Delivery scenario

One particular scenario for the origins of life on the early Earth invokes cometary delivery in the following way:

- An isolated body of water with important molecules...
- ...is impacted by a comet which delivers hydrogen cyanide (HCN).
- Additional energy activates the cyanosulfidic pathway to life...
- ...which leads to the formation of RNA, lipid and protein precursors.

This work aims to determine how effective cometary impacts are at delivering HCN.

Methods

Impact simulations

- iSALE grid-based hydrocode
- Spherical comet made of pure water ice with a homogeneous HCN distribution
- Solid basalt impact site to simulate surface of early Earth

Chemical Modelling

- Simple model:
  - Thermal decomposition of H₂O
  - Radical driven destruction of HCN

Which cometary impacts are most efficient at delivery?

Small... slow... & oblique.

The impact shockwave passes through smaller bodies quicker, reducing the time the material stays at high temperatures, boosting HCN survival.

Higher impact velocities increase the temperatures experienced by the cometary material, efficiently destroying HCN.

Oblique impacts reduce the temperature experienced by the cometary material, increasing HCN survival.

References