

Research suggests that ancient granites made advanced life possible

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John Parnell examining granite in Laxford Brae, Sutherlandshire, U.K. Image credit: University of Aberdeen

A little less than 2 billion years ago, metals including copper, molybdenum and zinc became available to primitive cells, at the same time that the cells began to become much more complex. Scientists indicate that they have identified the event that introduced these metals, which made it possible for those primitive cells to develop, evolve, and spread.

The secret, according to researchers, was granite.

The new research suggests that the large amount of heat within the Earth at this time caused metal-laden magmas to rise from great depths, which cooled into granites near the surface. The scientists conclude that this event caused the substantial change in the Earth's surface and ocean chemistry that began about 2 billion years ago.

This hypothesis challenges the prevailing consensus that changes in [ocean chemistry](#) were responsible for enabling life to undertake this transition.

"There's no doubt that probably a lot of metal was locked up in the oceans," said John Parnell, a geologist from the University of Aberdeen, in the U.K. "[We're] suggesting that it's the [terrestrial environment](#) where the metal was really being made newly available."

Parnell brought together several pieces of evidence to show that granites formed, came to the surface of continents, then weathered. [Weathering](#) freed up metals, he said, which traveled with runoff to fill lakes and shallow seas, places where [primitive life](#) could incorporate the metals and become more complex.

"We propose that metals were delivered due to a critical combination of continental growth, near-surface [metal](#) concentration, and erosion into the surface environment during the Mesoproterozoic [a time period from roughly 1.6-1.0 billion years ago]," Parnell and his colleagues wrote in their paper, published this month in *Geology*.

Life originated more than 3.5 billion years ago, as basic prokaryotic cells, which did not have a nucleus. Advanced cells -- called eukaryotes -- added a nucleus. They evolved around 2 billion years ago. Then, sometime between 2 billion and 1 billion years ago, these cells proliferated, sexual reproduction evolved, and the first multicellular organisms developed.

Parnell said that he brought together two areas of research to form this conclusion.. The first was from scientists who identified that critical advances in life lined up with increased access to metals about 1.5 to 2 billion years ago. A second group had shown that granites bearing many of these same metals formed at about the same time.

"Nobody had thought about it in this way before," said Parnell.

"It's really interesting and intriguing," said Ariel Anbar, a geologist at Arizona State University in Tempe. "A lot of us in the community have noted loosely that there's this correlation and we've wondered if there's something to it."

Anbar also called the article "thought-provoking." He suggested that the increased availability of oxygen in the environment may have been more responsible for life's increasing complexity.

However, Anbar also added that complex processes can have several contributing factors.

"I think we should all be cautious about saying, 'Oh, this one factor was the key,'" said Anbar. "There are probably multiple factors."

Regardless of the root cause that made new elements available to ancient life, metals such copper, molybdenum, and zinc remain important.

"Many people will know that we have plenty of iron in our body, and you can see that in the red color in our blood," said Parnell. "We have just as much zinc in our bodies as we have iron."

More information: Research paper: geology.gsapubs.org/content/ea.../07/G33116.1.abstract

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