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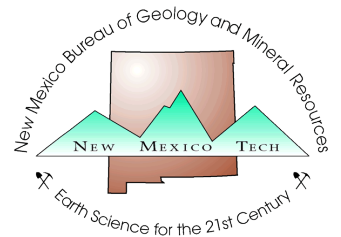
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Ron Broadhead: Petroleum geologist extraordinaire

—By Kristin Pearthree

When Ron Broadhead was a child, he lived in a house in Danville, Illinois with hard shale rock flooring. A fitting precursor of things to come.

As a graduate student at the University of Cincinnati, he would study shale rocks containing hydrocarbon resources in northern Ohio. And thirty years later, when horizontal fracturing made possible the extraction of unconventional gas resources from shale rocks, he would again return to the subject as a petroleum geologist at the New Mexico Bureau of Geology and Mineral Resources. In March 2020, Ron retired from the Bureau of Geology and gained emeritus status, all while sporting his signature hat.

Ron was born in Racine, Wisconsin in 1955 on the western shore of Lake Michigan. His family moved through a few Midwestern states before settling in Illinois. His parents tried to interest him in many things to see what stuck. They even gave him a paleontology kit one year for Christmas.

While in his senior year of high school, he elected to take a semester of earth science and a semester of geography, both courses his councilor assured him were for “the students who could not pass any other kind of science.” But he took them anyway. Through these courses, he developed a keen interest in the earth sciences.

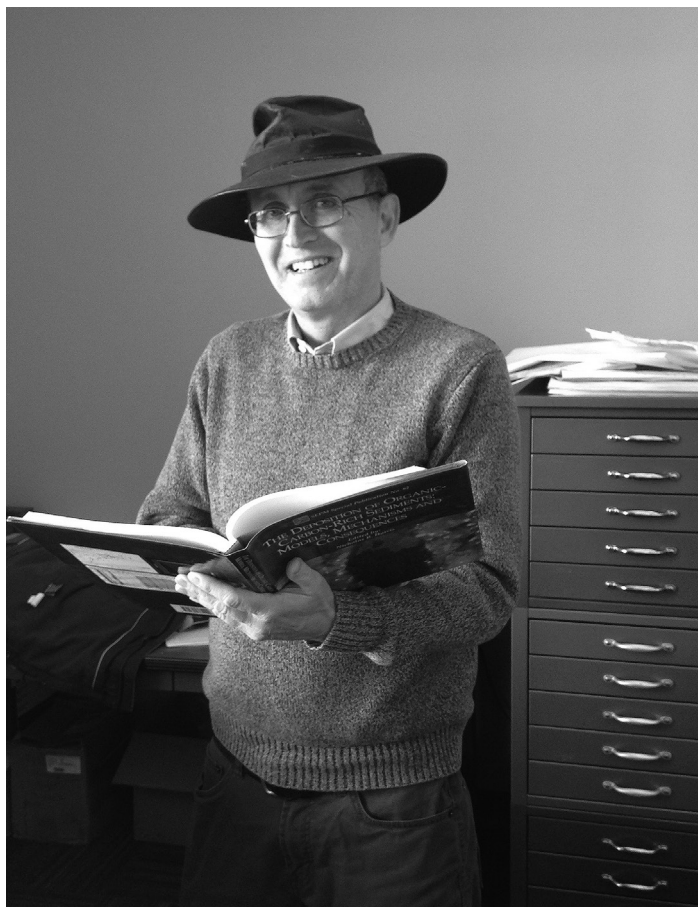
His high school had a room with filing cabinets full of literature from potential colleges. Ron found the postcard for New Mexico Tech and mailed it to request more information. He received a glossy brochure in return. When he showed New Mexico Tech’s earth science curriculum to his teacher, she said it looked good. Ron decided to move from the rainy prairies of Illinois to the dusty town of Socorro, New Mexico in 1973.

He dove right into challenging classes that, “kept him out of trouble,” or so he says. Ron was introduced to his future employer, then called the New Mexico Bureau of Mines and Mineral Resources, during the summer of his junior year.

Ron had just completed a geologist rite of passage: field camp. The professor teaching the class asked him if he would like to have a job for the rest of the summer working on a joint project led by the professor and the petroleum geologist at the Bureau. Ron then spent the rest of the summer examining metamorphic and igneous rocks in thin section. In the fall of his senior year, the petroleum geologist, Sam Thompson, offered Ron a job working on a project examining and logging well core cuttings. The end result was a junior authorship on a publication.

From there, global events shaped Ron’s path into petroleum geology. When looking at graduate school options, Ron thought, “Where can I make a living?” The answer: petroleum geology.

In 1973, the Organization of Petroleum Exporting Countries (OPEC) issued an oil embargo on the United States in response to the U.S.’s decision to supply the Israeli military



Ron in his office with his signature hat. Photo courtesy of Ron Broadhead.

during the Arab–Israeli War. The embargo banned petroleum exports to the U.S. and introduced cuts in oil production. There were nationwide oil shortages and the price of oil skyrocketed. This spurred domestic oil exploration and production, ensuring job opportunities in the industry.

So, for his graduate research at the University of Cincinnati, Ron studied approximately 400 million-year-old Upper Devonian gas shales in northern Ohio along Lake Erie. The study of gas shales was a very new field of study at the time, but one that would become essential in the future. Using stratigraphy, petrology, organic geochemistry, cores and rock outcrop studies, Ron conducted an integrated stratigraphic analysis of the shale rocks, and then related his results to where drillers had encountered natural gas.

Conventional oil production targets concentrated pockets of oil and gas in the subsurface with vertical drilling. In shale rocks, oil and natural gas are distributed within the formation and extraction by conventional means is not economically feasible. Technological developments in industry would later open up these “unconventional” resources. “People



Ron (right) on a core logging expedition with fellow University of Cincinnati graduate student Greg Hinterlong, December, 1978.

Photo by Roy C. Kepferle. Courtesy of Ron Broadhead.

asked me at the time, ‘Why are you looking at shales?’” Ron remembers, “Now we know.”

When Ron graduated in 1979, the only real jobs available for him were in the oil industry. He joined Cities Service Company working as a petroleum geologist in Oklahoma for two years. He went out to wells during the drilling process to verify if they should be completed or abandoned, developed drilling prospects in Oklahoma, Arkansas and Texas, and evaluated lease requests by other companies to drill on his company’s land. “I learned a lot. It was a lot of responsibility for somebody that young but I think I did pretty well. I made a couple of mistakes but I was determined not to repeat them,” says Ron. A lesson anyone can relate to.

But then one night, Ron returned to his apartment late after sitting on a well that was being drilled. He went into his kitchen. He had thrown out his copy of the American Association of Petroleum Geologists (AAPG) Explorer magazine and sticking out of the waste basket was a page with an advertisement for a petroleum geologist position at the New Mexico Bureau of Mines and Mineral Resources. Ron was tired. He thought, “Why not apply for it?” A month or two later, the Bureau called and asked him to come in for an interview.

And so Ron returned to Socorro in 1981. “I think I hit the ground running. The first day...the director at the time, Frank Kottlowski, came into my office and gave me a couple of assignments, so I took off with them,” Ron remembers. Over the next 38 years, Ron became “Mr. New Mexico, when it comes to resources,” according to Emeritus Oklahoma State University Professor Dr. John Shelton.

Ron conducted a pioneering study in the late 1980s on the Tucumcari Basin in the east-central part of the state. The basin was not a productive oil and gas province at the time.

Using a number of fundamental geologic methods, Ron pieced together the basin’s subsurface structure and stratigraphy. He then looked at how the structure influenced the location of source rocks, which produce oil and gas, versus reservoir rocks, where hydrocarbons become trapped. Reservoir rocks are targets for oil and gas exploration, and of keen interest to industry.

He returned again to the Tucumcari Basin in the early 2000s following a grant from the New Mexico State Land Office. By then hydraulic fracturing combined with horizontal drilling, a process commonly referred to as fracking, had changed the face of oil and gas exploration.

Hydraulic fracturing involves injecting a fluid usually mixed with sand into a target rock formation in the subsurface. The high pressure of the fluid injection generates fractures within the rock that are then held open by the sand. This increases connectivity in the rocks, allowing oil and gas to flow together through a spider web of fractures, becoming more concentrated and thereby increasing the ease of extraction.

In horizontal drilling, a well begins as a traditionally vertically-drilled well at shallow depths. Then, the well veers to a horizontal orientation when approaching the depth of the target rock formation. The horizontal orientation of the well ensures it intersects as many of the newly-formed fractures as possible. Hydraulic fracturing and horizontal drilling opened the door to “unconventional” oil and gas resources, like those present in the Tucumcari Basin and in the gas shales Ron studied as a graduate student.

“When I published the results of the grant, industry activity went wild and companies started leasing all over the place, including on state trust lands,” says Ron.

Later in his career, Ron began working in the San Juan Basin in northern New Mexico, studying the Mancos Shale. Industry was just starting to take notice of the Mancos as a target formation for unconventional oil and gas extraction. As the Bureau’s petroleum geologist, Ron was in a unique position to develop a basin-wide overview by mapping the potential distribution of resources.

One of Ron’s most significant contributions to geoscience, however, comes from his investigations of the geology of helium resources. Helium gas is indispensable in modern society. It is used to cool the magnets in MRI machines, to make fiber optic cables and computer screens, and in mass production of computer chips. “And it makes you talk funny,” Ron chuckles. Helium co-occurs with other natural gases, but not often in high enough concentrations to justify the expense required to extract it.

Ron mapped concentrations of helium-rich gases throughout the state. With helium resources becoming increasingly scarce, New Mexico stands to benefit from Ron’s work. “[It’s] still an up and coming resource,” says Ron, “And nobody had done that [mapped statewide helium concentrations] before in any state.” In helium, as in gas shales, Ron was ahead of the curve. Ron intends to continue investigating the geology of helium resources in his emeritus



Ron logging cuttings in the old Bureau of Geology building in 2000. Courtesy of Ron Broadhead.

position at his new office on the third floor of the Bureau of Geology's building.

Ron may be known for his wide-ranging knowledge of resources in New Mexico, but his work extends beyond just research and into teaching and professional service.

Ron taught Petroleum and Subsurface Geology at New Mexico Tech for 32 years, educating as many as 400 to 500 students. When he began teaching, he found that sometimes there was not any published literature that he could assign to his students, so he ended up writing it himself.

He has interacted constantly with geologists working in industry and for other state and federal agencies. Members of the public approach Ron with questions about land they own and potential resources. "He just is a wealth of knowledge about New Mexico and geology in general," says MARS Exploration and Energy petroleum geologist Mike Raines, "He's passionate about it [and] he's dedicated to it; I know he spends a lot of late hours. I've called him when I thought I'd be leaving a voice mail on his office phone and he was there. He answered the phone and he just [took] 30 to 40 minutes to talk to me about it."

Indeed, among his many awards, Ron received the Monroe G. Cheney Science Award from the Southwest Section of the American Association of Petroleum Geologists (AAPG) "for singular contributions and service toward the understanding of petroleum geology in the Southwest Region."

"So that tells you about Ron, that he's regarded as being a major contributor to the petroleum geology of New Mexico and the surrounding area in particular... those aren't handed out willy-nilly," says Shelton. "You have to do something for them, and certainly he did more than his share."

Ron's service extends into the professional organization sphere. He served as editor for the online AAPG publication Search and Discovery for two and a half terms. Why a half term? Because he served two terms and then voluntarily stayed on for an extra year until a new editor could be appointed. "Ron did well beyond what he was expected to do and he actually kept working when he could have easily said, 'Look, this is in your ball court,'" says Shelton, "And [that's] typical of Ron from what I know of him. He goes the extra mile in whatever he does." And that really gets to the heart of Ron as a person. "My second favorite thing about Ron is how knowledgeable he is about New Mexico and how passionate he is about geology in general," says Raines, "My favorite thing is how he treats people."

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