TERRESTRIAL IMPACT CRATERS AND THEIR PROJECTILE TYPES

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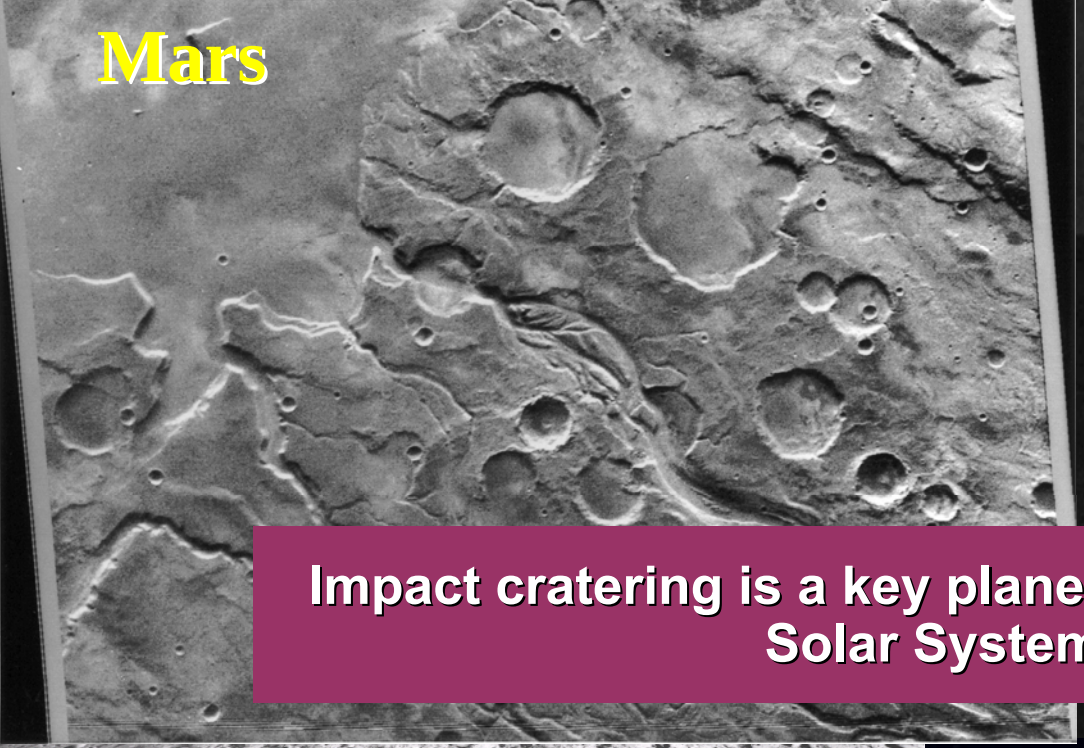
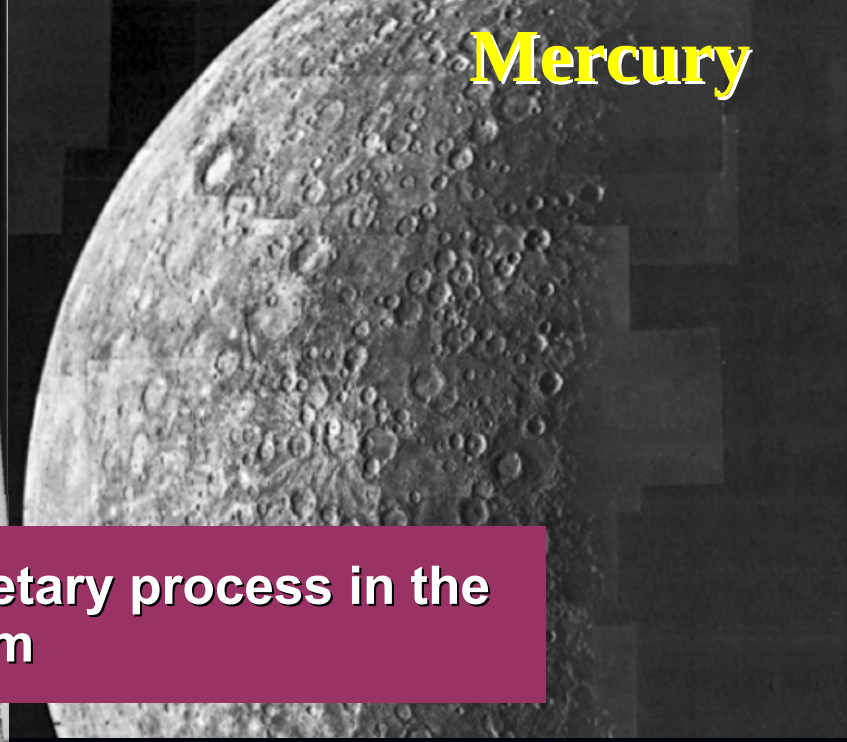
INTERNATIONAL METEOR CONFERENCE, POREČ, CROATIA, 24th-27th September 2009

QUESTIONS

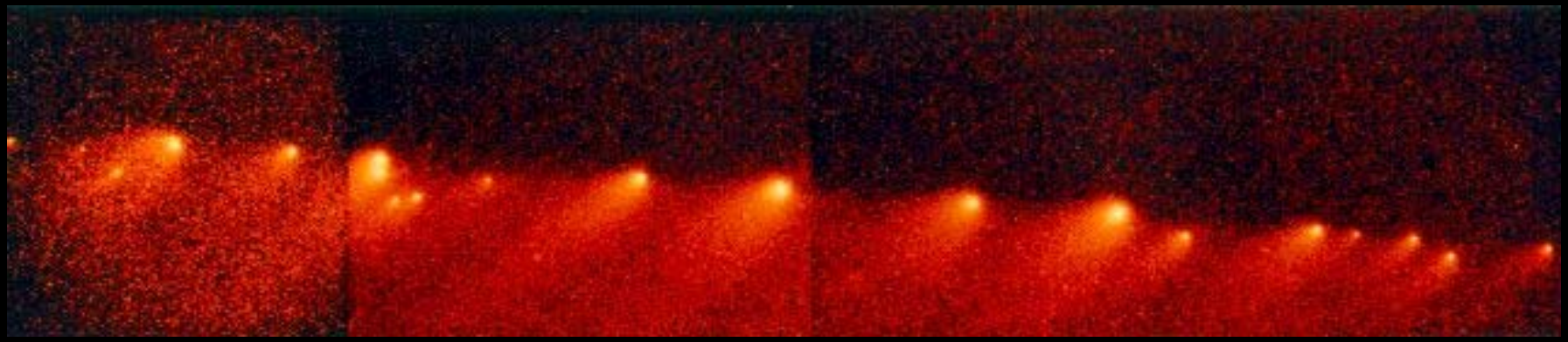
What are the chemistry and source of projectiles falling on Earth?





Impact cratering is a key planetary process in the Solar System

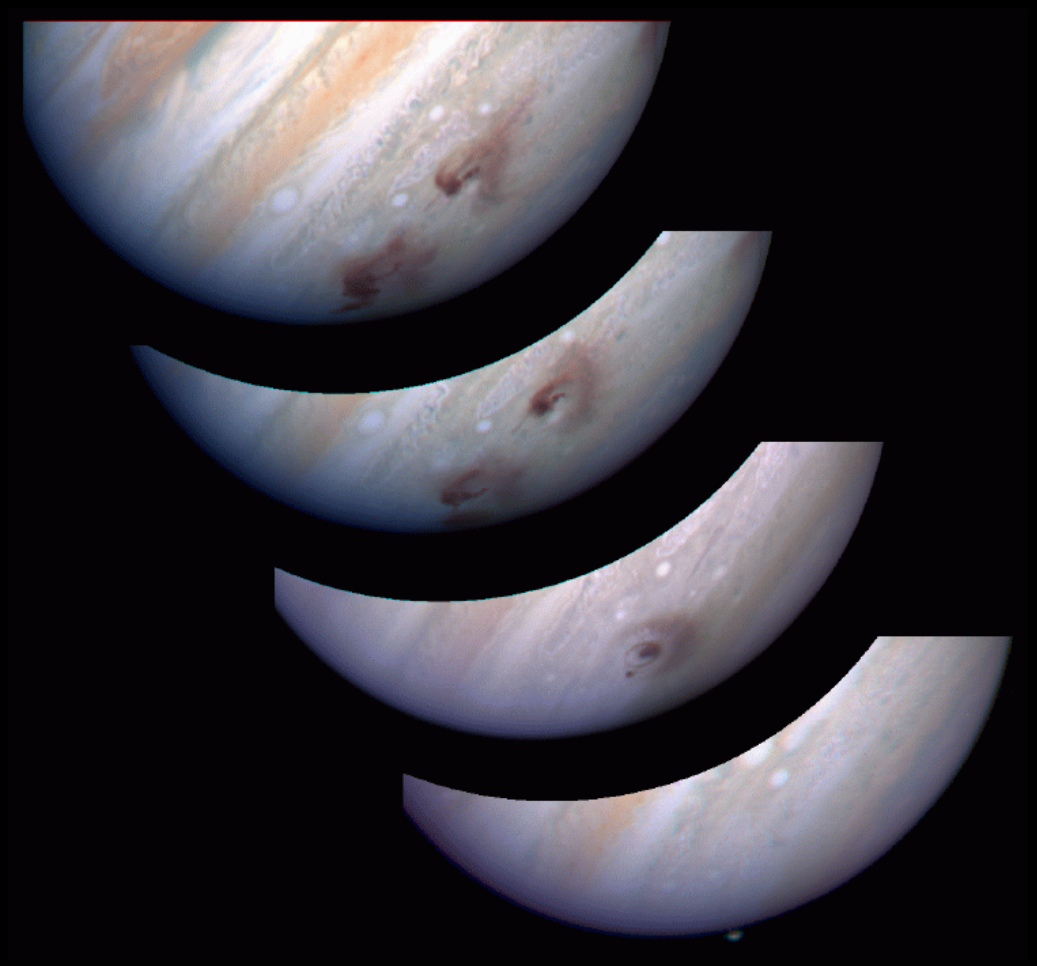
Before the impact



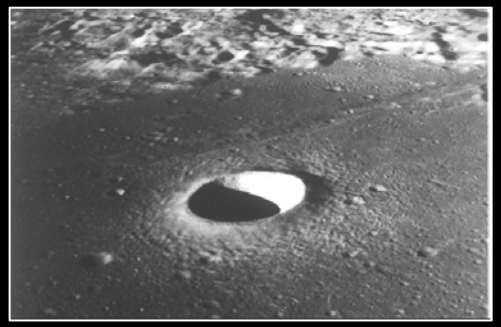
- Discovered: Eugene & Carolyn Shoemaker és David Levy (March 1993)

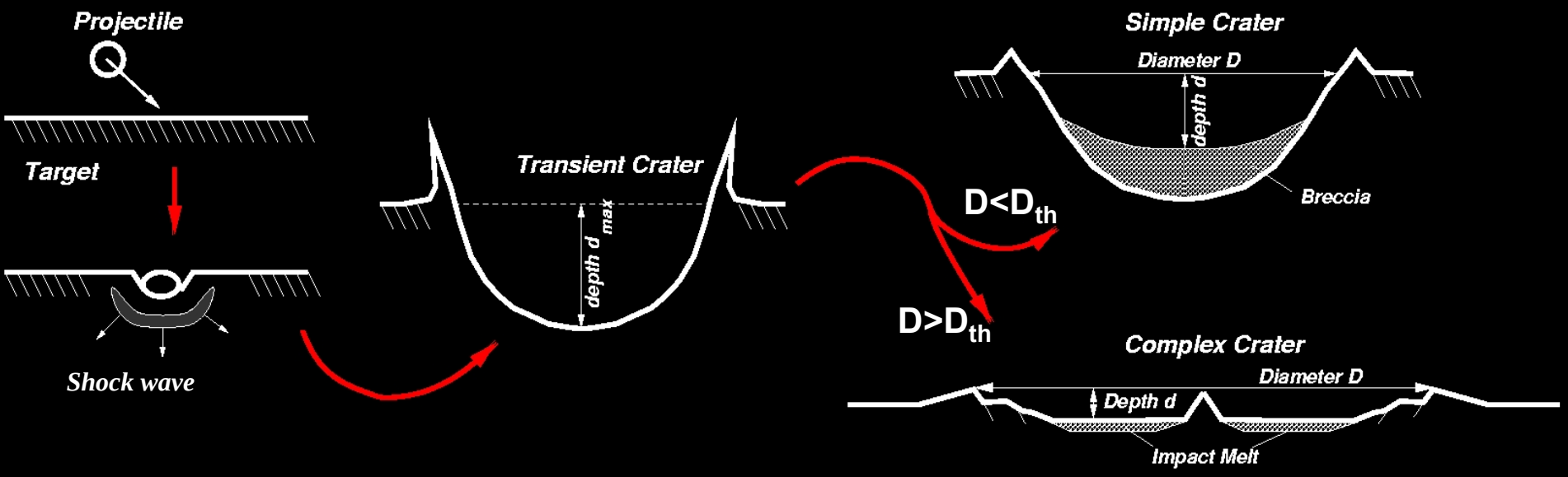
During the impacts

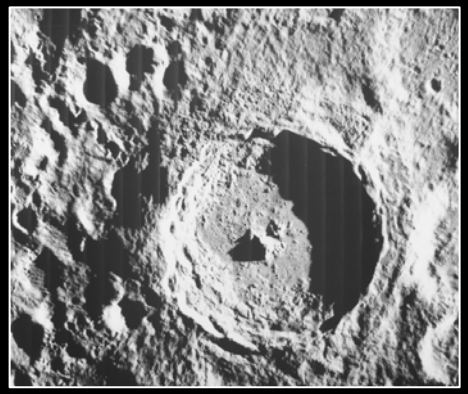
Series of an impact event: Shomaker-Levy-9 (SL-9 1993) Jupiter

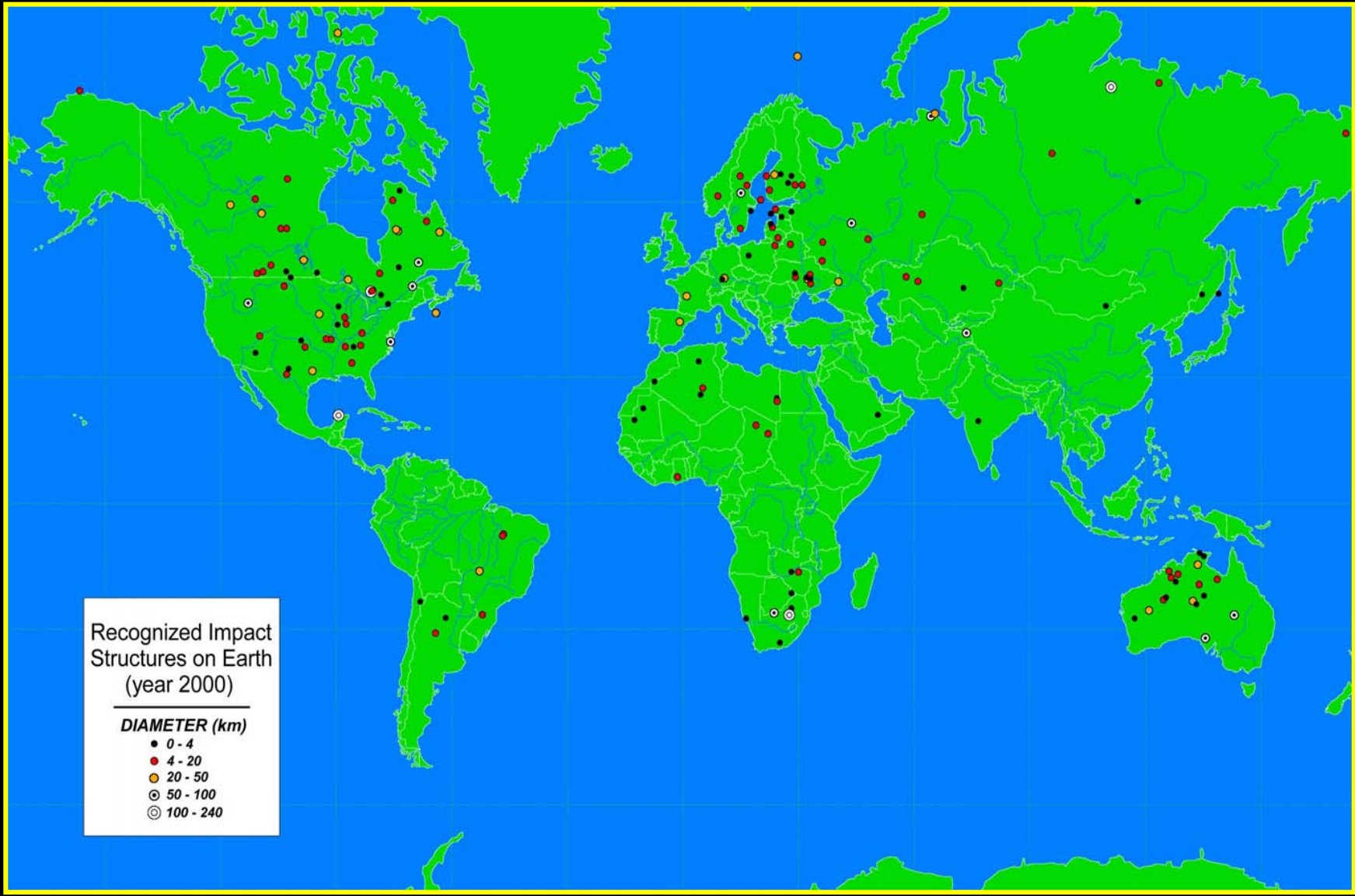


Formation stages of impact craters







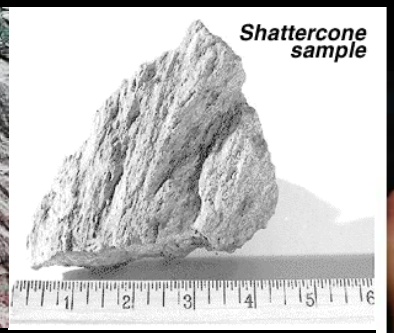


Geographic Distribution of Known Impact Structures

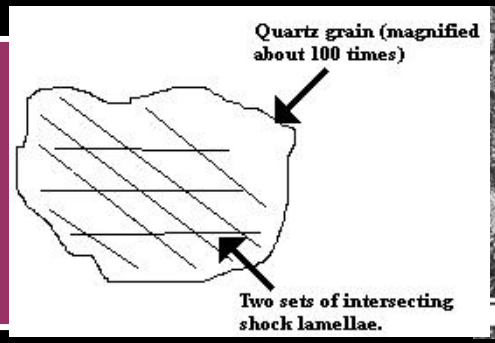
This image shows the geographic distribution of about 176 structures that have been positively identified to date as impact structures based on the presence of shock-metamorphic effects and/or the presence of a meteoritic component or fragments at the structure.

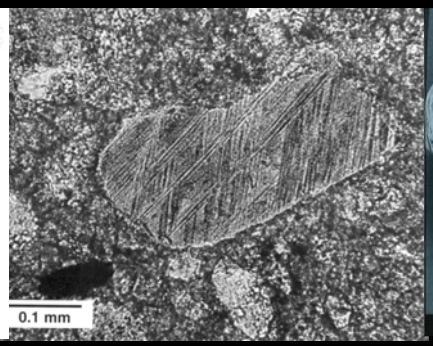
Geological and Mineralogical Indicators of an Impact Crater

Shatter cones



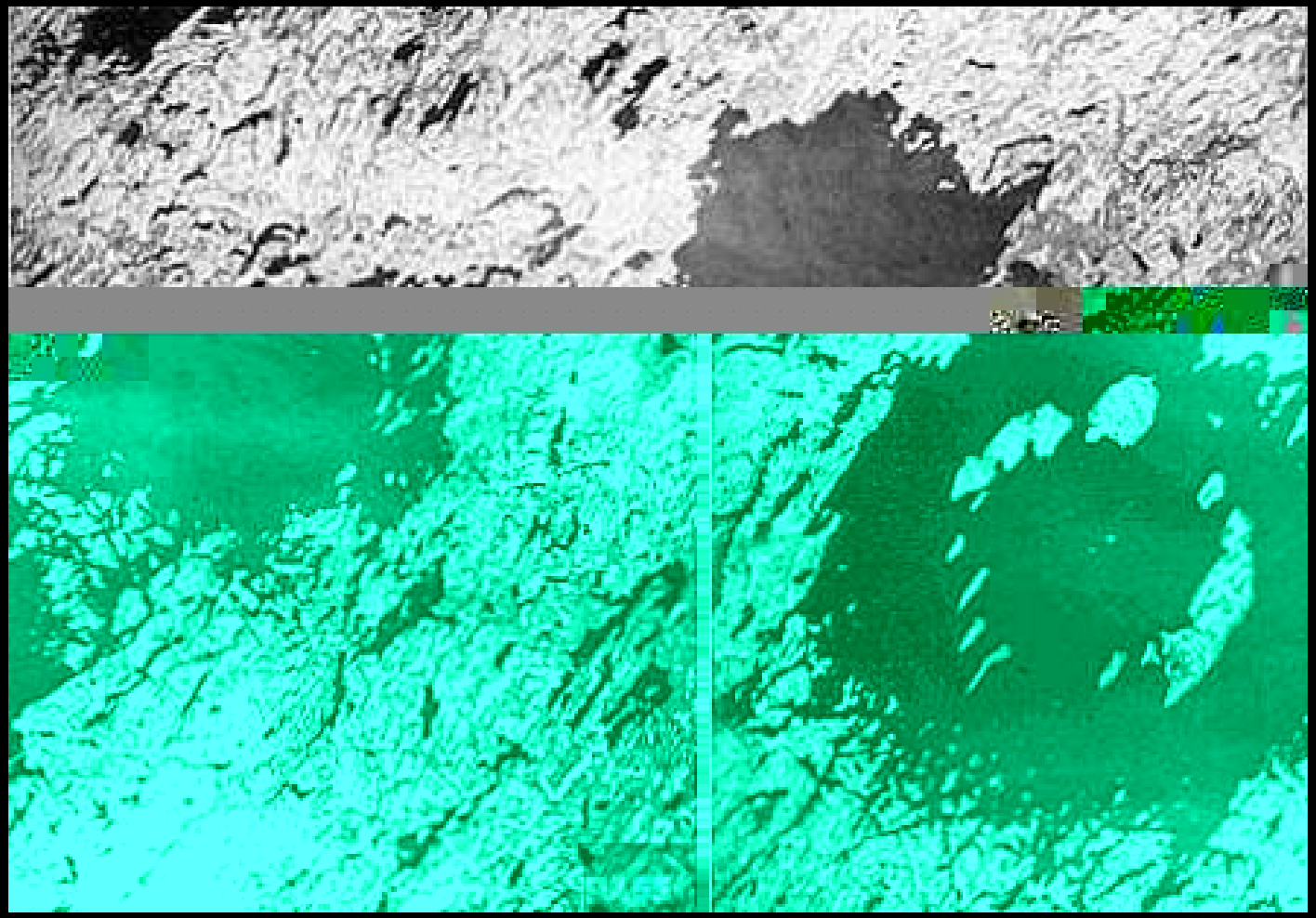
Shock-induced microstructures

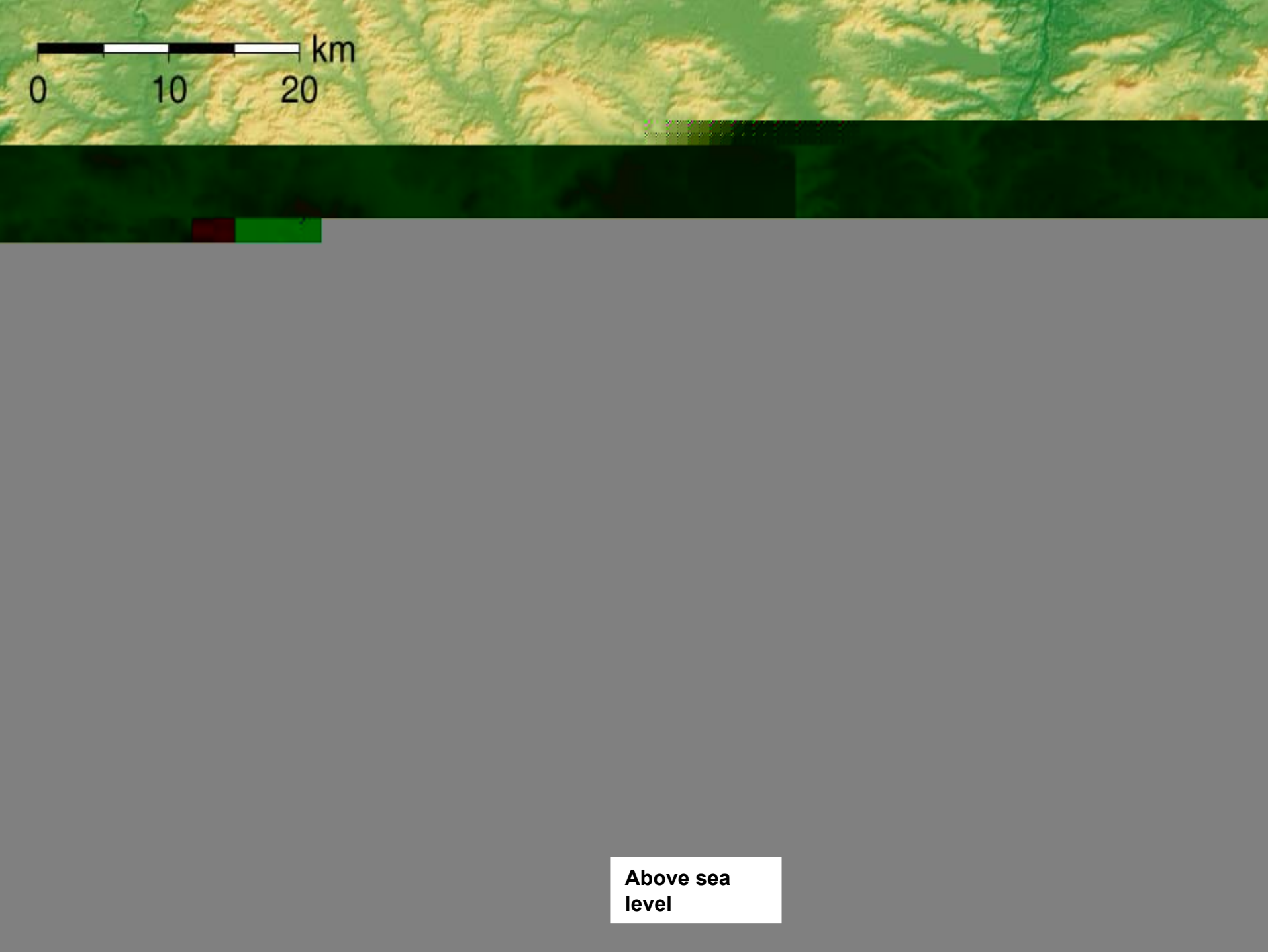


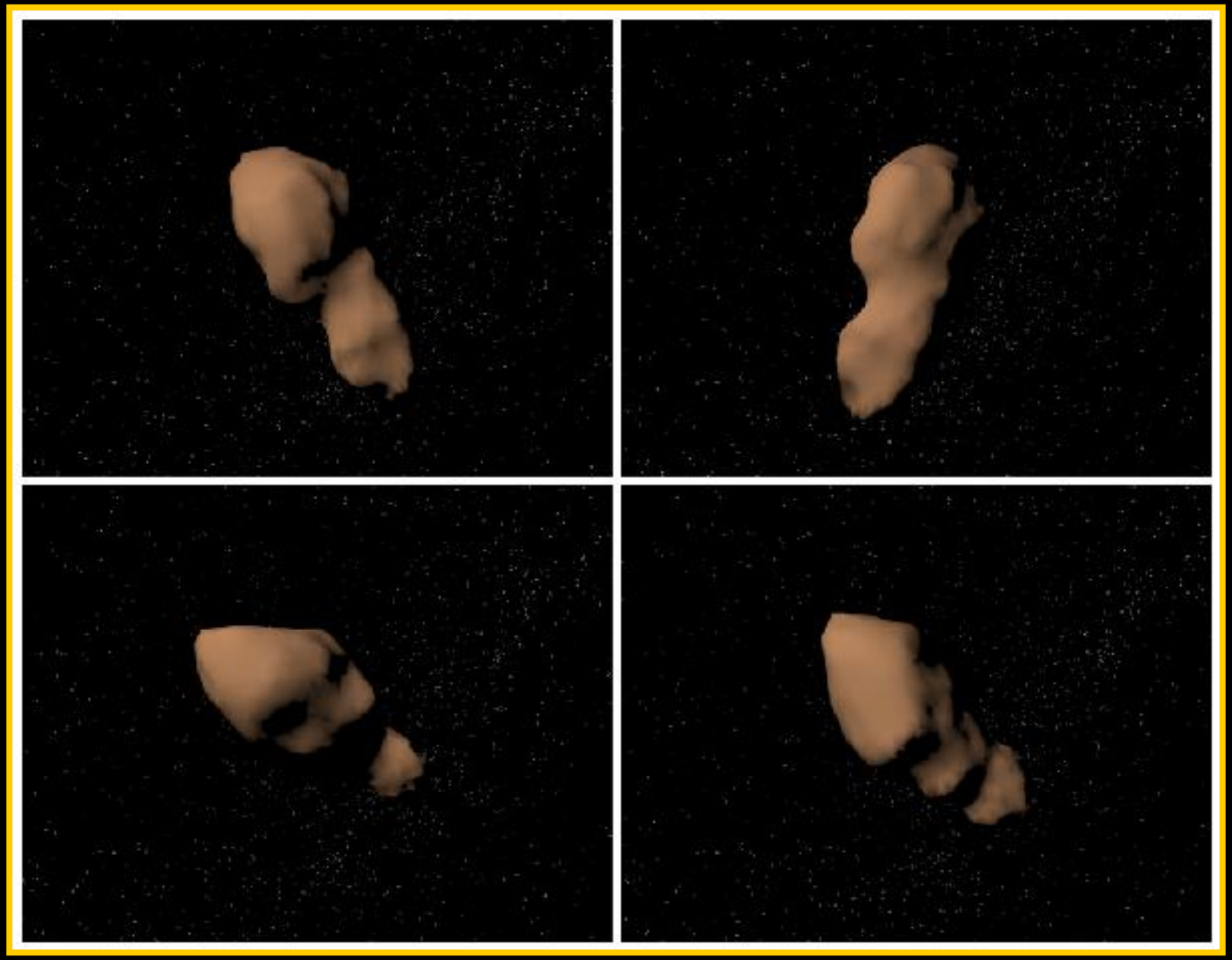


Impact Melts

Clearwater West and East (Canada): Binary Impactor

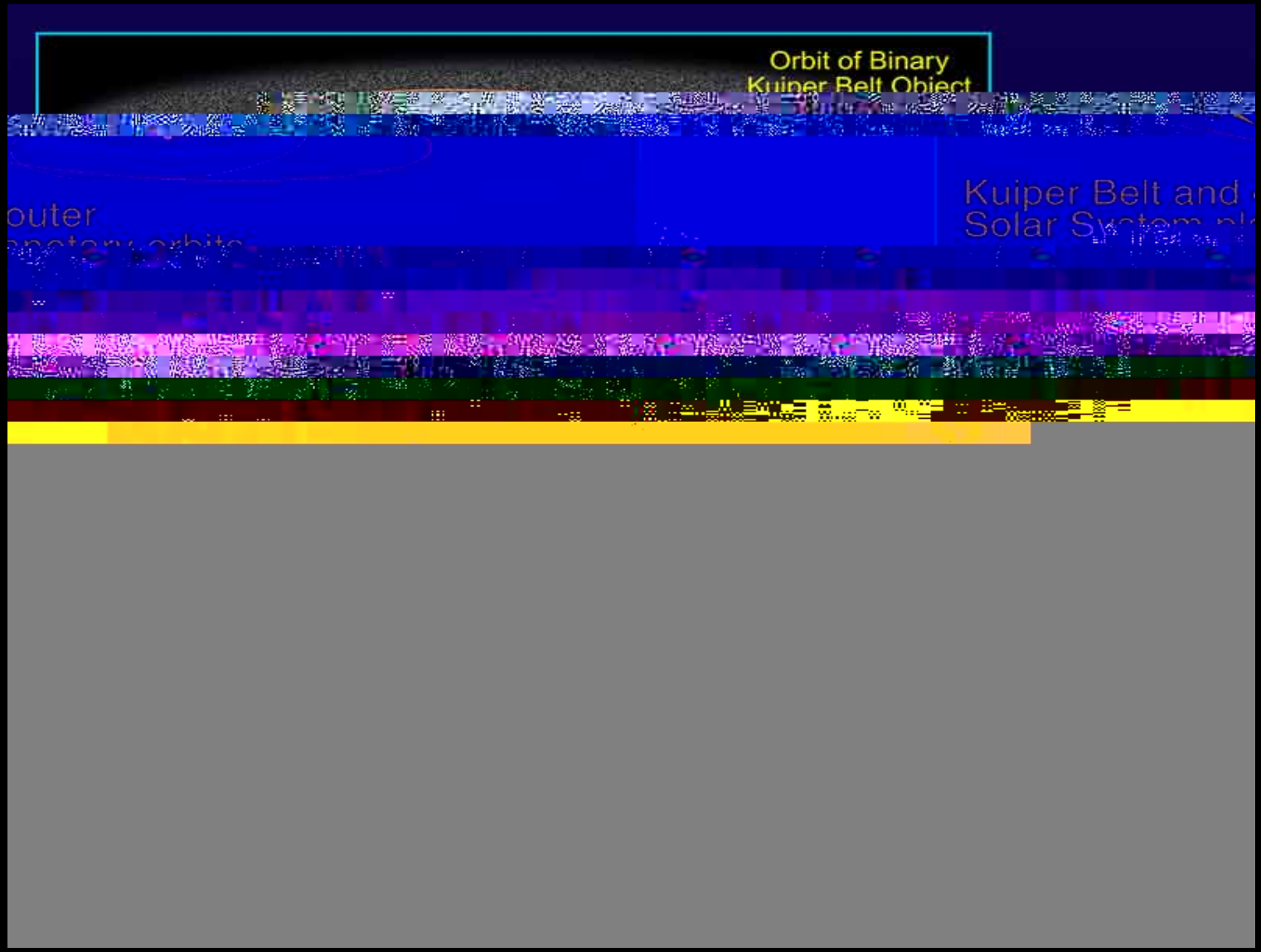



km
0
10
20
Above sea level



4179 Toutatis

Computer images of 4179 Toutatis, which could have a binary impactor system.



Kuiper Belt

A large body of small objects orbiting (the short period comets) the Sun in a radial zone extending outward from the orbit of Neptune (30 AU) to about 50 AU. Pluto maybe the biggest of the Kuiper Belt object.

Oort Cloud

Long Period Comets (period > 200 years) seems to come mostly from a spherical region at about 50,000 AU from the Sun.

Small part of the meteorite is incorporated into the impact melt

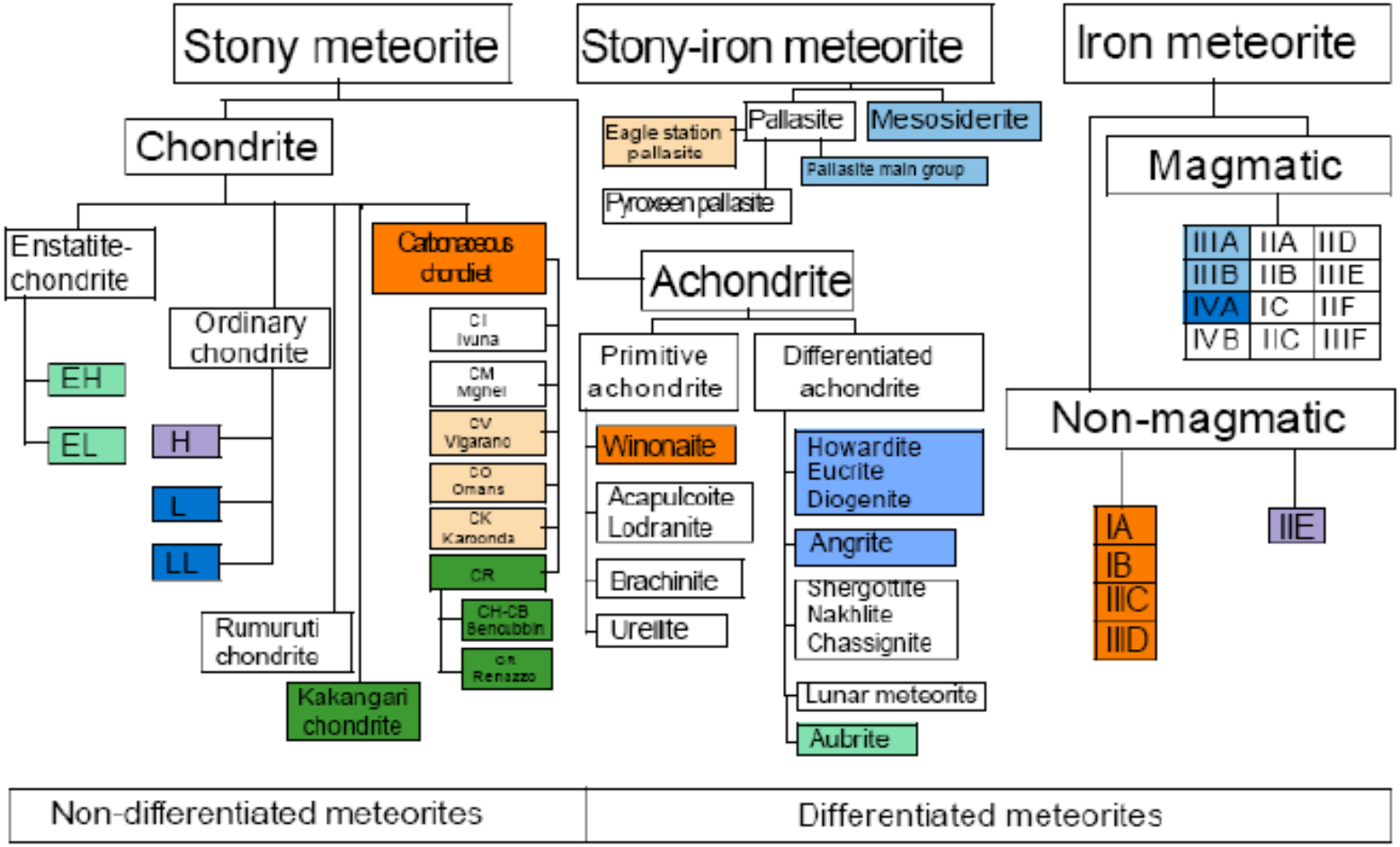
<0.1 to 7 wt%

This contribution is detected:

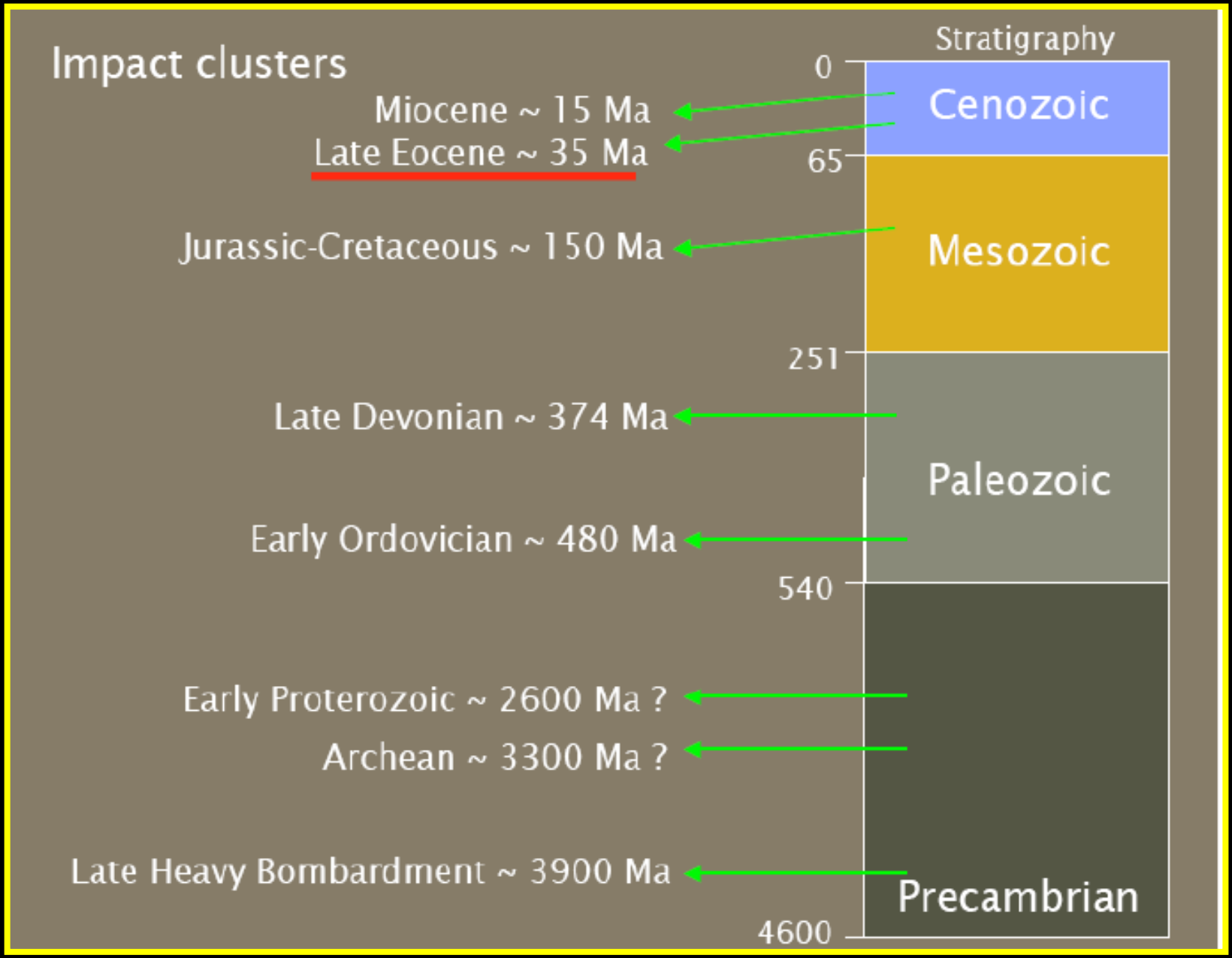
- by concentration in highly siderophile elements (platinum group elements: Ir, Ru, Pt, Os, Rh, Pd)
- the Os ($^{187}Os/^{188}Os$) or Cr ($^{53}Cr/^{52}Cr$) isotopic ratios (^{182}Hf-^{182}W ??)

Gederis and Claeys 2004

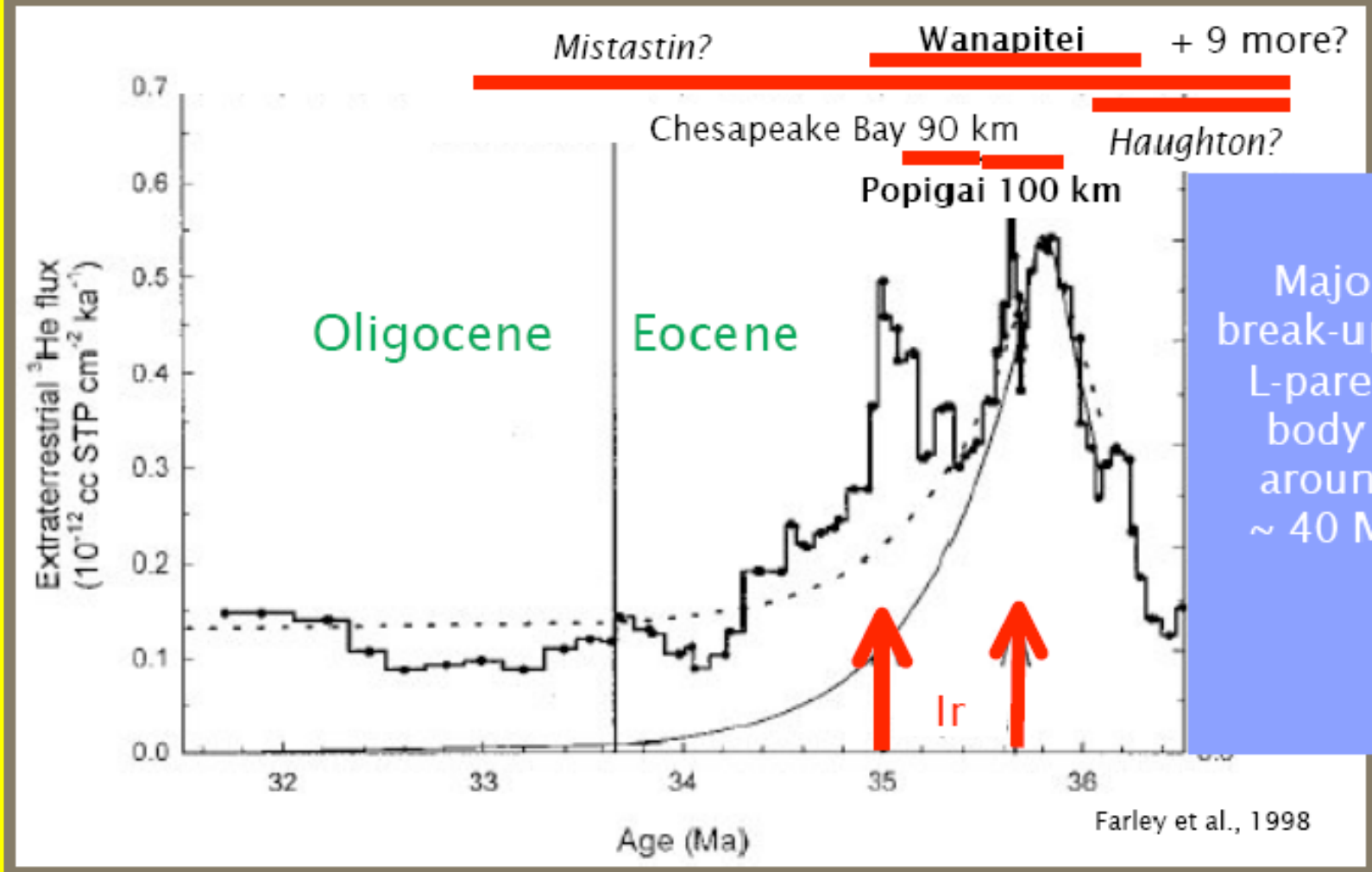
Meteorite classification



Gederis and Claeys 2004



Gederis and Claeys 2004



Major break-up of L-parent body ? around ~ 40 Ma

Concentration of craters made by ordinary chondrites and ^{3}He from dust also produced by collison

Gederis and Claeys 2004

Earth Impact Effects Program - Windows Internet Explorer

http://www.lpl.arizona.edu/impacteffects/

Projectile Parameters

Projectile Diameter [ ] m

Projectile Density (in kg/m^3) [ ] or Select from a list

Impact Parameters

Impact Velocity [ ] km/s

This is the velocity of the projectile before it enters the atmosphere. The minimum impact velocity on Earth is 11 km/s. Typical impact velocities are 17 km/s for asteroids and 51 km/s for comets. The maximum Earth impact velocity for objects orbiting the sun is 72 km/s.

Impact Angle (in degrees) [ ]

The impact angle is measured from a plane tangent to the impact surface. This angle is 90 degrees for a vertical impact. The most probable angle of impact is 45 degrees.

Target Parameters

Target Type

- ○ Water of depth: [ ] meters
- ○ Sedimentary Rock
- ○ Crystalline Rock

Calculate Effects | Reset Form

CONCLUSIONS

Ordinary chondrites dominate and are distributed in two impact clusters-LHB?

Large craters formed by non-magmatic iron meteorites.

Single CC impact known at KTB.

Archean impacts are also related to CC.

Thank you very much for your attention.