

Thursday, October 21
Mass Extinctions



You can pick up problem set #1 after lecture.

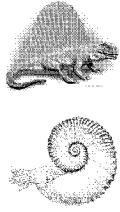
Average score = 82.4 percent

Points	Letter grade
91 - 100	A
81 - 90	B
71 - 80	C
61 - 70	D
0 - 60	E

Mass Extinctions
Key Concepts

- 1) Dinosaurs went extinct 65 million years ago, during the **K-T mass extinction**.
- 2) The K-T mass extinction was probably triggered by the impact of an asteroid.
- 3) Other mass extinctions may also have been caused by impacts.

Dinosaurs became extinct during the **K-T mass extinction**, 65 Myr ago.



The K-T extinction killed ~70% of **all** species on Earth (not just dinosaurs!)

(K-T = between the Cretaceous and Tertiary periods.)

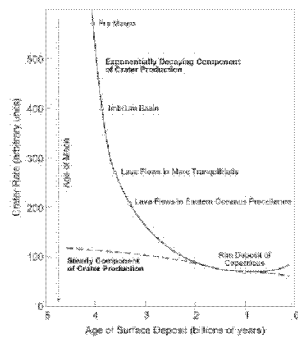
(Cretaceous is spelled with a "K" in German.)

The favored explanation for the K-T extinction is that it resulted from the impact of an asteroid.



The rate of impacts decreased during the Hadean Eon, but then leveled off.

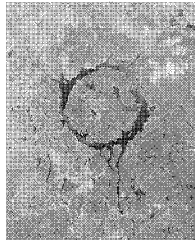
The rate at which asteroids and comets have hit the Earth has been roughly constant for the past 2 Gyr.



About 50 impact craters are known on Earth with diameters greater than 20 kilometers.



Clearwater Lakes
northern Quebec
290 Myr ago

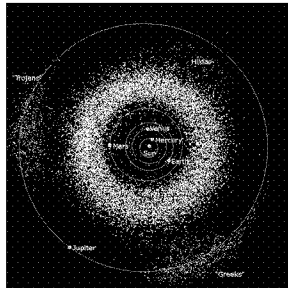


Lake Manicouagan
central Quebec
214 Myr ago

Most asteroids are in the asteroid belt (between Mars & Jupiter).

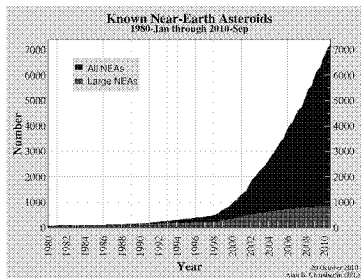
~1 million asteroids are bigger than 1 km across.

Sometimes asteroids are kicked by Jupiter's gravity into the inner Solar System.



Near-Earth Objects (NEOs) are asteroids that have orbits that take them near Earth.

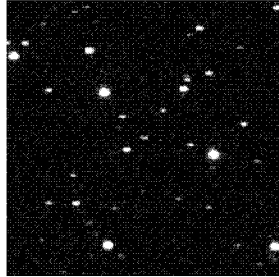
7300 NEOs are known, most just a few meters across.



There are ~1000 NEOs larger than 1 km across.

A close call on March 18, 2004: asteroid 2004 FH came within 34,000 km of Earth.

This asteroid was about 30 meters across.
It was detected only 3 days before closest approach.



A hit on June 30, 1908: an asteroid or comet hit Tunguska, Siberia.

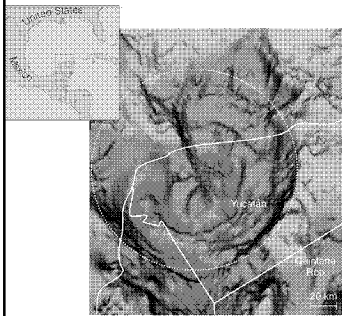
An airburst occurred 10 km up, with an energy release of ~15 megatons.

Impacting object was ~30 meters across.

Impacts of this magnitude are roughly a once-per-century event.



Evidence of a very large impact 65 Myr ago: Chicxulub Crater, in the Yucatan.



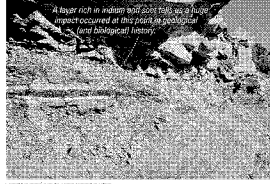
Diameter = 180 km, gouged by an asteroid ~10 km across.

Radiometric dating of rocks melted by impact: 64.98 Myr.

**More evidence for the impact:
the K-T Boundary Layer**

It's a layer of clay unusually rich in iridium & soot, dating to 65 Myr ago.

Iridium is very scarce in the Earth's crust, but much commoner in asteroids.



Total amount of iridium in K-T Boundary Layer = amount of iridium in a 10 km asteroid.

The aftereffects of the impact were lethal.

Energy release = 100 million megatons of TNT.

Global firestorms.

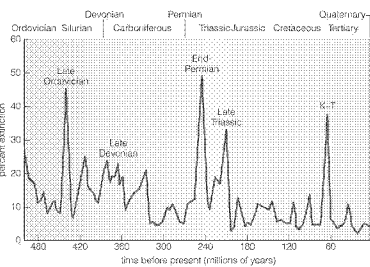
Monster tsunamis.

Dimming of sunlight by dust.



Mass extinctions have occurred a number of times in the history of life.

5 mass extinctions during the Phanerozoic Eon.



Earlier mass extinctions may have been due to impacts, or to other causes.

Could an impact happen again?
Yes. It's only a matter of time...

