THE CURTAIN RISES ON LIFE

Once oceans formed, Earth had all the necessary ingredients for life: energy sources, carbonaceous molecules, and protection from the sun's UV rays. Because meteors are still hitting the Earth, it is thought that there might be multiple cycles of life forming, being destroyed by giant meteor impacts, and then forming again, until most of the meteors are swept up, and Earth's surface is quiet enough to let the new life forms get a foothold. The heavy meteor bombardment ceased 3.8 billion years ago, based on the craters we see on other planets, including our moon. And that's the age of our oldest fossil evidence of life.

The most logical place for early life to have evolved is around hydrothermal vents on the seafloor. We study these structures today and find an entire ecosystem living off bacteria that get their energy from hydrogen sulfide gases that bubble out from underwater chimneys. It's not hard to imagine such structures as the breeding ground for life on Earth.

Close-up of bubbles of hydrogen sulfide and carbon dioxide gas at the Champagne hydrothermal vent site. © NOAA

Header Image: Active "smoker" chimneys precipitating iron, copper, and zinc sulfides from 230°C fluid. They are 9-m tall from the base to the top of the chimneys. These chimneys are surrounded by heat-loving bacteria that convert the energy in hydrogen sulfide gases into sugar—chemosynthesis. These vents are likely sites for where life first formed on our planet. © NOAA

It was likely that the same meteorites that wrought such havoc on Earth's surface during its first couple hundred million years were also the sources of the molecules from which early life evolved. Carbonaceous chondrites have been studied by scientists in labs across the world and among them all, we find 70 amino acids and a range of organic substances closely related to sugar.

Murchison Meteorite—a carbonaceous chondrite that exploded into fragments over the town of Murchison, 400 km north of Perth, Australia, on September 28, 1969. About 82 kg of the meteorite were recovered. Eyewitnesses arriving at the scene reported smelling something like methanol or pyridine, an early indication that the object might contain organic material. Subsequent analysis by NASA scientists revealed the presence of 70 amino acids (some found in proteins, others not found in any terrestrial life) and a range of polyols—organic substances closely related to sugars such as glucose.
© New England Meteoritical Services