# Rock Stars

## William Maurice Ewing:
## Pioneer Explorer of the Ocean Floor and Architect of Lamont

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Maurice Ewing was a driving force in marine geology for nearly 40 years until his death at age 67 in 1974. During the extraordinary expansion of marine geology after World War II, he was the indispensable leader of the discipline.

Ewing had an ambitious curiosity. He worked in a range of subjects, making contributions to earthquake seismology, explosion seismology, marine acoustics, sedimentology, and tectonics. He adapted seismic exploration methods to use in the oceans; explicated a large segment of the earthquake seismogram, the coda; did studies of Earth's free oscillations; and described the ocean sound channel and

Maurice Ewing was always a hands-on scientist. Here, at 43 in 1950, he helps rig some large water samples. Photo ©Woods Hole Oceanographic Institution. Used with permission.

the dispersion of sound in seawater.

He also developed or greatly improved many instruments and techniques for gathering geological and geophysical data at sea—the bathythermograph, the piston corer, heat-flow probes, sonar, hydrophones, gravimeters, deep-sea cameras, and even winches. Using some of these, he joined in demonstrating early on the existence and effects of turbidity currents, and he led the first accurate observations of an abyssal plain.

Ewing collected and caused to be collected a huge quantity and breadth of data, stretching the limits of what could be done at sea and creating a dense body of observations and samples. While he was an exacting scientist with excellent instincts, above all he had a passion to know. It was as explorer of two-thirds of Earth's crust—directly and through the generations of students he inspired—that he had his greatest and most lasting influence. Before science could explain it, Ewing saw, perhaps better than anyone, how much there was to learn about the seafloor. He encouraged and he pushed and he bullied and he insisted on the collection of data (oceanwide at first and worldwide later) at all times—as much data and of as many kinds as men and machines were capable. Maybe more.

Ewing was an amalgam of unblended traits and contradictions: a Texas farm boy dedicated in mind and body to the sea; an inspirational presence sometimes asleep in his own class; and a courteous Southerner who was a terror to the hidebound.

In 1949, Ewing started the institution he is most often associated with—the Lamont Geological Observatory (now Lamont-Doherty Earth Observatory), a branch of Columbia University, on an estate outside of New York City. Starting with just Ewing and a handful of graduate students, in a few years Lamont became one of the world's leading ocean research establishments.

### School Days

William Maurice "Doc" Ewing (with Maurice pronounced the English way, not the French) was born in 1906 and grew up on a farm in the parched plains of north Texas. He was the oldest of seven children, all but one of whom were sent to college. (The youngest, John, would join him in marine geology.) When Ewing applied to colleges, he was judged unprepared and was repeatedly turned down. However, Rice Institute (now Rice University) in Houston was moved to change its administrative mind after an indignant letter from Ewing's math teacher, rating him over "anyone I ever met—or I guess any-

Maurice Ewing at 38 in 1944. ©Lamont Doherty Geological Observatory. Used with permission.

one you ever met."

He started in electrical engineering, but soon had misgivings. "The engineering students had funny paper with crossing lines on it; they were elaborately careful how they wrote figure eights; an inkblot was a catastrophe. The professors were sarcastic Yankees," Ewing said. "But the three men I'd been learning from in math and physics were such gentle people, the kind of people I liked. The nicest people I ever met taught physics. I came to have essentially as private tutors men straight from the greatest centers of learning in the world. It was the middle of the great revolution of quantum physics.

"All the classic papers came out while I was at Rice, and as soon as the library got them, the physics professor had us read and discuss them and do the experiments—like diffraction of electrons."

Ewing was hooked. "Well, you only get measles from people who have them. And I sure was in contact with people with bad cases."

In 1926, his senior year, Ewing wrote his first research paper, and it was published in *Science*. Walking back to his college room many late nights, sometimes with moonlight glinting in the dew on the grass, he saw something that was both pretty and interesting—and not in the technical literature: "Dew Bows by Moonlight," as he titled his paper.

Many a brilliant man has not fulfilled his promise. Ewing had brilliance, but he had more. At Rice, his labs and classes were from nine in the morning to four in the afternoon. From five in the afternoon to midnight he held jobs to help pay his way. And there was also the need to fit in homework, meals, and time with friends.

Catnapping during a cruise on RV *Atlantis*, 1956. Photo by Don Fay. ©Woods Hole Oceanographic Institution Archives. Used with permission.

The resolution for maintaining this schedule was pure Ewing. “In some of my freshman reading, it said that sleep is deepest and most restful in the first two hours. I thought about that. It looked to me that I could just sleep for two hours twice a day and then have time to do all the stuff I had to do.”

It worked pretty well for a while. Then a professor invited Ewing to dinner. Before the meal, his host poured wine for his wife, daughter, Ewing, and himself. Ewing had never so much as seen wine before. He was on his best behavior, sitting chatting at one end of a long sofa. The next thing he knew, he awoke in a bed upstairs and it was daylight.

Years later, sleep still took second place to science. “Once, Doc joined the ship at Nassau,” said colleague Charles Drake. “He looked exhausted. He probably was. He usually is. I took the first watch, he took the second. He looked so pooped that I let him sleep that night, and stood his watch after mine. Along about 4 a.m. up comes this real mad body. ‘Why didn’t you wake me up?’ he asked. ‘Well, you looked tired,’ I said. ‘Don’t you ever do that again!’ he yelled. And bow-wow-wow-wow-wow.”

## From Coal Country to the Continental Shelf

After graduate school, also at Rice, Ewing taught physics, first at the University of Pittsburgh (1929–1930) and then at Lehigh University (1930–1940), where he had 21 class hours weekly. There was little opportunity for research in physics, but he scrounged what he could in the surrounding coal country (“Locating a Buried Power Shovel by Magnetic Measurements” was one topic), and each year, he had a paper to read at the meeting of the new American Geophysical Union (AGU).

On a winter afternoon in 1934, Ewing, then 28, had callers at his basement office at Lehigh. They were Richard Field of Princeton and William Bowie, head of the Coast and Geodetic Survey. Today, the AGU awards honors named for each of them (one for Ewing, too). They wanted to send Ewing to sea, and they posed a question that Ewing would expand outward in widening arcs across one ocean and into the others.

Bowie and Field thought it an important geological problem to determine the structure of the continental shelf, establishing whether its steep outer edge was a tectonic fault or the edge of a giant wedge of sediment. They had heard Ewing speak at AGU meetings and wondered if the seismic methods he worked with could be done at sea.

“If they had asked me to put seismographs on the Moon I would have agreed, I was so desperate to do research,” he said. (Thirty years later, Ewing would initiate a project that did put seismographs on the moon.)

Ewing solved the problem of putting listening gear under water by sealing stock geophones in reliable over-the-counter rubber sheaths. He demonstrated "by several masterly devices," wrote the geologist Walter Bucher, that the continental basement sloped evenly down from an outcrop near Richmond, Virginia, to the lip of the continental shelf, where it was covered by 12,000 feet of sediments.

## Seafloor Discoveries

In 1953, soon after founding Lamont, Ewing acquired its first ship, the *Vema*. He secured the use of a second ship, the *Conrad*, in 1962. Instead of making voyages of a few months with defined goals to limited areas, Lamont’s ships soon circled the globe annually, accumulating 40,000 or so miles and 300 days at sea year after year. Work did not stop; information was collected continuously with every usable kind of measurement, whether or not anyone had asked for it. Doc always wanted it. Crews soon had a motto: A core a day keeps the doctor away.

Ewing had the nose of a truffle hound for good questions. Even when his ship was disabled at sea, he had a project that just fit the three days of drifting before a tugboat came. The first notable outcome of Lamont’s global perspective was a realization that Earth’s crust is the same in all ocean basins, yet fundamentally different there from the continents. Ewing delighted in identifying what he called “brutal” facts, which must be taken into account in all subsequent work. The oceanic crust was a brutal fact of the highest order. It did violence to some venerable ideas (like lost continents) that became abruptly untenable.

An equally brutal corollary (1956) was that the then plural mid-ocean ridges were really a single, continuous, worldwide mid-ocean ridge. Moreover, the ridge was cleft at its midpoint by a rift. Careful recalculation of the positions of seafloor earthquakes showed them strung along the length of the rift like a necklace of precious stones. Out in the middle of the sea, Earth’s crust was active, unstable, and changing.

Lamont also was able to publish the first detailed maps of the seafloor in the North Atlantic (1959), South Atlantic (1961), and Pacific and Indian (1968) ocean basins. The same basic crustal features had been found in every basin—the ridge and its rift, regions of abyssal hills, abyssal plains, trenches, and the continental rise.

Maurice Ewing was devoted to new and ingenious instruments, such as this timed release mechanism, which was triggered by the dissolution of a block of salt, seen at right. Photo ©Woods Hole Oceanographic Institution. Used with permission.

The brutal facts would be the backbone of a new global theory of geology. By the mid-1960s, the dogged old idea of continental drift was turned on its ear, into seafloor spreading. The first motions of tectonics were in the rifted mid-ocean ridge, which was structurally the oceanic lithosphere. To a disproportionate degree, the theory was proved, elaborated, and enlarged—seafloor spreading in turn becoming global tectonics—with Lamont data. Ewing’s conviction about that had paid off handsomely. It still does. Lamont’s libraries of core samples, bottom profiles, magnetic profiles, and heat-flow measurements continue to be mined for data by enterprises like the Ocean Drilling Project.

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