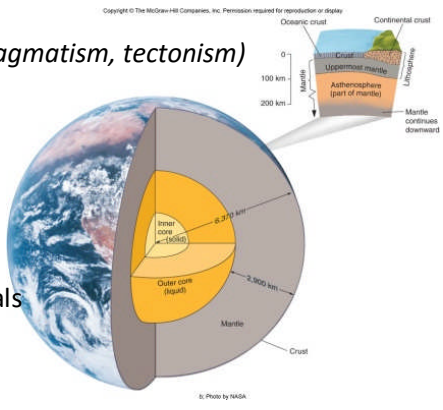

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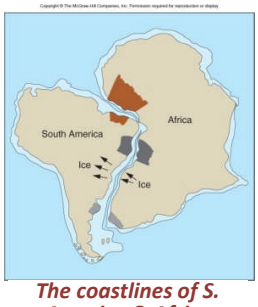

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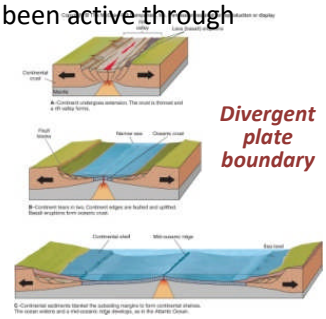

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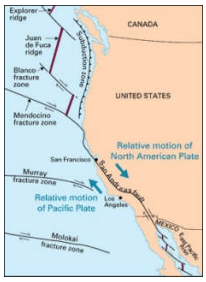

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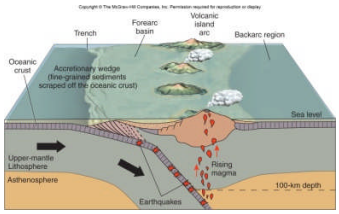

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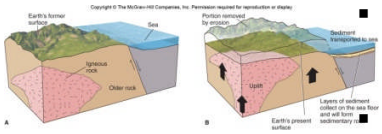

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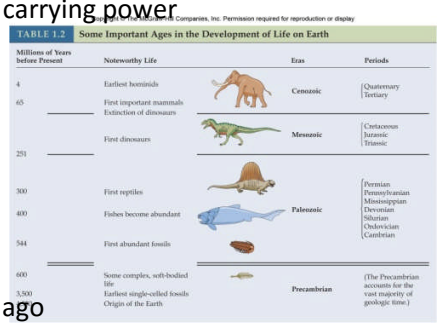

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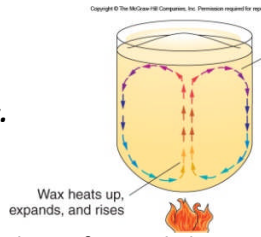

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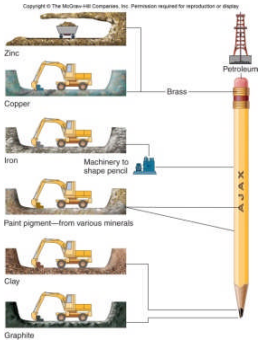

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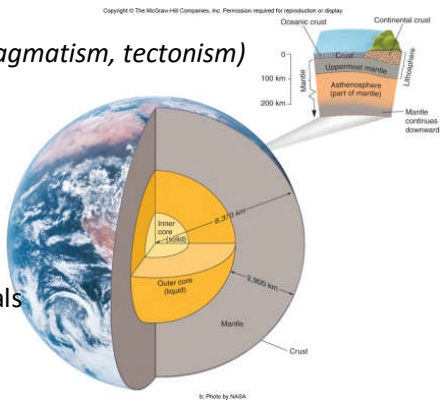

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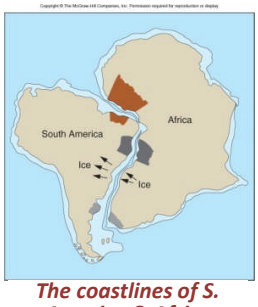

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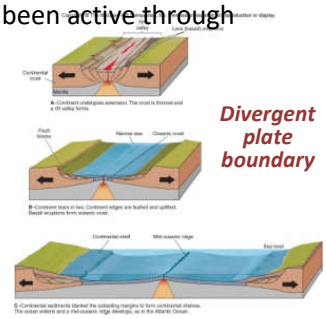

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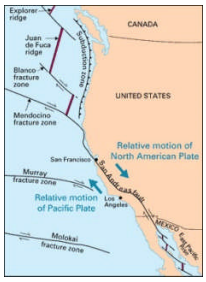

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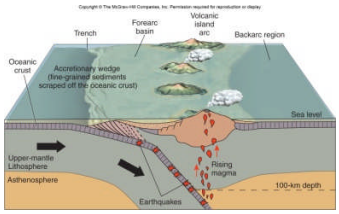

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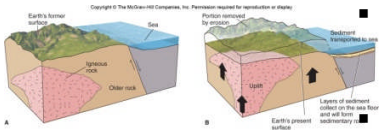

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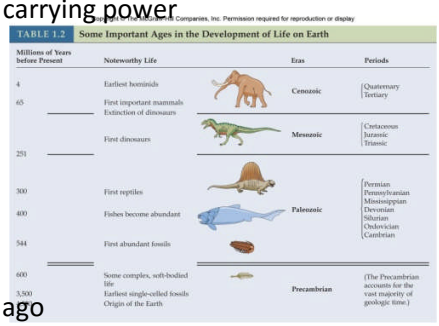

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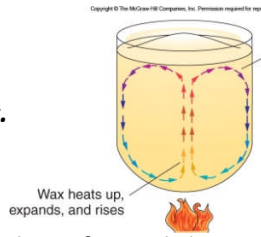

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

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- Geological hazards – Avoiding them
- Environmental protection
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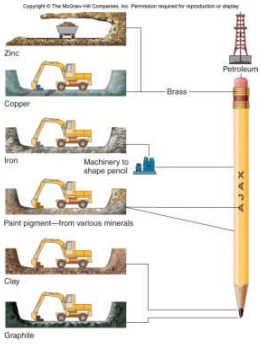

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Oil pipeline

- All manufactured objects depend on Earth's resources
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Earthquake damage

- **Earthquakes**
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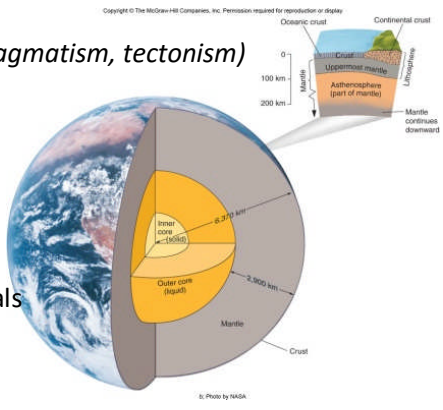

Earth's interior

- **Compositional Layers** *(defined by their composition)*
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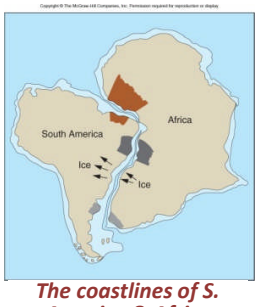
Theory of Plate Tectonics



The coastlines of S. America & Africa appeared to 'fit' together

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  - **Divergent boundaries**
    - Plates move apart
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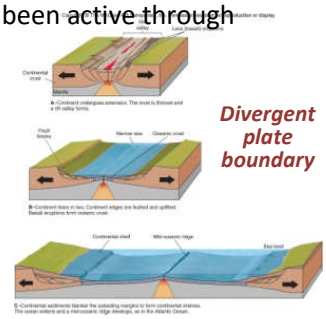

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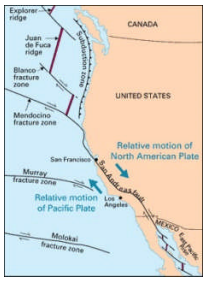

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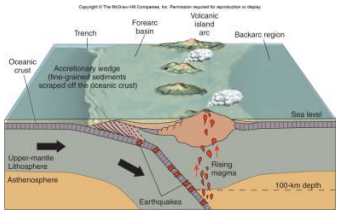

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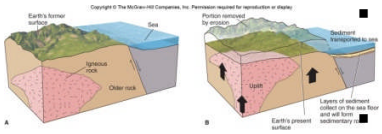

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- **Deep Time**
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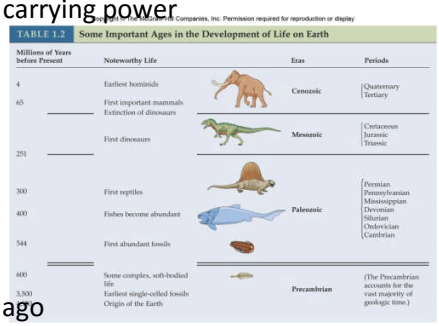

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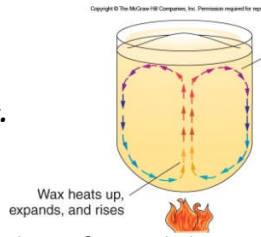

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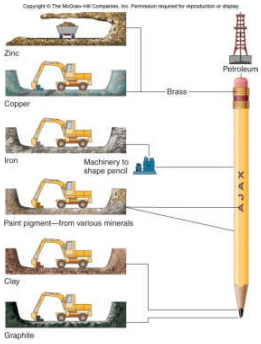

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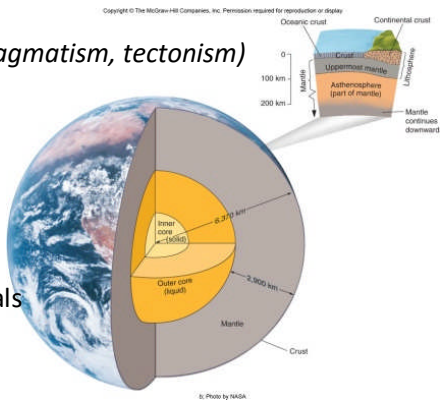

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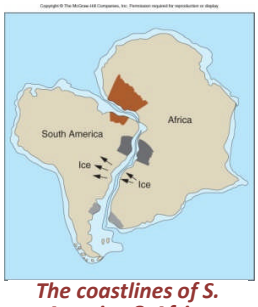

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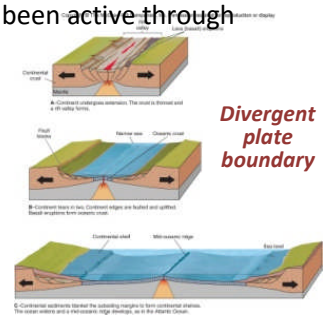

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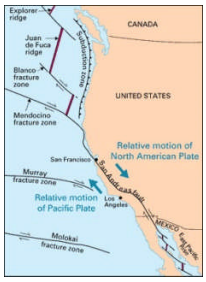

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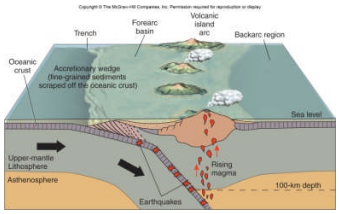

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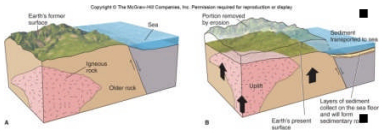

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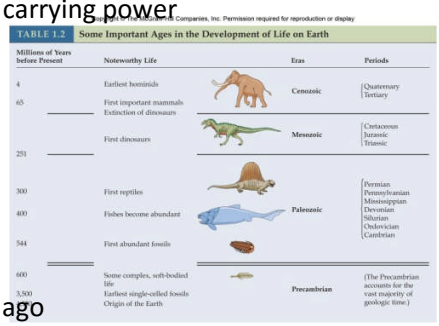

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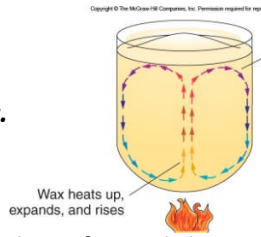

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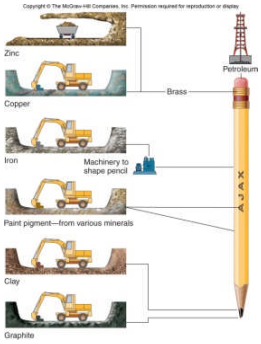

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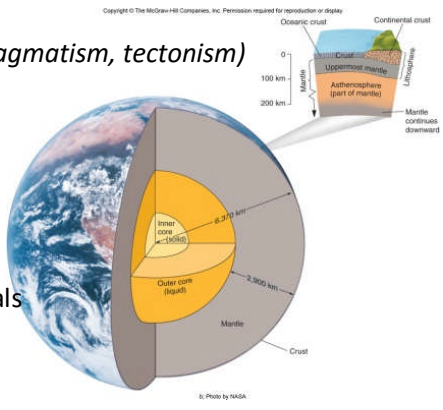

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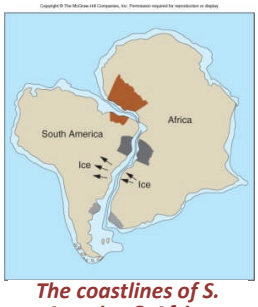

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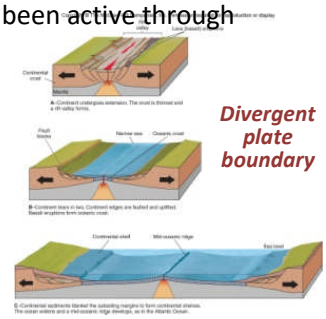

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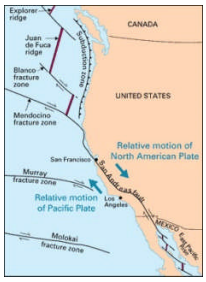

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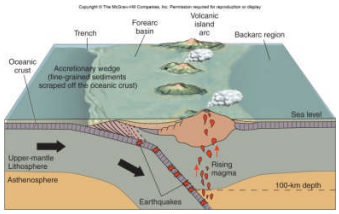

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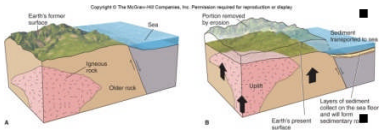

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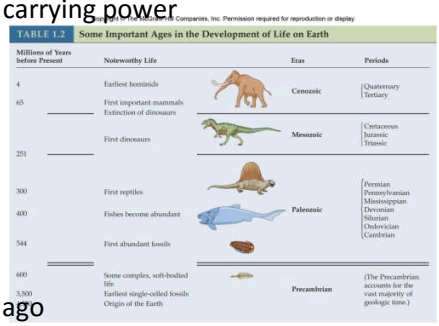

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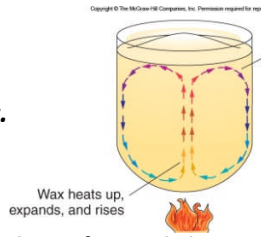

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

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- Geological hazards – Avoiding them
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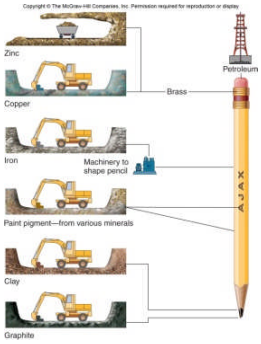

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Oil pipeline

- All manufactured objects depend on Earth's resources
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Earthquake damage

- **Earthquakes**
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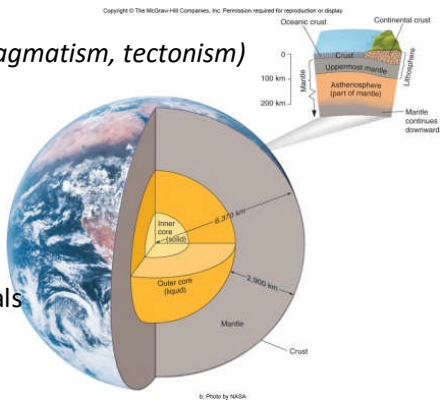

Earth's interior

- **Compositional Layers** *(defined by their composition)*
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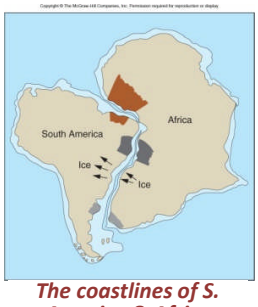

The coastlines of S. America & Africa appeared to 'fit' together

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  - **Divergent boundaries**
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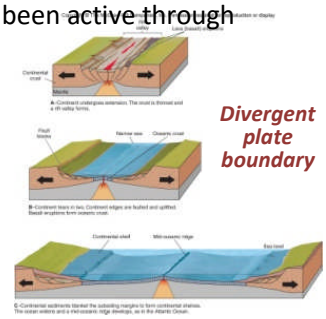

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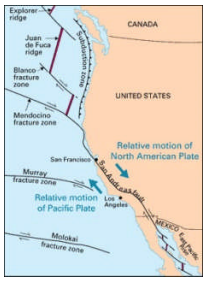

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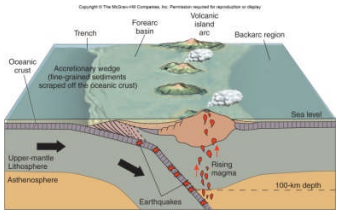

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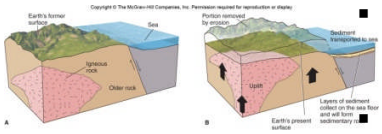

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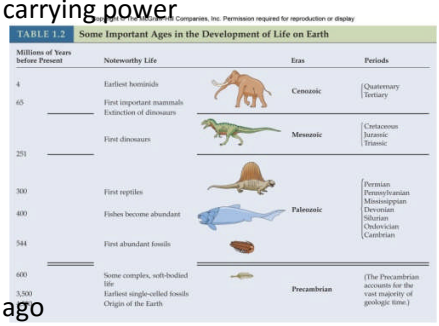

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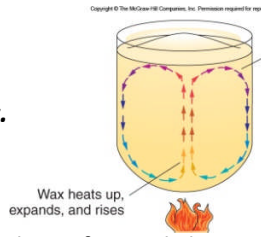

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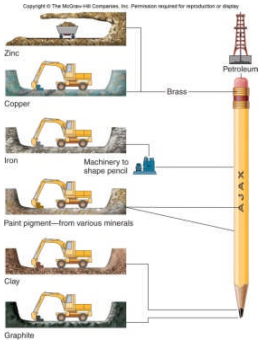

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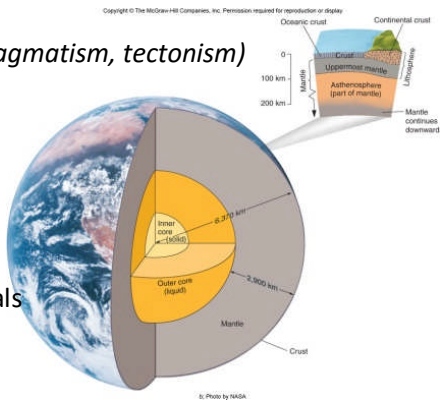

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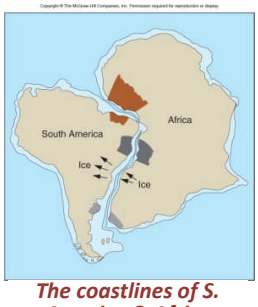

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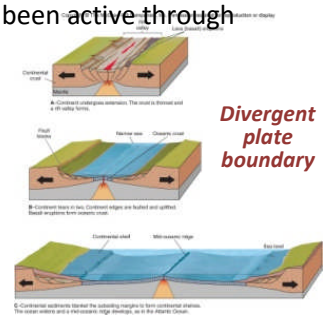

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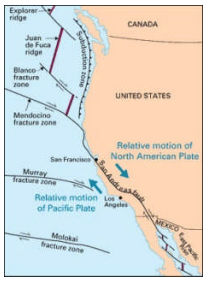

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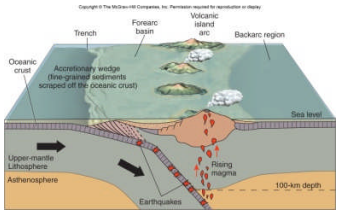

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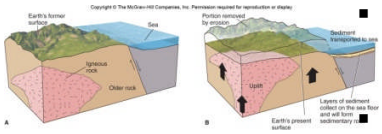

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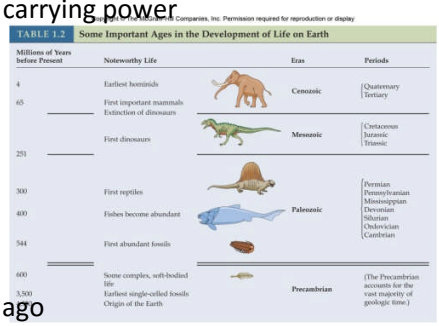

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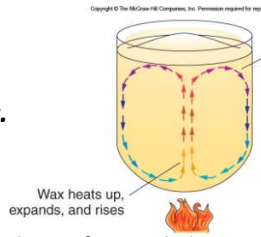

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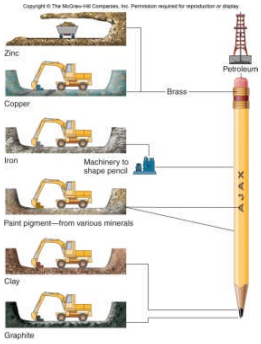

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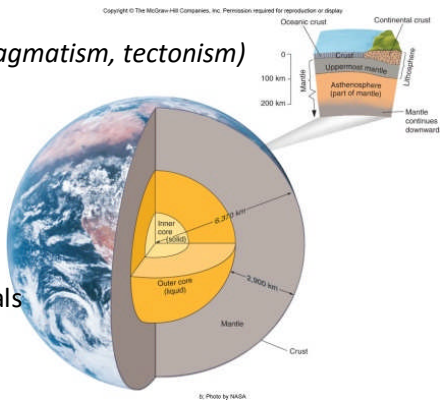

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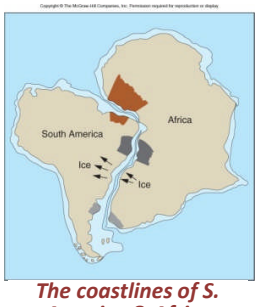

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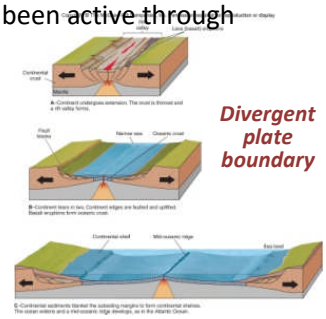

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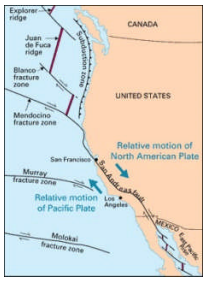

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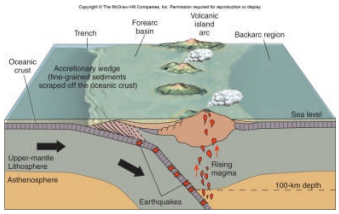

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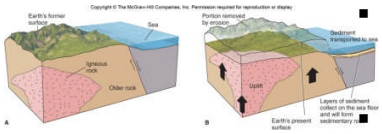

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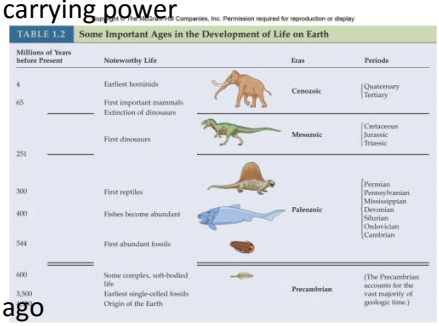

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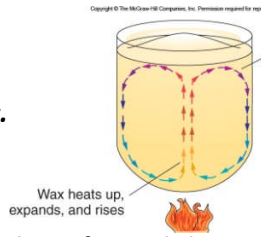

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

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- Geological hazards – Avoiding them
- Environmental protection
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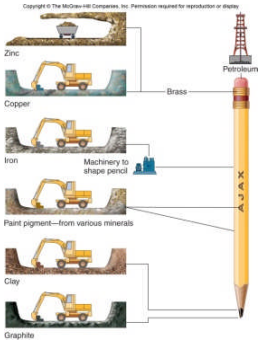

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Oil pipeline

- All manufactured objects depend on Earth's resources
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Earthquake damage

- **Earthquakes**
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Floods

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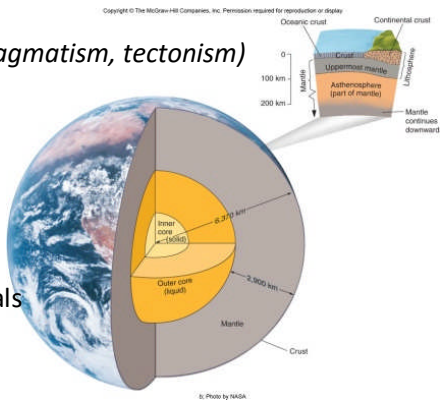

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- **Compositional Layers** *(defined by their composition)*
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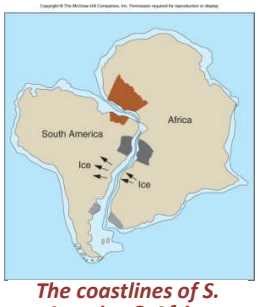
Theory of Plate Tectonics



The coastlines of S. America & Africa appeared to 'fit' together

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  - **Divergent boundaries**
    - Plates move apart
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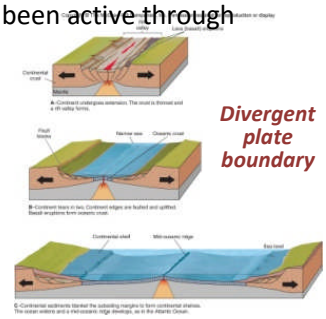

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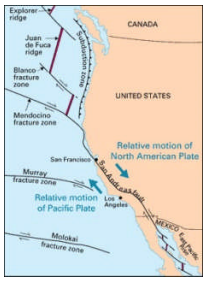

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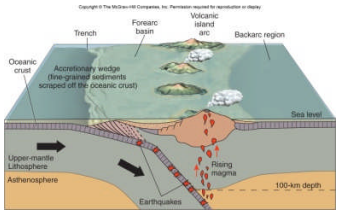

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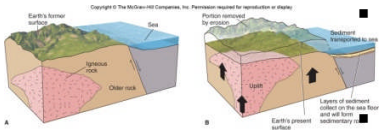

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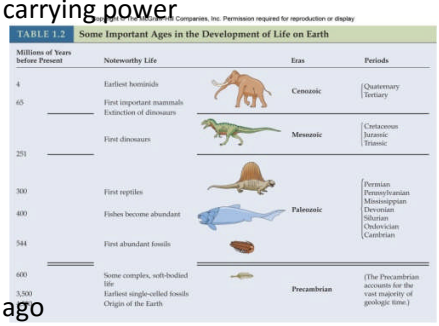

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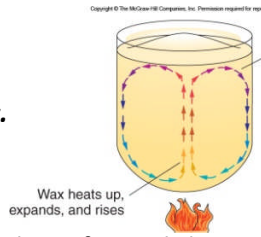

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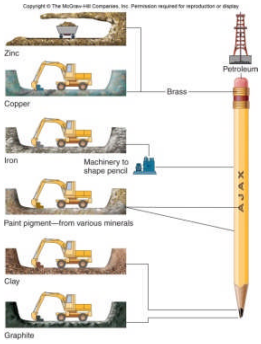

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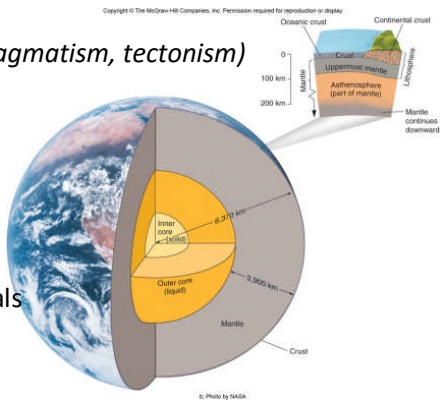

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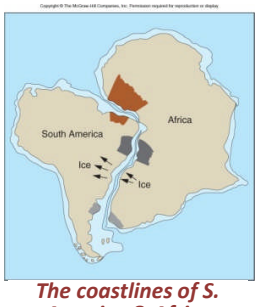

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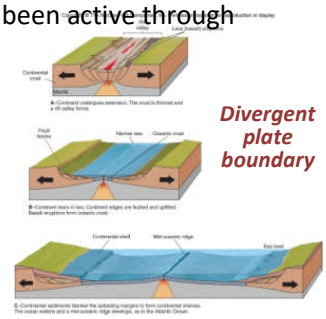

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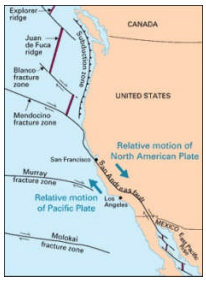

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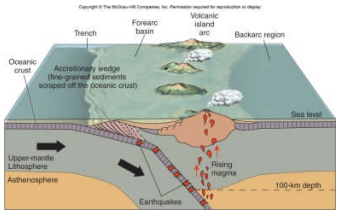

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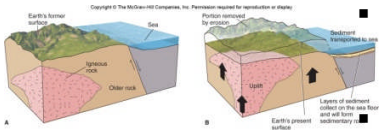

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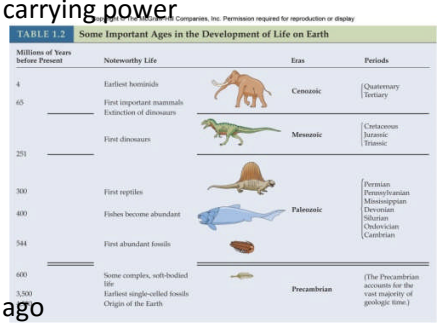

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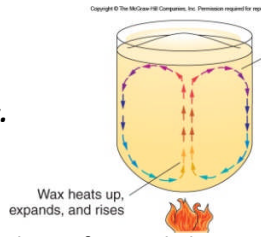

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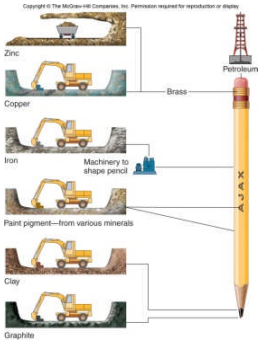

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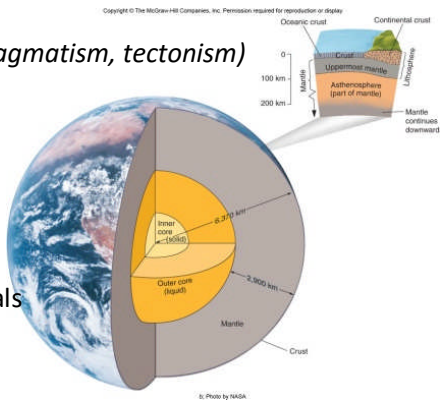

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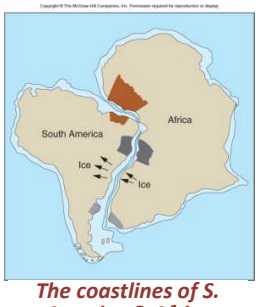

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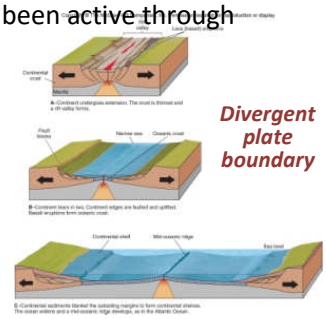

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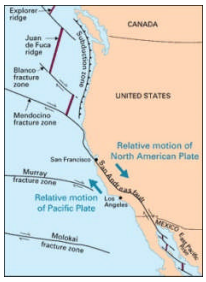

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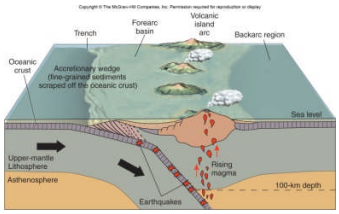

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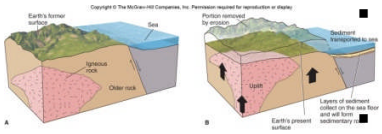

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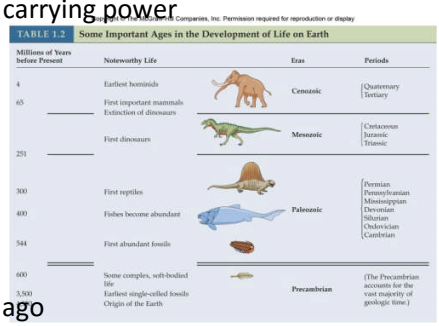

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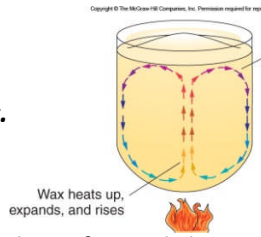

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

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- Geological hazards – Avoiding them
- Environmental protection
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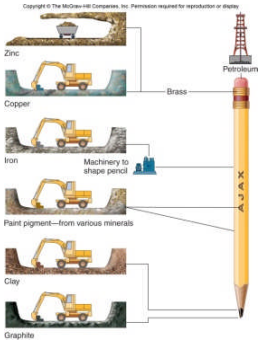

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Oil pipeline

- All manufactured objects depend on Earth's resources
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Earthquake damage

- **Earthquakes**
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Floods

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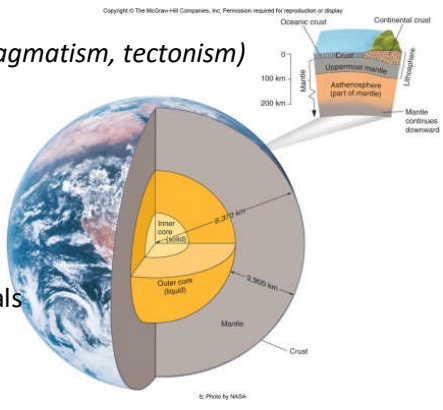

Earth's interior

- **Compositional Layers** *(defined by their composition)*
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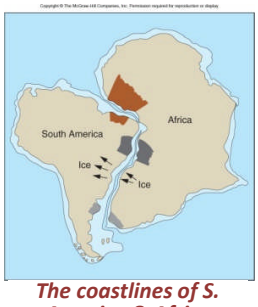
Theory of Plate Tectonics



The coastlines of S. America & Africa appeared to 'fit' together

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  - **Divergent boundaries**
    - Plates move apart
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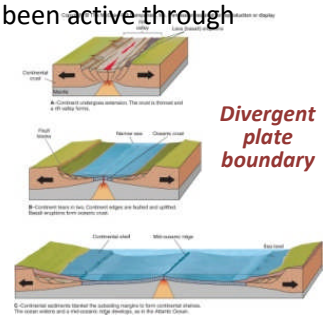

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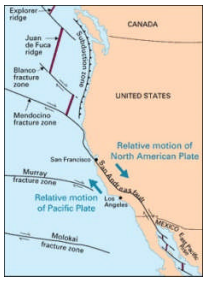

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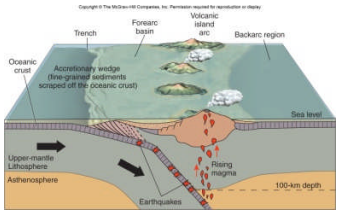

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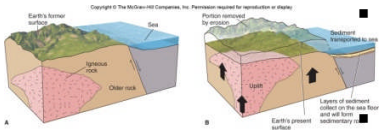

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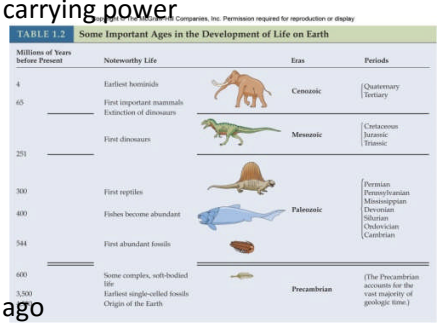

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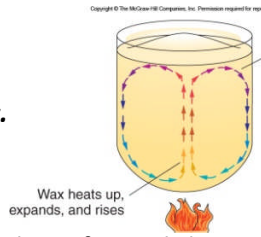

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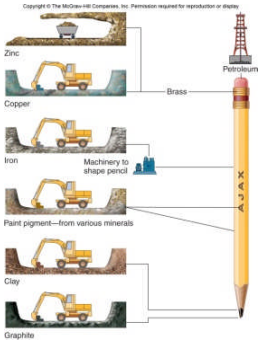

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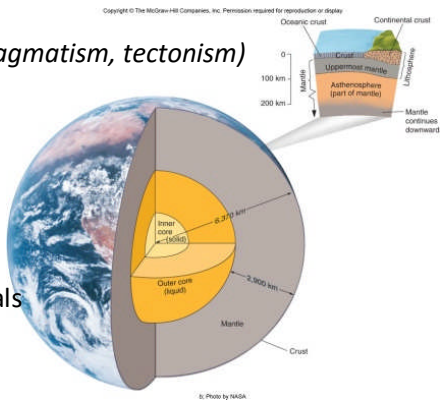

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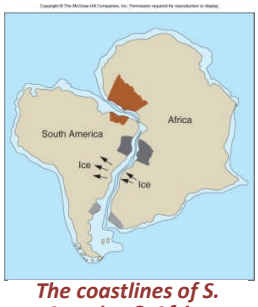

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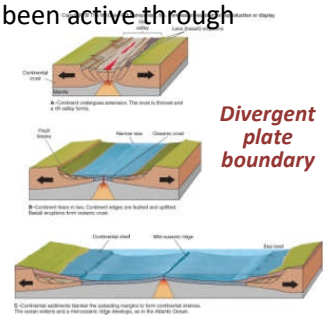

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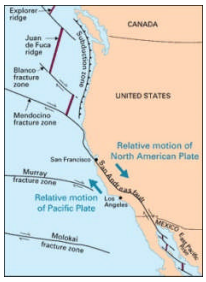

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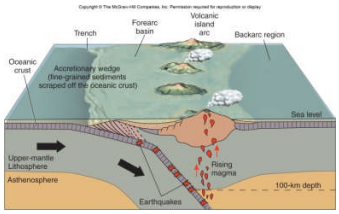

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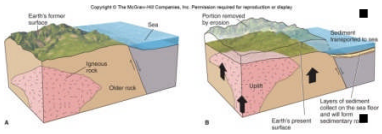

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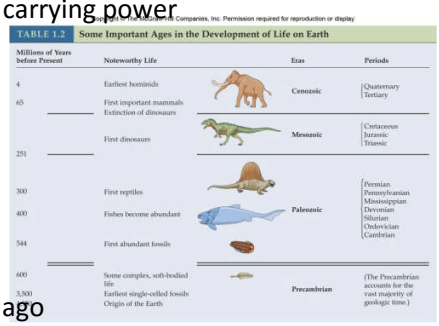

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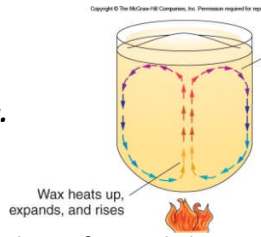

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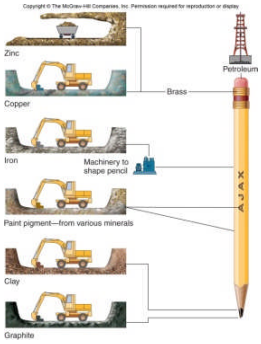

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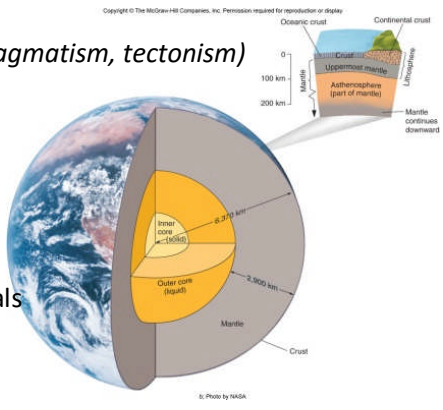

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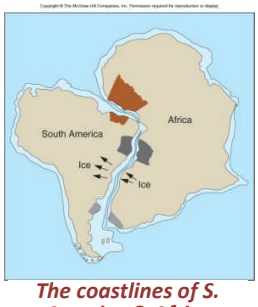

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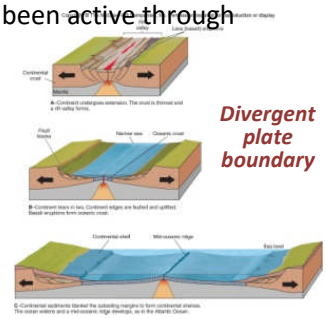

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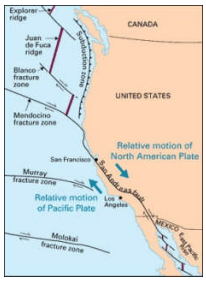

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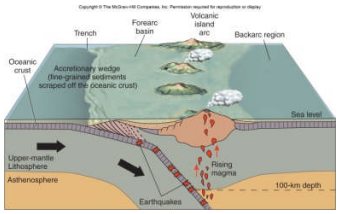

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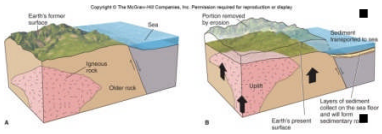

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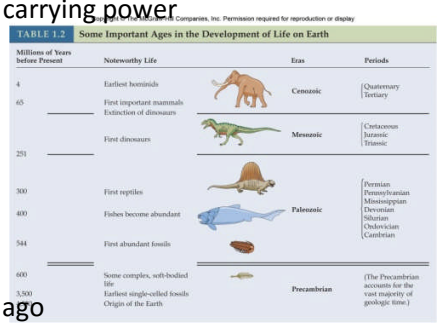

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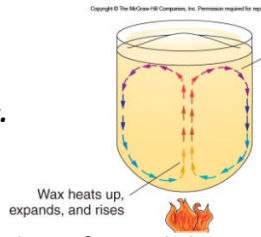

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

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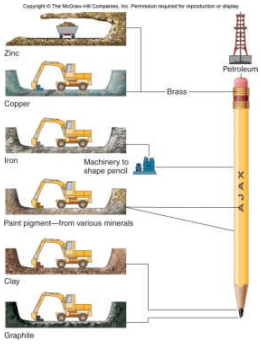
- Geological hazards – Avoiding them
- Environmental protection
- Understanding our surroundings – Aids us in making good decisions



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Oil pipeline

- All manufactured objects depend on Earth's resources
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Earthquake damage

- **Earthquakes**
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Floods

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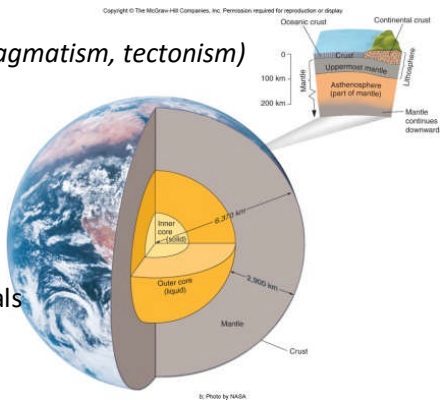

Earth's interior

- **Compositional Layers** *(defined by their composition)*
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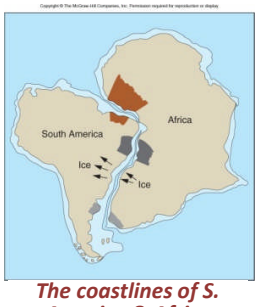
Theory of Plate Tectonics



The coastlines of S. America & Africa appeared to 'fit' together

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  - Explains the origin and distribution of volcanoes, fault zones and mountain belts
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- Tectonic Plate Boundaries
  - **Divergent boundaries**
    - Plates move apart
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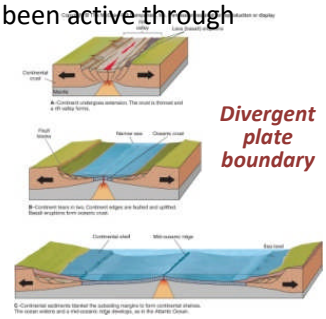

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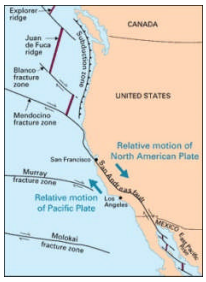

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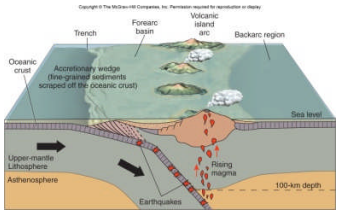

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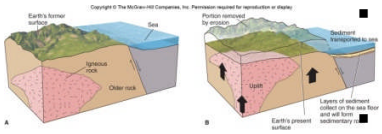

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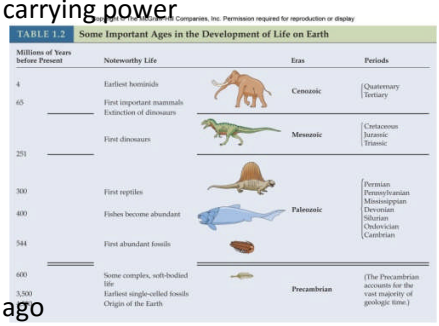

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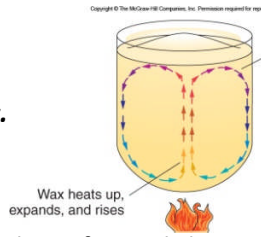

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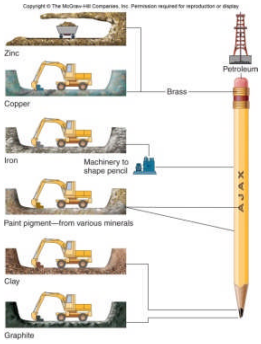

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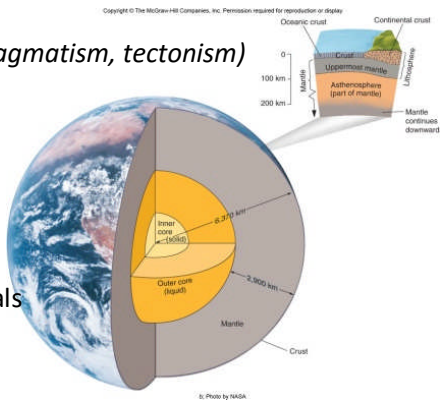

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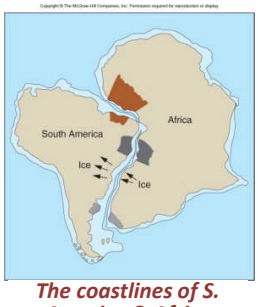

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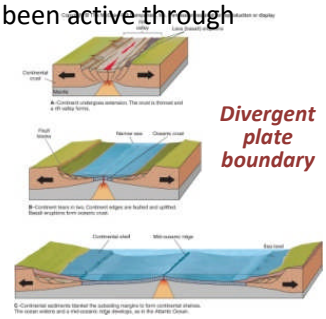

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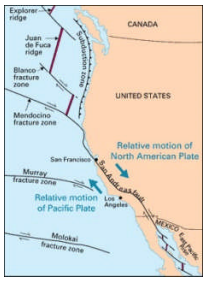

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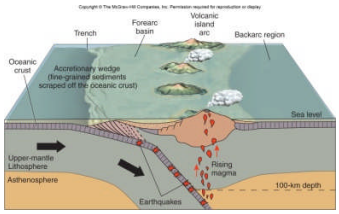

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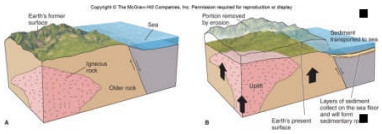

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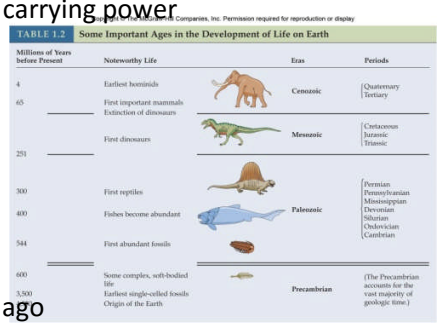

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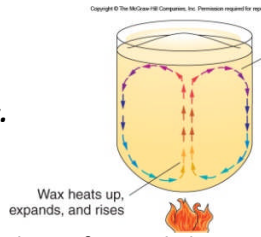

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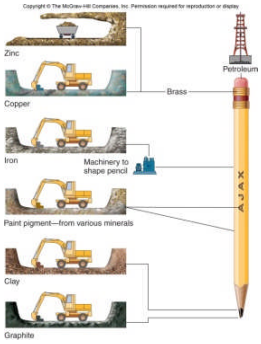

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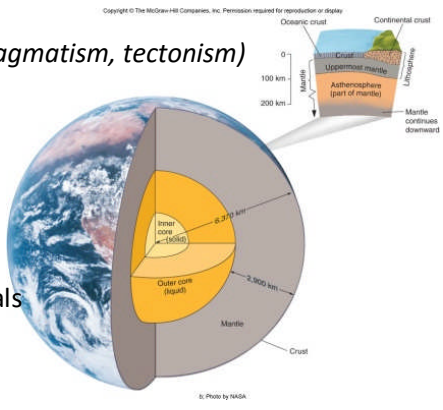

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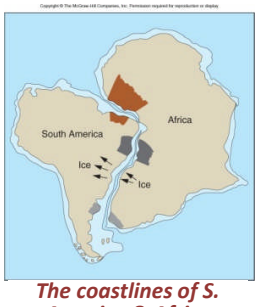

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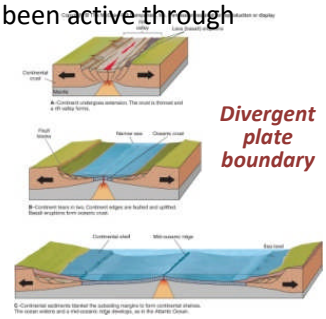

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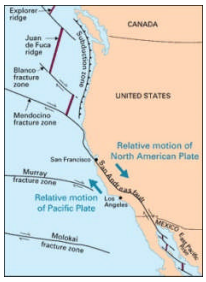

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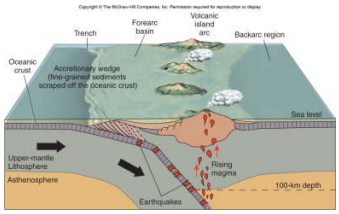

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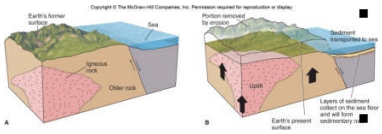

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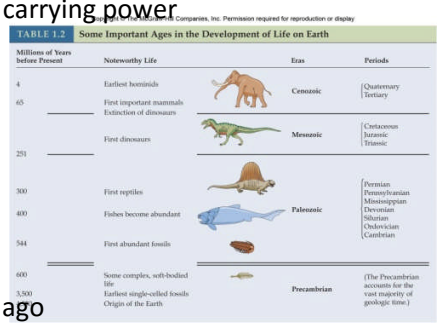

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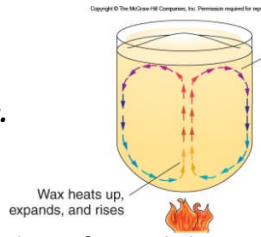

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

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- Geological hazards – Avoiding them
- Environmental protection
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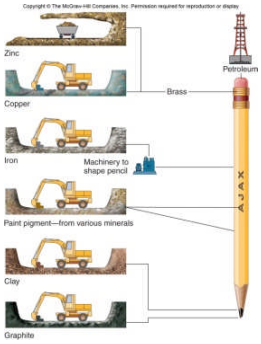

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Oil pipeline

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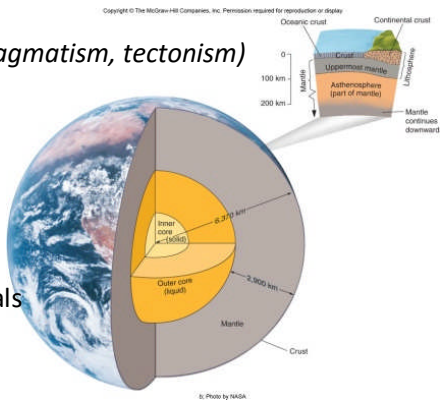

Earth's interior

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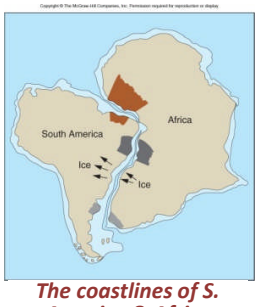
Theory of Plate Tectonics



The coastlines of S. America & Africa appeared to 'fit' together

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    - Plates move apart
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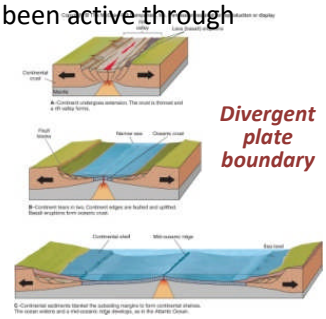

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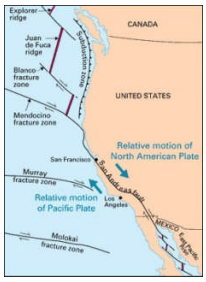

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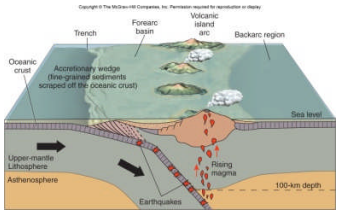

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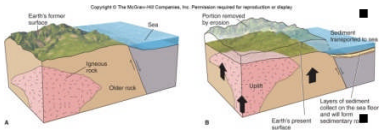

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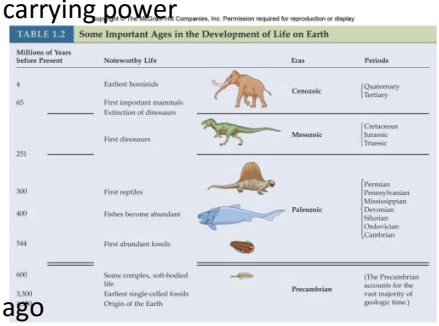

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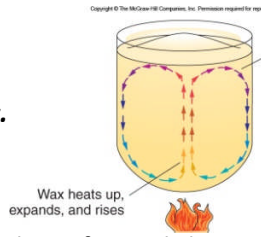

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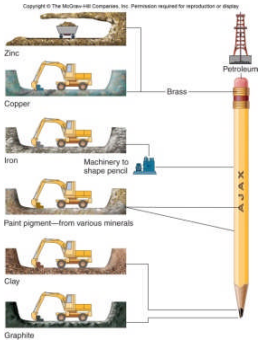

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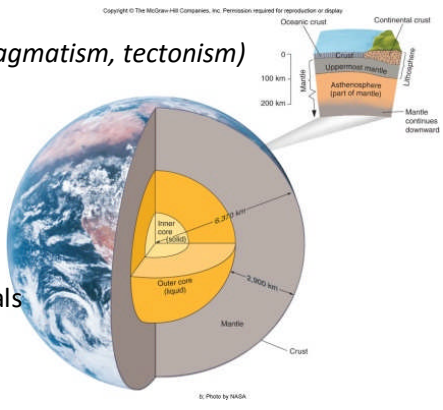

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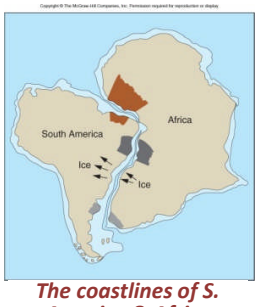

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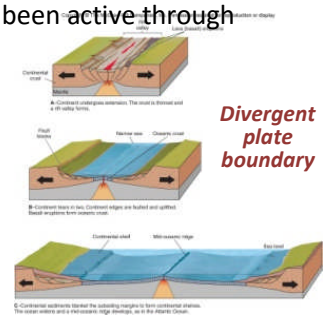

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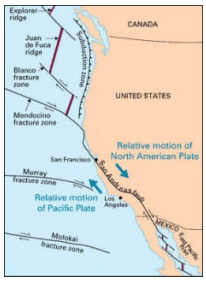

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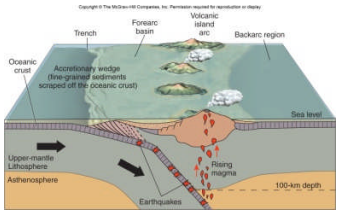

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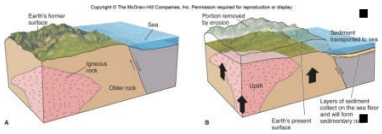

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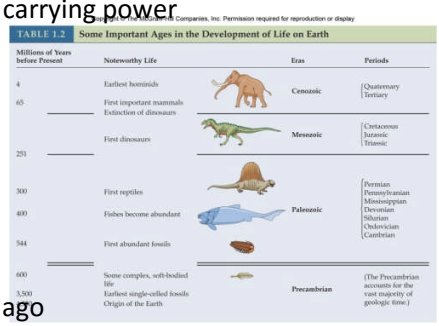

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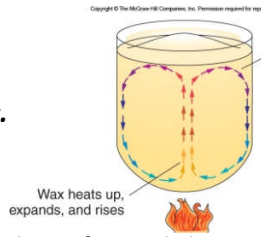

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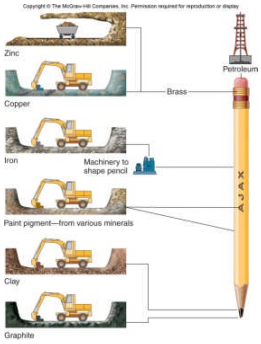

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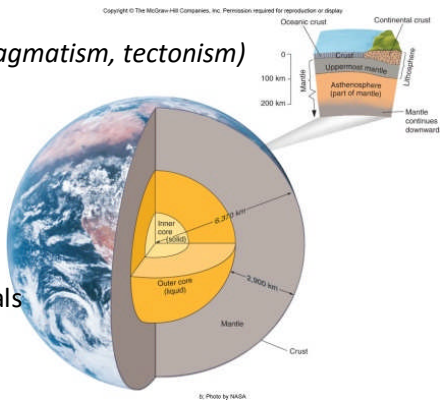

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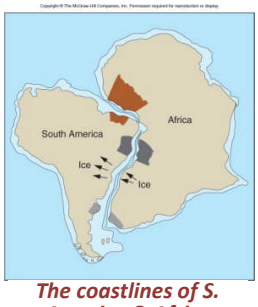

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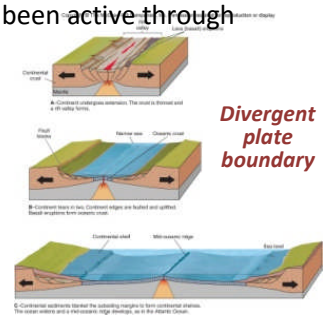

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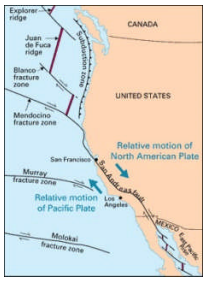

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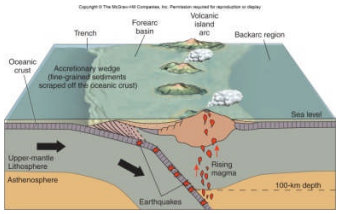

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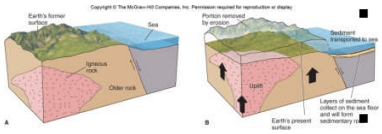

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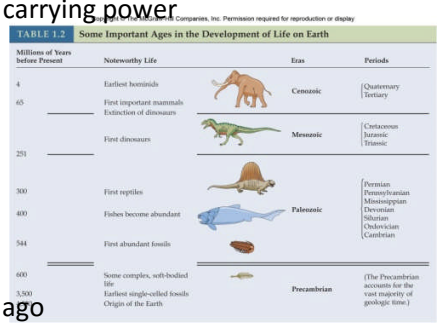

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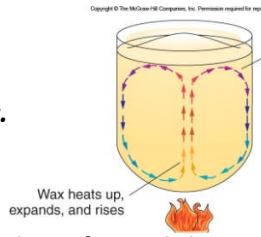

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

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- Geological hazards – Avoiding them
- Environmental protection
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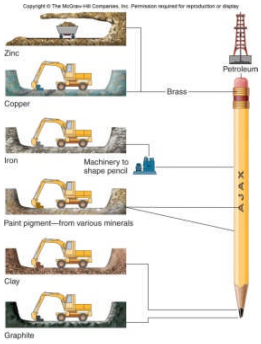

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- All manufactured objects depend on Earth's resources
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Earthquake damage

- **Earthquakes**
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Floods

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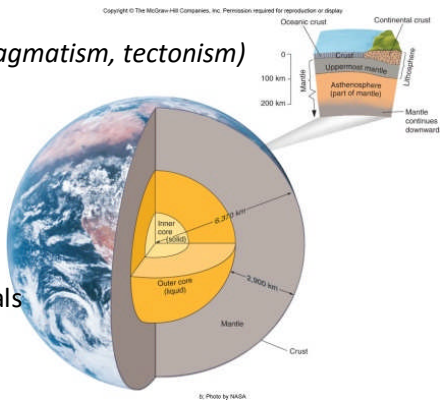

Earth's interior

- **Compositional Layers** *(defined by their composition)*
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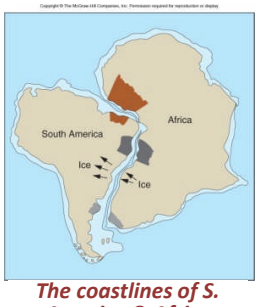
Theory of Plate Tectonics



The coastlines of S. America & Africa appeared to 'fit' together

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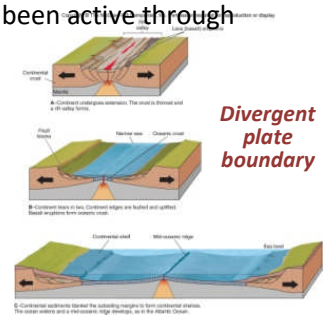

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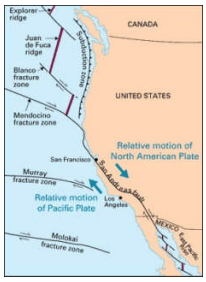

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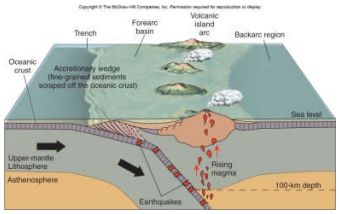

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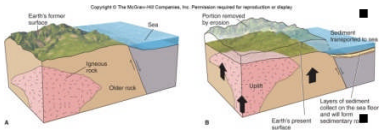

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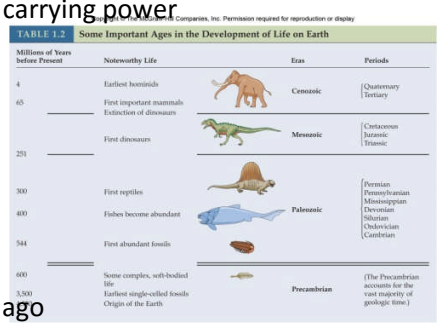

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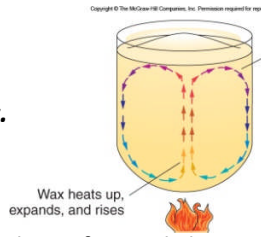

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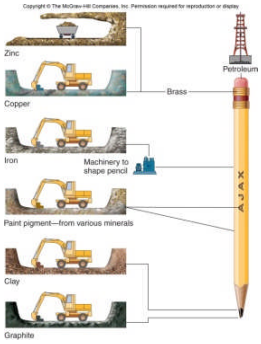

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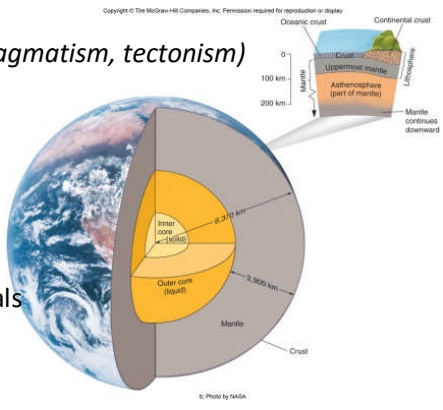

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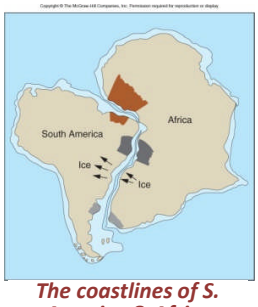

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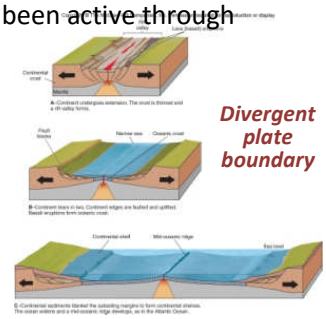

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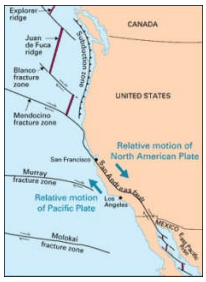

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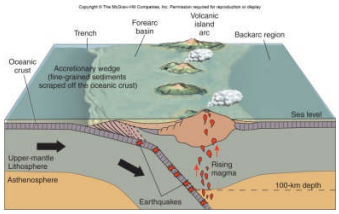

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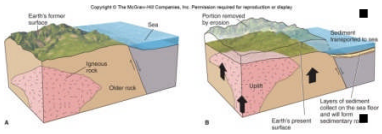

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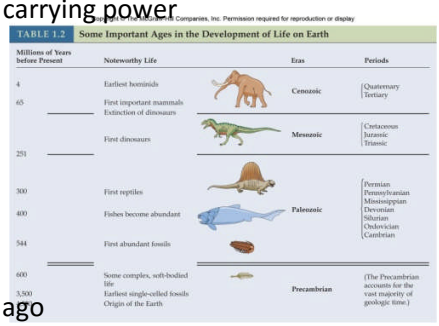

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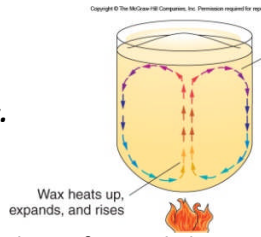

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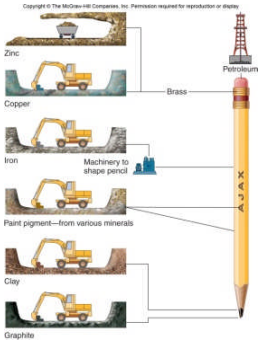

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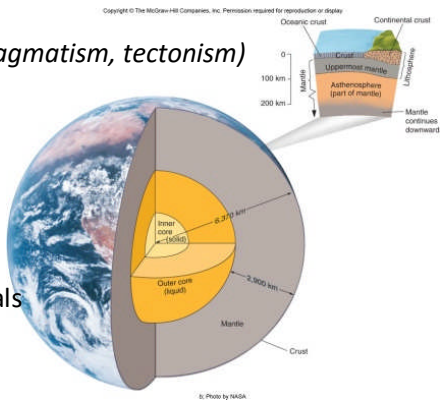

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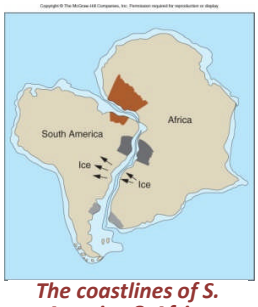

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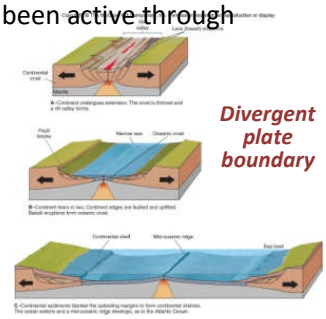

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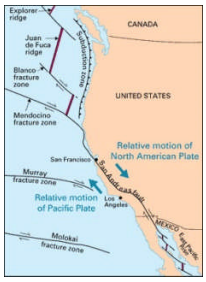

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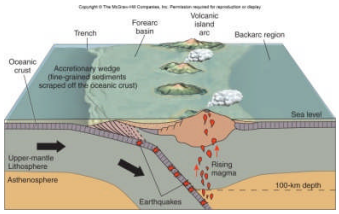

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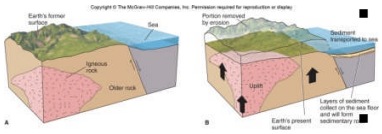

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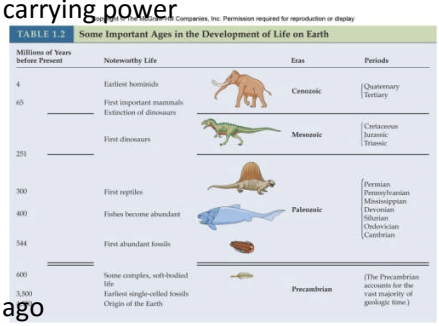

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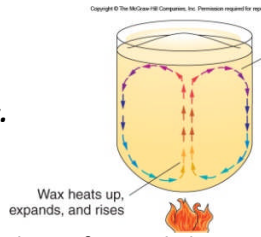

Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

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- Geological hazards – Avoiding them
- Environmental protection
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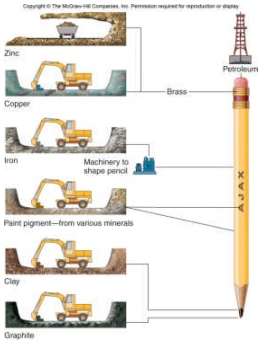

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Oil pipeline

- All manufactured objects depend on Earth's resources
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Earthquake damage

- **Earthquakes**
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Floods

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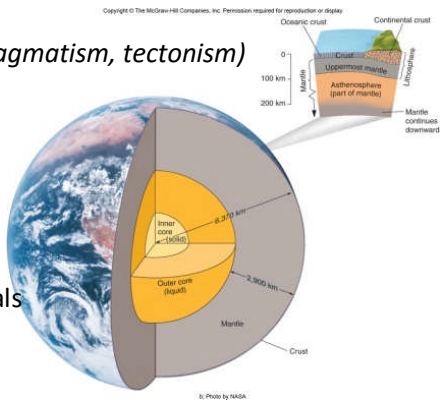

Earth's interior

- **Compositional Layers** *(defined by their composition)*
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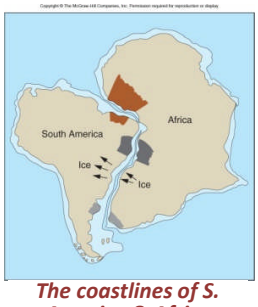
Theory of Plate Tectonics



The coastlines of S. America & Africa appeared to 'fit' together

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  - **Divergent boundaries**
    - Plates move apart
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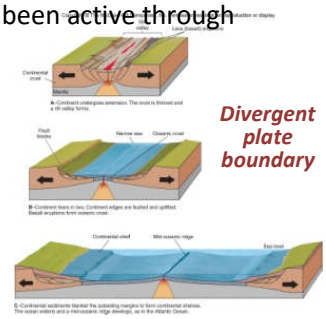

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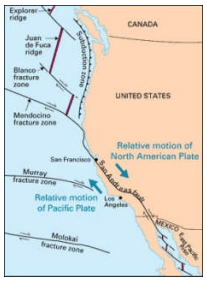

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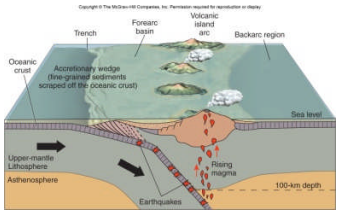

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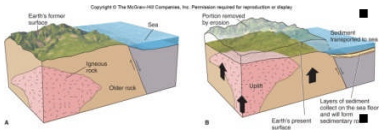

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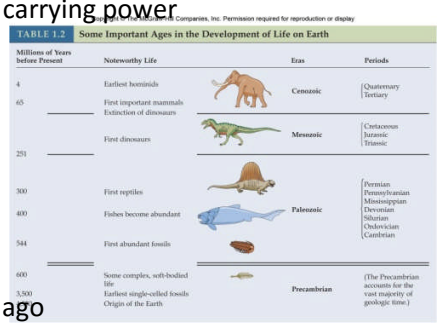

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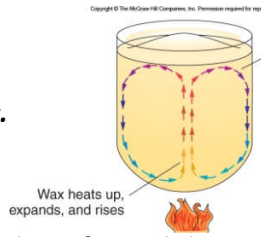

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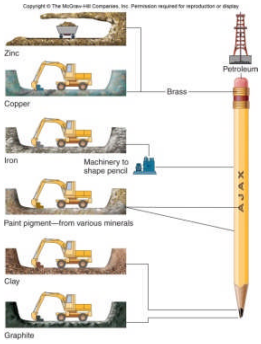

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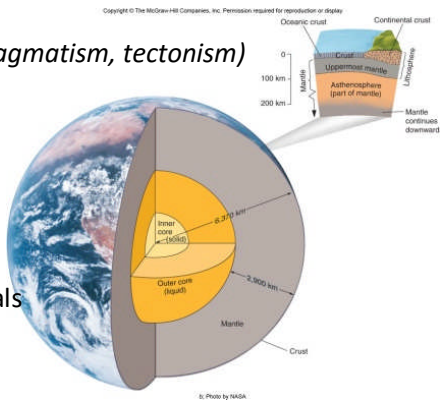

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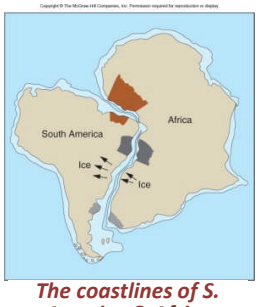

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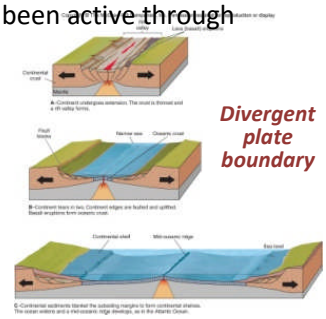

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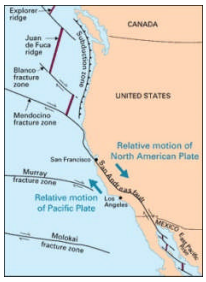

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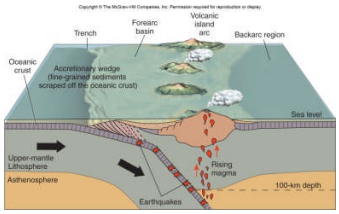

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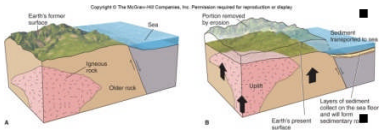

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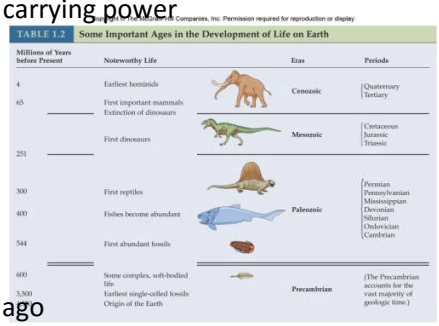

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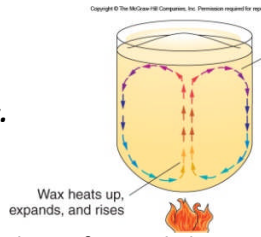

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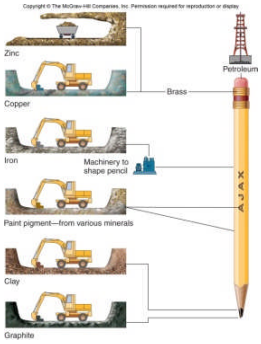

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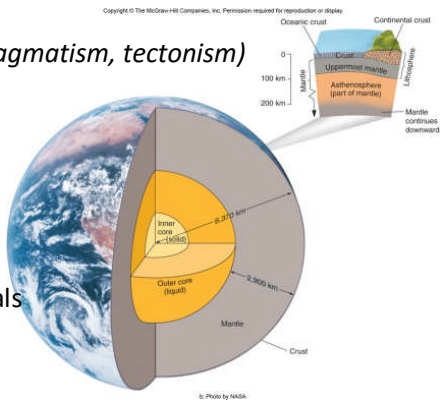

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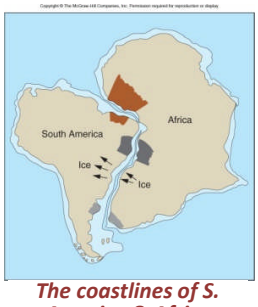

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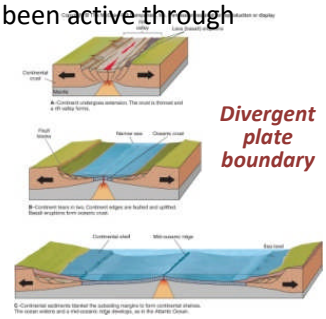

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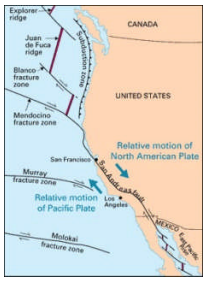

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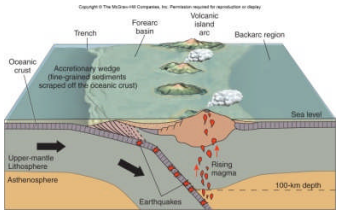

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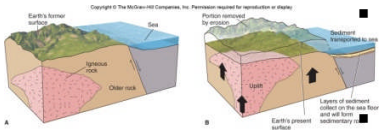

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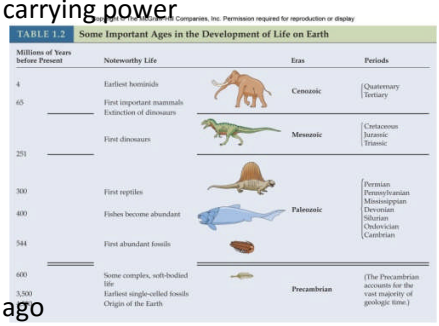

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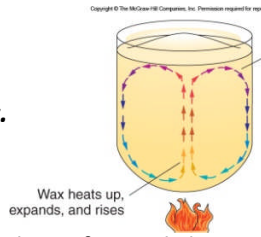


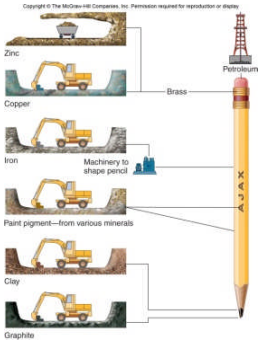
Convection is responsible for many of Earth's processes

Introducing Geology, Plate Tectonics, & Other Concepts

Physical geology is the study of the earth's rocks, minerals, and soils and how they have formed through time. Complex internal processes such as plate tectonics and mountain-building have formed these rocks and brought them to Earth's surface. Earthquakes are the result of sudden movement of crustal plates, releasing internal energy that becomes destructive at the surface. Internal heat and energy are released also through volcanic eruptions. External processes such as glaciation, running water, weathering, and erosion have formed the landscapes we see today.

Practical Aspects of Geology

- Natural resources – Supplying the things we need
- Geological hazards – Avoiding them
- Environmental protection
- Understanding our surroundings – Aids us in making good decisions



Most materials we use are mined

Resource Extraction & Environmental Protection of Natural Resources

Oil pipeline

- All manufactured objects depend on Earth's resources
- Localized concentrations of useful geological resources are mined or extracted
- If it can't be grown, **it must be mined!**
- Many resources are limited in quantity and non-renewable
  - Careless mining can release acids into groundwater
  - Petroleum Resources - removal, transportation and waste disposal can 'damage' the environment

Geologic Hazards

Earthquake damage

- **Earthquakes**
  - Shaking can damage buildings and break utility lines; large undersea quakes may generate tsunamis
- **Volcanoes**
  - Ash flows and mudflows can overwhelm populated areas
- **Landslides, floods,** and **wave erosion**

Floods

Physical Geology Concepts

Earth's Systems

- **Atmosphere**—the gases that envelop Earth
- **Hydrosphere**—water on or near Earth's surface
- **Biosphere**—all living or once-living materials
- **Geosphere**—the solid 'rocky' Earth

Heat can create convection currents similar to a lava lamp

Earth's Heat Engines

- **External** *(energy from the Sun)*
  - Primary driver of atmospheric *(weather)* and hydrospheric *(ocean currents)* circulation
  - Controls weathering of rocks at Earth's surface
- **Internal** *(heat moving from hot interior to cooler exterior)*
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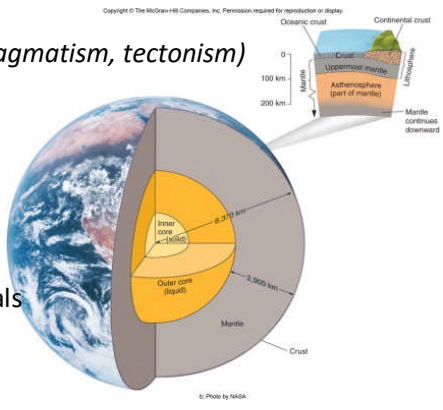
Earth's Interior

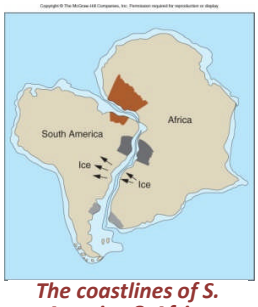


Earth's interior

- **Compositional Layers** *(defined by their composition)*
  - **Crust** *(~3-70 km thick)*
    - Very thin outer rocky shell of Earth
    - Continental crust differs from oceanic crust
  - **Mantle** *(~2900 km thick)*
    - Hot solid that flows slowly over time; Fe-, Mg-, Si-rich minerals
  - **Core** *(~3400 km radius)*
    - Outer core - metallic liquid; mostly iron
    - Inner core - metallic solid; mostly iron

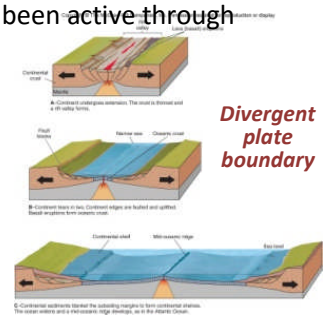
- **'Mechanical' Layers** *(defined by their physical characteristics)*
  - **Lithosphere** (~100 km thick)
    - Rigid/brittle outer shell of Earth
    - Composed of both crust and uppermost mantle
    - Makes up Earth's tectonic 'plates'
  - **Asthenosphere**
    - Plastic *(capable of flow)* zone on which the lithosphere 'floats'

Theory of Plate Tectonics

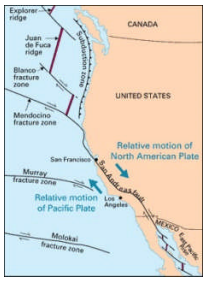


The coastlines of S. America & Africa appeared to 'fit' together

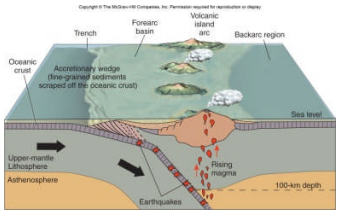
- **Continental Drift Hypothesis**
  - Originally proposed in early 20th century by Alfred Wegener to explain the "fit of continents", also matching rock types and fossils across ocean basins, etc.
  - Insufficient evidence found for driving mechanism; hypothesis initially rejected
- **Plate Tectonics Theory**
  - Originally proposed in the late 1960s
  - Included new understanding of the seafloor and explanation of driving force
  - Describes lithosphere as being broken into plates that are in motion
  - Explains the origin and distribution of volcanoes, fault zones and mountain belts
  - As a result of plate tectonics, the same rock forming processes have been active through much of Earth's history…and continue today.
- Tectonic Plate Boundaries
  - **Divergent boundaries**
    - Plates move apart
    - Magma rises, cools and forms new lithosphere
    - Typically expressed as mid-oceanic ridges
  - **Transform boundaries**
    - Plates slide past one another
    - Fault zones, earthquakes mark boundary
    - San Andreas fault in California is one example
  - **Convergent boundaries**
    - Plates move toward each other
    - Mountain belts and volcanoes are common
    - Oceanic plates may sink into mantle along a subduction zone, typically marked by a deep ocean trench



Divergent plate boundary

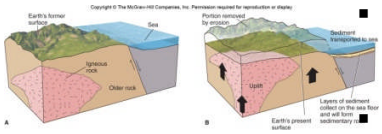


The San Andreas Fault is a transform plate boundary



Convergent plate boundary

Surficial Processes



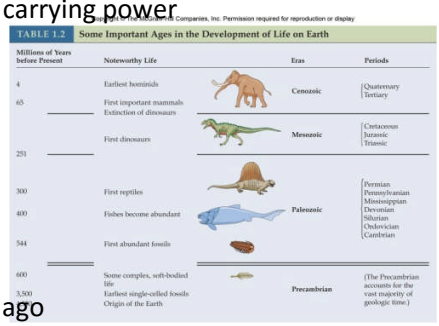
Uplift & erosion

- **Uplift**
  - Volcanic and/or tectonic forces build crust up above sea level
  - Removal of material by erosion allows isostatic uplift of underlying rocks
- **Weathering and Erosion**
  - Rainfall and glaciers flow down slopes carrying 'sediment' with them
  - Moving water, ice, and wind loosen and erode geologic materials, creating sediment
- **Deposition**
  - Loose sediment is deposited when the transporting agent loses its carrying power
  - Sediments then get buried and harden into sedimentary rock

Geologic Time

"Nothing hurries geology" Mark Twain

- **Deep Time**
  - Most geologic processes occur gradually over millions of years
  - Changes typically imperceptible over the span of a human lifetime
  - Current best estimate for age of Earth is ~4.56 billion years
- **Geologic Time and the History of Life**
  - Complex life forms first became abundant about 544 million years ago
  - Reptiles became abundant ~230 million years ago
  - Dinosaurs became extinct *(along with many other organisms)* ~65 million years ago
  - Humans have been around for ~3 million years



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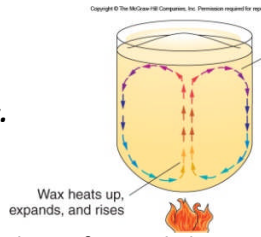

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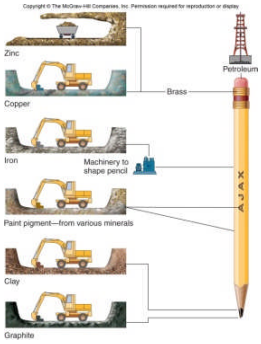

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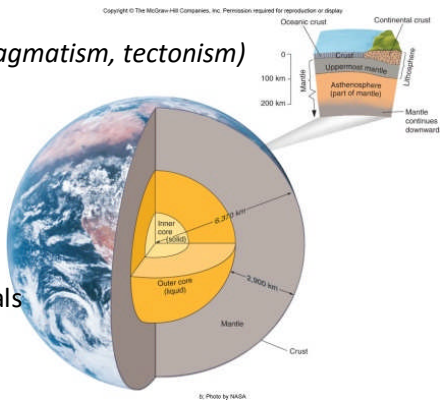

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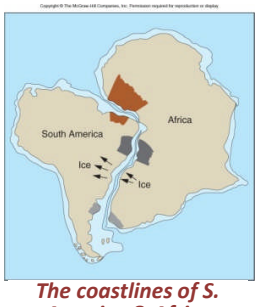

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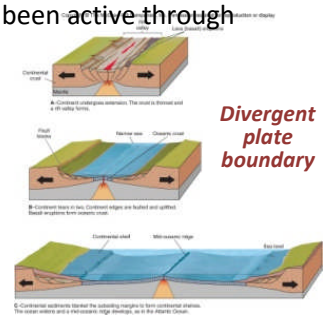

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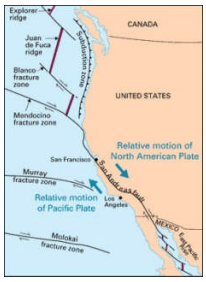

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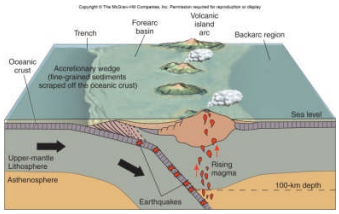

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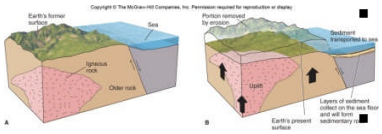

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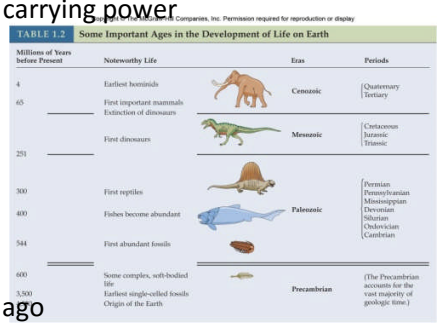

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