

Where did ancient lead disappear from Earth's surface? Scientists have found an answer



An international team of researchers from Nanyang Technological University (Singapore) has found a likely explanation for one of the long-standing geochemical mysteries: where a significant portion of ancient lead, which should have been present in Earth's crust, has gone.

The study results were published in the journal Nature Communications.

The “Missing” Lead Paradox

Lead is an important element for geological dating because its isotopes allow scientists to determine the age of rocks and trace processes that occurred throughout Earth's history. However, scientists have long noticed a discrepancy: significantly more “young” lead is found in rocks of the Earth's crust than expected, while ancient lead appears to have vanished.

The new study proposes a solution to this mystery: the missing ancient lead most likely did not disappear but instead formed deep in Earth's mantle, where it remains in the form of stable compounds.

Lead Sulfides Under Extreme Conditions

The researchers conducted simulations of how lead compounds bonded with sulfur behave under the pressures and temperatures typical of the deep mantle. The calculations showed that lead sulfide can form extremely stable crystalline structures

capable of withstanding temperatures up to 5,000 °C while remaining solid even under such extreme conditions.

As a result, ancient lead could have been preserved for billions of years in isolated mantle “reservoirs,” without rising to the surface or mixing with other elements.

Why Lead Sometimes Reappears

The study also explains why traces of ancient lead are sometimes found in volcanic rocks. Under certain conditions, some sulfide compounds can partially melt and gradually migrate upward along with magma flows. This process allows small amounts of lead to return to Earth’s crust.

Significance of the Discovery

According to the authors of the study, the results help close an important gap in understanding Earth’s geochemical evolution. They may also prove useful for studying processes occurring within the interiors of other terrestrial planets.

In Brief

Scientists from Nanyang Technological University have explained where ancient lead may have disappeared from Earth’s surface. According to their simulations, a significant portion of this element formed deep in the mantle, where it exists in the form of stable sulfide compounds capable of withstanding temperatures up to 5,000 °C. These compounds remain stable in isolated mantle reservoirs for billions of years, explaining the paradox of the “missing” lead. Under certain conditions, part of this lead can return to the crust along with magma. The study was published in the journal Nature Communications.

<https://tech.news.am/eng/news/7056/where-did-ancient-lead-disappear-from-earths-surface-scientists-have-found-an-answer.html>