Ancient diamond 'inclusions' reveal shift in carbon cycle of early Earth

Timmermans, S.; Davies, G.R.

published in
UPI
2017

document version
Publisher's PDF, also known as Version of record

document license
Article 25fa Dutch Copyright Act

UPI

Ancient diamond 'inclusions' reveal shift in carbon cycle of early Earth

Published: Feb. 23, 2017 at 1:08 PM

Brooks Hays

Feb. 23 (UPI) -- Researchers have discovered a diamond that grew for more than 2 billion years. Inside the record-setting diamond are clues revealing a significant shift in the carbon cycle of early Earth.

Scientists discovered a diamond from a Botswana mine with "inclusions" separated by 2 billion years. At the center of the diamond lies silicate, incorporated 2.3 billion years ago. In the diamond's outer rim, its lattice is interrupted by the presence of a 250-million-year-old garnet crystal. The diamond boasts the largest inclusion range yet discovered.

"Although a jeweller would consider diamonds with lots of inclusions to be flawed, for a geologist these are the most valuable and exciting specimens," Gareth Davies, a professor of Vrije Universiteit Amsterdam, explained in a news release. "We can use the inclusions to date different parts of an individual diamond, and that allows us to potentially look at how the processes that formed diamonds may have changed over time and how this may be related to the changing carbon cycle on Earth."

Davies and his colleagues analyzed 16 diamonds collected from Botswana's Orapa and Letlhakane mines. Though separated by just 25 miles, the two mines yielded diamonds with remarkably different inclusions.

Orapa diamonds boasted younger inclusions across a narrower range, dating between 400 million and more than 1.4 billion years old. Letlhakane diamonds featured inclusions between 700 million and 2.5 billion years old. Researchers linked the inclusions with ancient magmatic activity triggered by tectonic movement.

Researchers detailed their diamond survey in the journal Earth and Planetary Science Letters.

Additionally, analysis of the chemical composition of inclusions in the Letlhakane diamonds revealed a significant shift in early Earth's carbon cycle. Some of the inclusions in the Letlhakane diamonds were incorporated prior to the Great Oxidation Event, 2.3 billion years ago, when cyanobacteria began pumping oxygen into Earth's atmosphere.

"The oldest inclusions in the diamonds contain a higher proportion of the lighter carbon isotope," explained lead study author Suzette Timmerman. "As photosynthesis favours the lighter isotope, carbon 12, over the heavier carbon 13, this 'light' ratio finding suggests that organic material from biological sources may have been more abundant in diamond-forming zones early in the Earth's history than we find today."

Timmerman and Davies hypothesize higher temperatures in Earth's mantle prior to the Great Oxidation Event may have altered the way carbon was cycled into diamond-forming regions, affecting tectonic processes.

"However, we are currently working with a very small dataset and need further studies to establish if this is a global phenomenon," Timmerman concluded.