Closer to Earth: A new technique for examining ultralow velocity zones at Earth's core-mantle boundary

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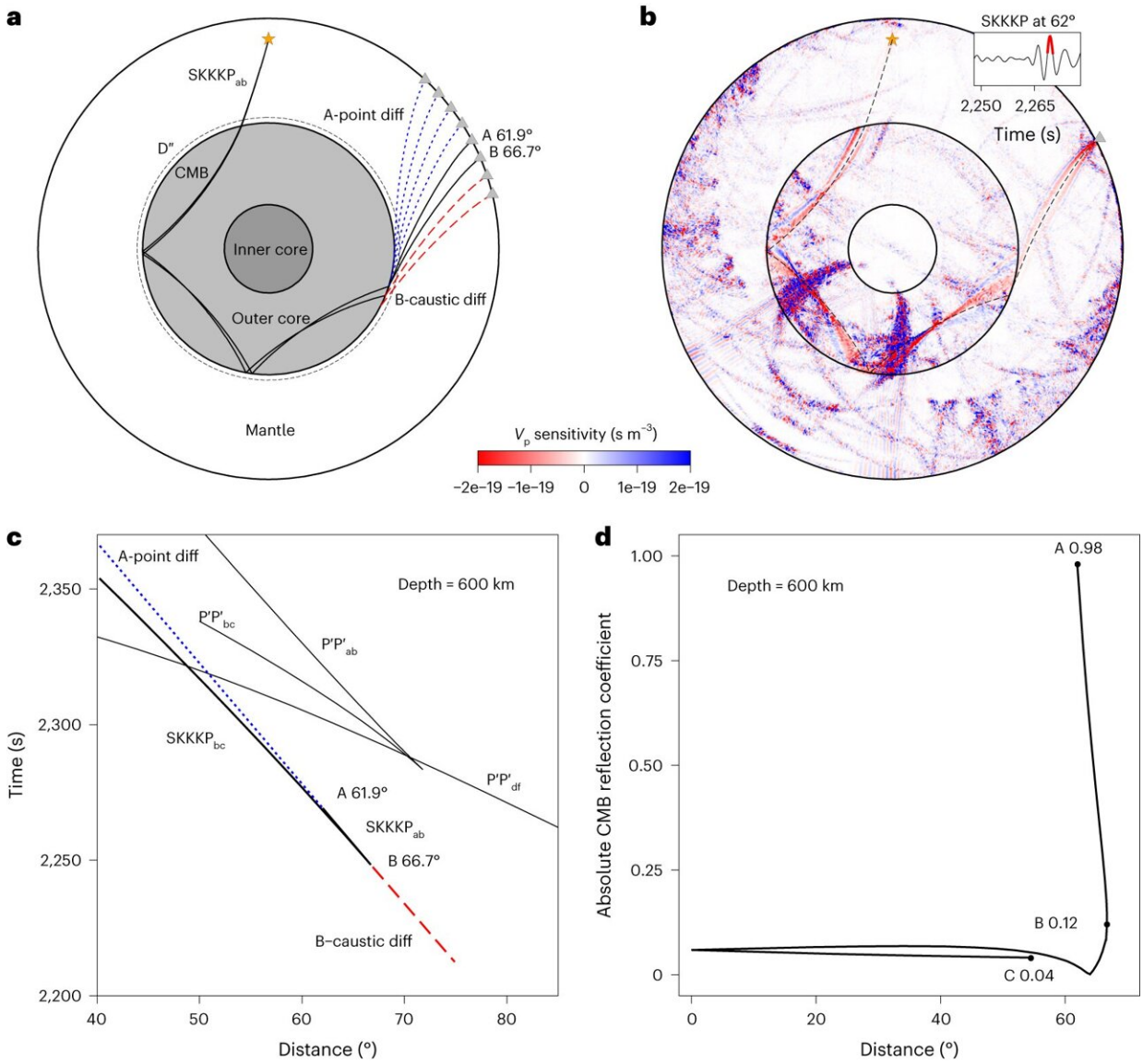

Basic information of SKKKP waves. Credit: *Nature Geoscience* (2024). DOI: 10.1038/s41561-024-01394-5

The core-mantle boundary (CMB) is crucial for the Earth's magnetic field and rotation. It is known that this boundary harbors complex structures, including ultralow velocity zones (ULVZs), characterized by significantly slowed seismic wave velocities. The origin and structure of these zones are key to unraveling and understanding some secrets in related fields, especially the Earth's science.

Seismological observations indicated that ULVZs primarily reside within and around large low-velocity provinces (LLVPs), while their presence in high-velocity anomalies remains unclear. To address this, researchers introduced a novel SKKKP B focal extension seismic phase technique to detect ULVZs at the CMB.

The technique focused on analyzing the SKKKP seismic core phase—a specific pattern of wave propagation and reflection at the CMB. By conducting an in-depth analysis of SKKKP waves, researchers uncovered that the ULVZs are responsible for the unexpectedly large observable distances of these waves.

Researchers also discovered ULVZs not only around the Pacific Ocean and below Africa but also in less explored high-speed anomaly areas such as Central America, Central and Western Asia, Alaska, and Greenland.

Further explorations suggested that ULVZ formation might be linked to tectonic plate movement. As a subducting plate descends into the lower mantle, its oceanic crust, with a lower melting point, may separate from the underlying plate and sink to the CMB, potentially leading to partial

melting and ULVZ creation.

The study enhances the understanding of the Earth's inner workings and underscores the importance of collaboration in scientific exploration, offering us a closer look at our mysterious planet.

The study is published in the journal *Nature Geoscience*.

More information: Yulong Su et al, Detections of ultralow velocity zones in high-velocity lowermost mantle linked to subducted slabs, *Nature Geoscience* (2024). DOI: 10.1038/s41561-024-01394-5

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