

Jack Oliver

(1923–2011)

Seismologist who helped demonstrate that Earth's continents move constantly.

John “Jack” Ertle Oliver, who died on 5 January aged 87, was one of the founding fathers of modern seismology, plate tectonics and deep imaging of Earth's continental crust. He and Bryan Isacks, a former graduate student whom he had advised, showed that not just Earth's crust, but the entire 100-kilometre-thick outer layer of Earth, the lithosphere, moves over the face of the planet before plunging into the weaker underlying asthenosphere. This discovery gave the then-controversial theory of continental drift a solid foundation, paving the way for plate tectonics.

Two strong personalities had key roles in Oliver's scientific development. The first was Paul Brown, his high-school American-football coach in Massillon, Ohio — who later found fame as coach of the Cleveland Browns and founder of the Cincinnati Bengals. Brown was famously intolerant of prima donnas, and Oliver's philosophy of science and administration followed the same principle — that good scientists who worked together could produce more important science than the best scientists working alone.

Supported by a football scholarship, Oliver studied physics at Columbia University in New York, interrupted by three years of service in the Navy from 1943 to 1946. On returning he met Maurice Ewing, who became his PhD adviser. Ewing instilled in Oliver the view that going where no one had gone before offered a high probability of scientific discovery, and that discovery was fun — jet fuel to a man with insatiable curiosity.

In the 1950s, most seismologists recorded Earth's tremors by measuring the arrival times of two types of seismic wave, P and S waves, at their seismographs. These waves travel through the interior of Earth. Long-period waves that ripple over the surface of the planet offered a ‘place’ where few had gone before. Oliver was the first to recognize many of the peculiarities of the waveforms that computers now analyse and simulate. His papers from this period show exquisite recordings of surface waves, buttressed by sensible interpretation.

Towards the end of that decade, Oliver joined about a dozen of the country's outstanding scientists to form the Berkner Panel on Seismic Improvement. This was meant to

raise the game of seismology in the hope of finding ways to detect and identify underground nuclear explosions. (The Limited Test Ban Treaty, which banned nuclear tests from the atmosphere, underwater and in space, but not from underground, was ratified in 1963.) Modern seismology grew rapidly out of the panel's recommendation to build a global suite of detector stations — the World-Wide Standardized Seismograph Network.

Following Ewing's philosophy again, Oliver and Isacks installed seismographs in Fiji and Tonga to study what were then

not occur where temperatures were too great to support the needed stresses, but instead happened within slabs of still-cold lithosphere that had plunged rapidly to great depth.

Like many founders of plate-tectonics theory, Oliver soon changed direction. In 1971, he left Columbia University to revive the geological-sciences department at Cornell University in Ithaca, New York, and turned his attention to one of the blind spots in Earth science, the lower crust. He launched the Consortium for Continental Reflection Profiling, which pioneered the use of seismic

reflection technology — developed in the oil industry — to explore the lower crust of continents. It has since been copied by numerous nations.

He always worked to instil a sense of teamwork, and tried to erase the differences between geologists (sometimes belittled for being quantitatively challenged) and geophysicists (sometimes perceived as believing only what they could not see with their eyes). Cornell led the widespread transformation of geology and geophysics departments into integrated Earth-science departments.

Oliver continually inspired students around him, asking, almost as an interrogative mantra: “What is the next most important problem?” He once said, “Sure. I want to work with bright students, but what I really want are students who can ask good questions.” Time and again he demonstrated that asking the right question was a shortcut to answering an important one. Spicing his later writings with limericks, he once wrote:

*“If creativity is what you strive for,
The status quo you must learn to abhor,
Chains of convention unfetter,
Seek the different yet better,
Pay no attention to those keeping score!”*

Not a self-promoter, Oliver was as at home with technicians as with academicians. He died while in lucid conversation with his long-time administrative assistant, Judy Healey, abruptly announcing, without concern: “I'm done.” ■

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one of Earth's enigmas: deep earthquakes. These occur at 300–700 kilometres below the surface, where pressures and temperatures seemed far too high to allow rock to fracture. With seemingly little more than a glance at their seismograms, they knew they had something important: P and S waves with unusually high frequencies. They realized that the lithosphere (which includes the planet's crust and the uppermost ‘cool’ part of the mantle) underlying the Pacific Ocean to the east had plunged to a depth of 700 kilometres. Much of the scientific community was slow to appreciate their insight, for few seismologists had turned their attention to the theory of continental drift, or even taken it seriously, but scepticism quickly gave way to consensus with another of their studies.

In 1968, with Lynn Sykes, another researcher who had been advised by Oliver, Oliver and Isacks published what must be the most widely read seismological paper ever written, ‘Seismology and the new global tectonics’ in the *Journal of Geophysical Research*. Among their many insights, they realized that the formerly enigmatic deep earthquakes did