Our Solar System
• 187 confirmed impact structures on Earth
End excavation stage/start modification stage

Uplift of crater floor

Gravitational collapse of crater walls

Modification stage

Ejecta
Moltke Crater (d = 7 km); Apollo 10 photograph AS10-29-4324

Bessel Crater (d = 16 km); Part of Apollo 15 Panoramic photograph AS15-9328

Euler Crater (d = 28 km); Apollo 17 Metric photograph AS17-2923

Schrodinger Crater (d = 320 km); Mosaic of Clementine images. Image processing by Ben Bussey
The destructive power of impact events

Data from French (1998)
CRADLE OF LIFE
How killer asteroids created Eden

WHO ARE YOU?
PERSONALITY Towards a grand unified theory
IDENTITY The essential elements of self
Impact-generated hydrothermal systems (& their weathering products)

Impact-generated glasses

Impact-processed crystalline rocks

Impact-generated crater lakes
Hydrothermal activity at Haughton

Legend

Quaternary
- Stream sediments

Neogene
- Post-impact crater lake sediments

Impactites
- Crater-fill Impact melt breccias
- Fossil hydrothermal vents
- Selenite mineral vugs
- Marcasite + calcite mineral vugs
- Zone of intense calcite veining

Ordovician and Silurian
- Central uplift lithologies
- Lithologies of the faulted crater rim
- Fault (tick on downthrown side)

Hydrothermal activity at Haughton

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Hydrothermal activity at Haughton
Impact-induced hydrothermal systems

Cross section of crater.

Then have another, cold section with other habitats...


~5 to 200 km depending on size of projectile
• First geochemical evidence for life: ~3.8 Ga.
• Lunar craters: impacts ~10–20 times more common ~3.8 Ga than they are now.
• Why should (and how did) life evolve at the harshest, most inhospitable time in Earth’s history?
“If we could conceive in some warm little pond, with all sorts of ammonia and phosphoric salts, light, heat, electricity present, that a protein compound was chemically formed, ready to undergo still more complex changes. At the present day, such matter would be instantly devoured or absorbed, which would not have been the case before living creatures were formed.”

Charles Darwin, The Origin of Species (1871)
A hydrothermal origin of life?
A hydrothermal origin of life?
Questions?