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Pseudo-reflection imaging of the Lunar Moho beneath the Apollo seismic stations using deep-moonquake seismic interferometry

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In 30 years following NASA's Apollo missions, numerous geophysical methods have been applied to determine the depth of the Lunar Moho. These methods, such as travel-time analysis and gravity inversion, have yielded inconsistent estimates. Here, we apply a seismic interferometry technique using body waves. We use deep moonquakes recorded by the Apollo stations to retrieve zero-offset reflection responses beneath each seismic station on the Nearside of the Moon. We call this application deep-moonquake seismic interferometry (DMSI). We present here the first pseudo-reflection imaging of the Lunar Moho, which we interpret to reside at around 50 km depth. Our interpretation agrees with JAXA's SELENE result, and with earlier travel-time studies. Our DMSI results also show lateral inhomogeneity beneath the Moho, suggesting strong scattering within a zone characterized by seismic velocity that exhibits little variation at our resolution scale (0.2-2.0 Hz). This zone is where most of the shallow moonquakes are presumed to be occurring.