

J. Lamar Worzel, a pioneering geophysicist and engineer who helped shape human understanding of how sound travels through the oceans and who cofounded Columbia University's Lamont-Doherty Earth Observatory, died 26 December 2008. He was 89. He was struck suddenly by a heart attack at his home in Wilmington, N.C.

A frequent sailor in submarines and ships, Worzel improvised complex new measuring instruments out of spare parts and household objects in the 1930s, a time when scientists had only primitive concepts of deep marine seabeds, currents and acoustics. He and colleagues investigated the makeup of sediments in the Atlantic by exploding homemade bombs in the depths and reading the echoes. Their discoveries helped World War II submarines elude enemies, guided Cold War sub detection, and provided tools for charting Earth's crust and climate.

It was Worzel's longtime boss at Lamont-Doherty, William Maurice Ewing, whose seminal ideas drove early systematic mapping of the world's oceans in the 20th century. But it was Worzel's energy and ingenuity that brought many ventures to fruition, according to Dennis Hayes, a Lamont oceanographer who worked under both men.

John Lamar Worzel was born on 21 February 1919, in Staten Island, USA, where his father was a real-estate lawyer. Ignoring his given name, his family called him "Lamar," and scientists called him "Joe"—the latter, after he and fellow physics students at Lehigh University adopted a 1937 pop song that went, "What do you know Joe? We don't know nothing." Ewing, then a professor at Lehigh, took a small gang of undergrads to sea, and Worzel soon became a star.

Working first out of Massachusetts' Woods Hole Oceanographic Institution, Worzel and others built instruments that did not yet exist: a camera for snapping photos thousands of feet below the surface, with a coffee-can lid for a flash reflector and a thick, diner-style drinking glass for casing; a seismograph that employed a modified Hamilton railroad watch; an oscillograph pushed by a motor from a toy electric train. In order to detonate explosions under deep-sea pressures up to 8000 pounds per square inch—presumed impossible by experts—Worzel carefully packed explosives into inner tubes, then figured out how make them go off by adapting paper caps from toy cowboy revolvers. "We never allowed ourselves to think that anything we decided to do was impossible," he wrote in an unpublished autobiography, completed in 2001.

On the brink of World War II, the U.S. Navy funded their work, and Worzel and Ewing quickly made fundamental discoveries. One was the existence of "shadow zones"—underwater regions defined by specific combinations of temperature and pressure, in which sounds from the surface (say, a ship's sonar) refused to travel. With this information, Worzel coauthored a manual that enabled many a World War II sub commander to hide from deadly enemy ships above. Conversely, they identified the "deep sound channel"—a narrow horizontal zone about 3000 ft down that transmits low-frequency sounds thousands of miles with fantastic clarity, like a natural telephone line. They showed they could blow up a few pounds of TNT off South America, and pinpoint the source on the deep channel from as far off as West Africa. This discovery became the basis of the Navy's vast Cold War

SOFAR (sound fixing and ranging) program and its successors—secret weapons that girded the world with underwater listening devices to identify and track USSR subs by their engine noise. After the nuclear-powered sub USS *Thresher* mysteriously disappeared in 1963, an acoustic investigation marshaled in large part by Worzel helped locate the remains, at a depth of 8400 ft off New England. For this, he received a Navy Meritorious Public Service Citation.

In 1948, Ewing and a handful of his grad students including Worzel moved to Columbia University and founded Lamont Geological Observatory (later renamed Lamont-Doherty Earth Observatory). Dwight Eisenhower, then Columbia president, lured them by agreeing to let them use a Hudson riverfront estate in Palisades, New York, USA, newly donated by the Lamont family. Ewing became director and Worzel deputy. Worzel and his wife lived on the expansive grounds and eventually raised four children there. Frequently covered head to foot in grease from working on machinery, he was occasionally mistaken by visitors as one of the maintenance staff.

Starting in the early 1950s, Worzel arranged to obtain a series of research vessels—the first, a modest schooner powered partly by sail—that crisscrossed the oceans on a wide variety of missions. These made Lamont a global powerhouse in marine research. Worzel perfected a system to efficiently remove cores of sediment from depths of over 12 000 ft, and the institution assembled the world's largest collection of such samples. He initiated the use of satellite navigation in research ships. He and others working independently pioneered an important advance at this time via the design and development of systems that could make precise measurements of the Earth's gravity field from surface vessels. Until then, constant rolling and pitching on ships upset readings of previous instruments, and it had been possible to take the scientifically vital readings only in the still depths inhabited by subs. Worzel and his colleagues helped site the Hudson River's Tappan Zee Bridge by mapping the riverbed's structure with seismic signals.

In the late 1960s, violent student protests against the Vietnam War forced many universities, including Columbia, to halt secret military work. Worzel felt that "as citizens of our country, if we had skills that were of use ... it was our duty to make them available," so he and his colleagues founded a nonprofit corporation, the Palisades Geophysical Institute, which continued classified Navy work outside of Lamont. Simultaneously, he kept his academic posts. Worzel served as the corporation's president more than three decades.

In 1967, Worzel and his Lamont friend Robert Gerard coauthored a paper in the journal *Science* proposing a green energy scheme with a distinctly 21st-century outlook. They proposed that tropical nations use windmills to pump chilly water from the ocean deeps into giant containers along shore. Brushed by warm, humid breezes, the containers would act like iced-tea glasses on a summer day, condensing copious fresh water on their surfaces for drinking and farming. The nutrient-rich ocean water would be recycled to feed aquaculture lagoons.

In 1972, Worzel and Ewing left Columbia together for the University of Texas, Austin. When Ewing died two years

later, Worzel succeeded him as director of the university's Institute of Geophysics. He retired in 1979.

In 2002, the Palisades Geophysical Institute decided to disband when Worzel and others felt its basic research was being applied too directly to weaponry. Its carefully husbanded surpluses, built up over the years, were used to endow at least \$10 million in professorships and grants for young geoscientists

at Columbia, Woods Hole, the universities of Texas and Memphis, and the National Academy of Sciences.

Worzel retired to Wilmington, N.C., but was active to his last moments; among other things, he was studying string theory.

—Kevin Krajick

James Martin Templer, a member of SEG for 25 years, passed away on 9 February 2009. He was born on 14 February 1958 in Dhahran, Saudi Arabia. His parents lived and worked there for ARAMCO. As a family, they lived in Saudi Arabia, Beirut, Lebanon, and the Hague, Netherlands. He graduated from Oregon State in 1981 with a degree in geology. He started his career with Atlantic Richfield as a geophysicist and continued for the next 23 years as an acquisition consultant where he worked in 20 different countries. One of his favorites was Cameroon, where he sponsored a young Cameroonian boy through high school and was sponsoring him through college. He was a consummate professional in the field and well respected by his peers.



—Bill Stinson

Maurice Eugene “Shorty” Trostle, a modern-day legend in the field of seismic exploration, died in Brenham, Texas, USA on 26 December 2008. He joined Geophysical Service in 1944 and participated in all the developments in the industry up to about 1990. He was a recognized leader in many phases of seismic operations, interpretation, and technical development.

Trostle was born in Mediapolis, Iowa on 2 November 1923. After graduating from high school, he attended Burlington Junior College in Burlington, Iowa. He joined GSI during World War II, along with his brother, Dale, who also became widely known and respected in the industry. Trostle went to work as a field helper, but he quickly advanced to observer, computer, and party chief working in California, Colorado, Montana, and Mexico. In the early 1950s, he was transferred to west Texas where he served for many years as party chief, supervisor, and area manager, and it was there that he first became recognized as a budding legend for his work in improving record quality in that difficult area.

Trostle was a pioneer of the digital era; he fielded some of the first digital crews in the early 1960s and soon thereafter had one of the early digital processing centers under his guidance. He perfected his already outstanding people skills during this time of rapid expansion, which he managed while maintaining a very professional organization. In recognition of this work, he became a vice president of GSI in 1966.

He was also a very early and major contributor to the development of 3D seismic. The very first 3D crew fielded by GSI, which was a development crew sponsored by a consortium of oil company clients, was under his management. In 1973, he was awarded a patent, assigned to Texas Instruments, for 3D common depth point techniques. Later, after his transfer to Houston, he managed the very first GSI marine crew to collect and process 3D data for a client. For his early work in the development of 3D, Trostle, along with Bob Graebner and Milo Backus, received a Special Commendation from the SEG in 1997, and in 2005 he was inducted into the Offshore Energy Center Hall of Fame for his contribution to marine 3D. Also, in 1996 he received the Energy Award from the Midland, Texas oil and gas industry.

Early in his doodlebugging career, Trostle met and married Helen Giese of Brenham, Texas, and she moved with him to all the places he worked during the 37 years of their marriage. They had three children, daughters Linda and Nancy and son John. In 1978, when Helen began a five-year battle with cancer, Trostle took early retirement from GSI and moved to Brenham to care for her. During this period he worked part-time as a consultant, but his prime job was caring for Helen. He became a consultant to Fairfield Industries and, following Helen's death in 1983, he joined them full time as president and CEO.

In 1985, he married Lois Winkleman, also of Brenham, and in 1988 he retired for good to travel and play golf. But he found a new career in community service in Brenham. He was a founding board member of Goodfellows and Bread Partners, a Little League volunteer, former chairman of City Planning and Zoning and the Board of Adjustments and Appeals, vice president of the Brenham Country Club, member of the Brenham Rotary Club, and was honored as a Paul Harris Fellow. He was active in First United Methodist Church of Brenham and later as a member of St. Paul's Evangelical Lutheran Church there. In 1998, he was named “Man of the Year” by the Washington County Chamber of Commerce. He was a man of many accomplishments right to the end of his life. Several of the friends I spoke to after his death referred to him as a “gentleman's gentleman,” and he was all of that.

Shorty and I had parallel careers at GSI and, though at times we were competitive, it was always a friendly competition. We spent many good times and some difficult times together, and after retirement we became even closer. Even though we didn't get together too frequently, we spoke often by phone and kept up with what was going on in each of our lives. I regret that I missed his 85th birthday party, which was held just a few weeks before his death. I spoke to him by phone on the day before the party, during which we reminisced about our careers, and we both agreed that, if we could, we would do it all over again. Along with his family and a very large group of his friends, I shall miss him.

—Jack M. Proffitt