12 May 2005

Building a Better Biosphere

Thirty years ago, geochemists took away the primordial soup that biologists thought they needed to cook up the first life on Earth. Now, atmospheric chemists are giving it back. They're showing that the early Earth could have held onto much more of its volcanic hydrogen, a key ingredient in the recipe for making the organic compounds that may have led to the first life.

Creating the primordial organic goo used to be easy. Mix the methane and ammonia seen in the still-primordial atmosphere of Jupiter, pass lightninglike sparks through the mixture, and, voilà, complex organic compounds such as amino acids form. But then, in the 1970s, geochemists spoiled the party with the insistence that Earth's earliest atmosphere was nothing like Jupiter's. Earth's carbon would have been tied up in carbon dioxide rather than available as methane; its nitrogen would have been inaccessible as inert nitrogen gas; and hydrogen would have quickly escaped to space. That left chemists with a thin gruel, indeed. It had far too much oxygen, which destroys organics, and not enough of the hydrogen that lets carbon atoms link to form the complex polymers needed for life.

Now, atmospheric chemist Feng Tian of the University of Colorado, Boulder, and his colleagues argue in the 13 May issue of *Science* that hydrogen on the early Earth would have escaped much more slowly than has been assumed. Lacking the oxygen that absorbs solar energy, the outer fringes of the early atmosphere would have been far colder than they are today, the team points out. That would have greatly reduced the amount of lightweight hydrogen that simply "evaporated" into space.

The researchers are also the first to figure out how to calculate the rate at which hydrogen would have been lost as wisps of the atmosphere flowed away into space. Overall, hydrogen would have escaped at one-hundredth the rate previously assumed, the group says. Rather than building to concentrations of just 0.1%, hydrogen might have reached 30%. That would make for a far more productive atmosphere than chemists have been coping with the past 30 years. "The end result is you drop vast amounts of organic compounds into the ocean to make a soup," says the group's Brian Toon.

"On the face of it, what they have produced is quite reasonable," says atmospheric chemist Yuk Yung of the California Institute of Technology in Pasadena. "It's a nice piece of work. It's going to make the biologists a lot happier."

--RICHARD A. KERR

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