

# Diamonds may not be so rare as once thought

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Diamonds may not be as rare as once believed, but this finding in a new Johns Hopkins University research report won't mean deep discounts at local jewelry stores.

"Diamond formation in the deep Earth, the very deep Earth, may be a more common process than we thought," said Johns Hopkins geochemist Dimitri A. Sverjensky, whose article co-written with doctoral student Fang Huang appears today in the online journal *Nature Communications*. The report says the results 'constitute a new quantitative theory of diamond formation,' but that does not mean it will be easier to find gem-quality [diamonds](#) and bring them to market.

For one thing, the prevalence of diamonds near the Earth's surface—where they can be mined—still depends on relatively rare volcanic magma eruptions that raise them from the depths where they form. For another, the diamonds being considered in these studies are not necessarily the stuff of engagement rings, unless the recipient is equipped with a microscope. Most are only a few microns across and are not visible to the unaided eye.

Using a chemical model, Sverjensky and Huang found that these precious stones could be born in a natural chemical reaction that is simpler than the two main processes that up to now have been understood to produce diamonds. Specifically, their model—yet to be tested with actual materials—shows that diamonds can form with an increase in acidity during interaction between water and rock.

The common understanding up to now has been that diamonds are formed in the movement of fluid by the oxidation of methane or the chemical reduction of carbon dioxide. Oxidation results in a higher oxidation state, or a gain of electrons. Reduction means a lower [oxidation state](#), and collectively the two are known as 'redox' reactions.

"It was always hard to explain why the redox reactions took place," said Sverjensky, a professor in the Morton K. Blaustein Department of Earth and Planetary Sciences in the university's Krieger School of Arts and Sciences. The reactions require different types of fluids to be moving through the rocks encountering environments with different oxidation states.

The new research showed that water could produce diamonds as its pH falls naturally - that is, as it becomes more acidic—while moving from one type of rock to another, Sverjensky said.

The finding is one of many in about the last 25 years that expands scientists' understanding of how pervasive diamonds may be, Sverjensky said.

"The more people look, the more they're finding diamonds in different rock types now," Sverjensky said. "I think everybody would agree there's more and more environments of diamond formation being discovered."

Nobody has yet put a number on the greater abundance of diamonds, but Sverjensky said scientists are working on that with chemical models. It's impossible to physically explore the great depths at which diamonds are created: roughly 90 to 120 miles below the Earth's surface at intense pressure and at temperatures about 1,650 to 2,000 degrees Fahrenheit.

The deepest drilling exploration ever made was about 8 or 9 miles below the surface, he said.

If the study doesn't shake the diamond markets, it promises to help shed light on fluid movement in the deep Earth, which helps account for the carbon cycle on which all life on the planet depends.

"Fluids are the key link between the shallow and the deep Earth," Sverjensky said. "That's why it's important."

**More information:** Dimitri A. Sverjensky et al. Diamond formation due to a pH drop during fluid–rock interactions, *Nature Communications* (2015). [DOI: 10.1038/ncomms9702](https://doi.org/10.1038/ncomms9702)

Provided by Johns Hopkins University

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