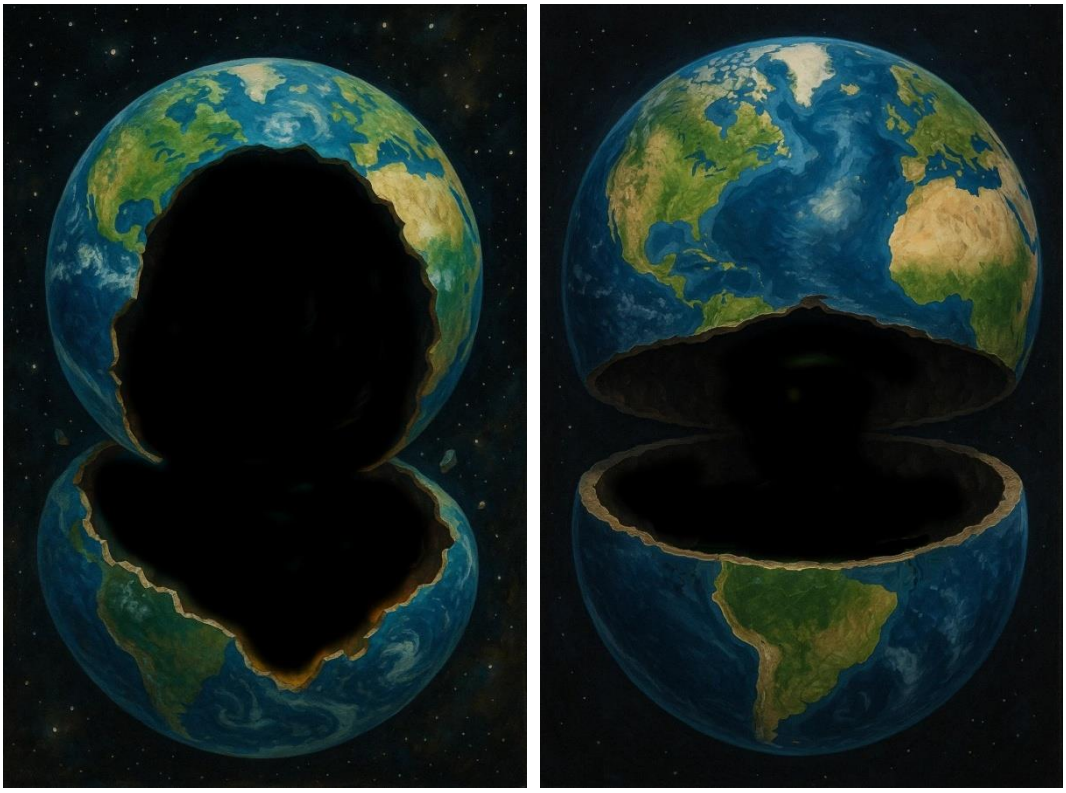
WHAT THE DEPOSIT OF MATERIAL WE CALL PLANET EARTH'S SURFACE LOOKS LIKE



We were wrong about plate tectonics.

The Earth's crust today has a surprisingly similar composition to the planet's first outer crust, or "proto-crust," new research reveals.

This early rocky shell had chemical signatures that were previously thought to only occur in continental crusts formed by subduction, a process in which one tectonic plate slides beneath another. But plate tectonics isn't actually required to create these signatures, according to a new study.

While this may not seem particularly important, it is because the findings are important to the debate about when our planet's plate tectonics began. No one knows exactly when or why the Earth's surface broke apart into plates that collided with each other, forming mountains and volcanoes and triggering earthquakes. Historically, the fact that the chemical signatures observed in modern plate tectonic processes appeared in the protocrust of the Earth's first billion years, during the Hadean eon, has been used as evidence to support the theory that plate tectonics began almost as soon as the Earth had solid ground—about four billion years ago.

"That's now probably a flawed argument," that is, the assumption that the Earth has always behaved as it does now, all along, so you can analyze it backwards.

The precise signatures being discussed are trace elements, such as titanium and niobium, that combine in the crystal structure of rocks as they solidify from hot magma. However, the behavior of these elements depends greatly on the conditions around them.

Scientists have come to realize that the chemistry of the molten, early Earth was quite different from that of today.

As the Earth solidified from the shrinking sediment, the crust formed. The researchers modeled the behavior of these trace elements under conditions from the first few hundred million years of Earth, when the crust and mantle were still separating.

The pattern they found looks “remarkably like a subduction zone signature,” meaning that chemical signatures cannot be used as evidence that subduction was occurring on the early Earth. They could also arise directly from the initial transition from a liquid-surface planet to a solid-surface planet.

“Some of the evidence that people use to argue for early plate tectonics probably doesn’t show you plate tectonics at all,”
That’s not to say that plate tectonics wasn’t happening back then, at least occasionally. There was a lot of debris flying around in the young solar system, and Earth was often bombarded by impacts, some of which would have been large enough to break up the protocrust and start localized periods of subduction.

But the entire planet likely transitioned to plate tectonics later, between 3.2 billion and 2.7 billion years ago. There is much more evidence that rocks are being recycled and pushed around during that time period.

Be healthy Rudolf Bošnjak.