Geological Society of Washington 2023 Bradley Lecture
Precision Seismology, with Applications to Signal Old and New
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Abstract: In recent decades, seismologists have developed precise methods for measuring and interpreting the slight differences between pairs of carefully-selected seismograms. These records of ground motion can originate from neighboring earthquakes -- or explosions -- and the use of whole waveforms enables precision measurements that have diverse applications. I shall describe interesting discoveries about changes occurring in the Earth's inner core; about patterns of seismicity in regions of damaging earthquakes; and about nuclear explosive tests and their aftershocks in North Korea. Applying the new methods to old data, an accurate origin time for the very first nuclear explosion (TRINITY, July 16, 1945) has at last been obtained. These new methods make clear the importance of maintaining good archives of seismograms. Precise measurements made on millions of pairs of seismic events can be expected to improve our understanding of seismicity and earthquake hazard.

Paul G. Richards is the Mellon Professor of the Natural Sciences (emeritus) at the Lamont-Doherty Earth Observatory of Columbia University where his work has focused on the development of seismological methods to improve monitoring of both earthquakes and explosions. Paul contributed to President Reagan's Report to the Congress on Soviet Noncompliance with Arms Control Agreements, was a member of the team that negotiated the Comprehensive Nuclear-Test-Ban Treaty (CTBT), and with Xiaodong Song discovered seismological evidence that the Earth's inner core rotates with respect to the mantle and crust. He co-authored the book *Quantitative Seismology* with Kei Aki, the preeminent text that has been translated into at least three other languages and that nearly every seismology student has read. Paul is a Fellow of the American Geophysical Union, the American Association for the Advancement of Science, and the American Academy of Arts and Sciences. He has been awarded a Sloan Foundation Fellowship, a Guggenheim Fellowship, and a MacArthur Fellowship, and has been a recipient of the Macelwane Award, Harold Jeffreys Lectureship, Leo Szilard Lectureship, and Harry Fielding Reid Medal.
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