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Peter Vail: The sedimentary time master

Like many geologists in the oil industry during the 1960s, Peter Vail spent much of his time studying sedimentary rocks in the subsurface that were once part of ancient ocean basins for clues to their history, composition and relative ages. Particularly in industry, this stratigraphic work relies heavily on seismic data to help interpret and identify prospective hydrocarbon traps.

Oil companies in the early 1960s used seismic reflection data as a tool for defining regional stratigraphic and structural subsurface relationships. But their interpretation did not always work. Although a well would find sand in one spot, another well following the same amplitude of the seismic reflection would encounter silt or shale. Vail, however, found that the seismic reflections were not recording a difference in lithology, so much as they were recording different depositional histories in time. A layer that began as sand in one spot and shale in another would share the same reflection signal — following a geologic timeline.



Photo of Peter Vail courtesy of EGI.

This new interpretation meant a drastic change from the business as usual method, and many in the field opposed Vail when he first began presenting his findings. “One senior geologist accused me of proposing that the reflections were bouncing off the backs of fossils,” he said in a speech to accept the Sidney Powers Memorial Award, given to him during the annual meeting of the American Association of Petroleum Geologists (AAPG) in Salt Lake City. “Another suggested that I was telling him that what he was teaching his students was wrong.” Time and experience prevailed and now Vail’s concept is well accepted.

“[Vail] has made major contributions to the understanding of earth science and is very deserving of AAPG’s highest award,” says AAPG President Dan Smith. At the AAPG ceremony, a long time friend and former Exxon colleague Robert Mitchum, explained in a speech that, “When Peter Vail introduced the concepts and applications of sequence stratigraphy, the effects on stratigraphic geology and seismic interpretation were comparable to that of plate tectonics on structural geology.”

Vail began his industry career as a research geologist with the Carter Oil Company, a predecessor of ExxonMobil Upstream Research, in 1956. That same year he obtained his Ph.D. in geology from Northwestern University and married his wife Carolyn. While at Northwestern he had studied under Laurence Sloss, who in the 1950s, was establishing a theory of continent-wide sequences. Vail took this idea of sequences in the rock record to Exxon and at first began working with colleagues identifying and publishing reports showing correlative patterns using well-log marker horizons. When a colleague indicated that seismic data also recorded these patterns, Vail switched gears to the geophysics section at Exxon, “against the advice of my supervisors,” he told AAPG Explorer. There, with the help of colleagues, he developed his concept of sequence stratigraphy and soon tested it

in the field.

In 1977, Vail and his team published in AAPG Memoir 26 examples of seismic reflections that showed a high-amplitude signal off of a top layer of sand that continued along time-synchronous sedimentary layers or bedding surfaces rather than following the sand straight across. Vail soon went on to explain basin-wide stratigraphy patterns resulting from changes in sea-level rise.

“As I was studying seismic sections, I noticed a pattern in the sequences that onlapped [or overlapped at] the edges of the basin. I dated it with paleontology and found similar ages and made charts and interpreted it as eustatic sea-level and that idea is still being debated,” Vail says. Mitchum in his award ceremony speech added that, “Pete’s ideas on the unifying paradigm of eustatic cycles are probably as close to an original concept as most of us are privileged to see.”

In 1986, Rice University appointed Vail as its W. Maurice Ewing Professor of Oceanography. He retired from Exxon and began his academic career, while still pursuing his ideas on basin-wide sequence stratigraphy and sea level effects. In 1992 and 1993, he took a sabbatical in Paris where he worked to include European basins in his study. The sabbatical, however, almost turned deadly when Vail suffered a fall that ultimately left him paralyzed on the left side of his body.

Vail returned to Rice University where he continued to teach using a wheelchair and later only a cane. “I still have the cane,” he says. He became *emeritus* professor at Rice in 2001. The university and Exxon celebrated Vail’s retirement with a kick-off party called the Vail Fest Symposium that lasted for three days in March 2002 and featured talks from students and colleagues. At the urging of his sons, Vail is now back in the oil industry. As he explained to the AAPG audience in Salt Lake City, “I received many wonderful compliments so my kids responded by saying, ‘If you’re so smart why don’t you find us some oil?’ That sounded good to me, so besides consulting I decided to invest in some oil and gas wells.”

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