

## Outline 23: Archean and Proterozoic Crustal Evolution

### Terms

- Cratons - stable areas in the center of continents that have undergone no mountain building since the Precambrian.
- Shields - cratonic areas where Precambrian rocks are exposed.
- Orogens - ancient mountain belts

### Composition of Cratons

- The cratons are composed of:
- Archean protocontinents (also called Archean cratons)
- Proterozoic orogens

### Archean Protocontinents

- The first crust of the earth was entirely oceanic. It's composition was mafic and ultramafic. There were no continents.
- This crust is represented by Greenstone Belts, which are metamorphosed volcanic and volcanoclastic rocks.
- The Greenstone Belts are trapped between younger granites.

### Archean Protocontinents

- How did granitic crust form? It formed by the process of partial melting as oceanic crust was subducted into the mantle. (The remaining crust melted in the mantle.)
- The hydrated crust lowered the melting point for felsic components in the oceanic crust.

### Archean Protocontinents

- The felsic magmas rose to the surface because of their low densities.
- Enormous volumes of granite were thus "sweated" out of the oceanic crust to form continental crust 25 miles thick.

## Archean Protocontinents

Archean granites formed rapidly because the rate of seafloor spreading was 3 to 4 times faster than today because of higher heat flow from the earth's interior. Why? Radioactive heat production was much greater early in earth history.

## Proterozoic Plate Tectonics

- By the late Archean there were hundreds of little protocontinents.
- In the early Proterozoic they collided to form ever larger protocontinents.
- By the end of the Proterozoic modern sized continents had formed by collisions of protocontinents.

## Wilson Cycles

The constant motion of the continents has led to the formation and breakup of supercontinents at least twice in earth history.

800 MY ago: Rodinia

250 MY ago: Pangea

300 MY in the future: Pacific Ocean closes as new supercontinent forms