

The Wilson M. Laird Core and Sample Library

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Introduction

Invariably, the general public asks the same two questions regarding the Wilson M. Laird Core and Sample Library: “What is a core and sample library”? and “Who was Wilson M. Laird”? Samples or cuttings are the small bits of rock generated by the rotating rock bit in an oil well, potash well, coal or uranium test hole, etc. These small bits of rock are brought to the surface by the circulating drilling fluid, collected at regular intervals, washed, dried, placed in small paper envelopes and submitted to the core and sample library so they can be archived. Unlike the standard drill bit, a core bit only cuts along its outer edge leaving the rock (typically 3-4 inches in diameter) in the interior of the bit undisturbed and enclosed in the core barrel (fig. 1). In the past, 30-50 feet was the typical length of a continuous oil core. Today, that average length is 300 feet as companies core from the base of the Lodgepole Formation down to the top of the Birdbear Formation. In North Dakota, as soon as companies have completed testing their cores they are required to send them to the core and sample library.

In 1941, Wilson Laird became North Dakota State Geologist, a position he held for the next 28 years (fig. 2). Immediately, Laird went to work shepherding oil and gas conservation laws through the North Dakota State Legislature, fully ten years before oil would be discovered in North Dakota. These laws, based on the Interstate Oil Compact Commission’s Model Act, ensured the orderly development of oil and gas in North Dakota. The statutes made the North Dakota Industrial Commission the regulatory body for oil and gas, and designated the state geologist the commission’s advisor and enforcer of the rules. In 1981, the legislature shifted those duties to the Director of the newly created Oil and Gas Division.



Figure 1. Left to Right: Whole core, slabbed core, and samples.

Drill cuttings (or samples) were one of the items Laird addressed in the new rules and regulations. On December 19, 1941 Rule VI was adopted to read (in part), “If so ordered by the Commission, samples of drill cuttings shall be taken and preserved by the owner of the well and shall be accessible to the State Geologist and his agents at all reasonable times.” On November 17, 1950 this rule was expanded to specifically include cores, “Samples of drill cuttings or cores shall be taken and preserved by the owner of the well and shall be accessible to the State Geologist and his agents at all reasonable times.” Then, on November 1, 1956, five years after oil was discovered in North Dakota, Rule 206 was adopted, “Sample cuttings of formations, taken at regular intervals, in all wells drilled for oil or gas in the State of North Dakota, shall be

Background photo: One of eight aisles in the core library, each shelving unit holds 260 tons of rock.



Figure 2. Wilson M. Laird (1915-1997).

carefully identified as to operator, well name and location, and depth of sample, and shall be shipped free of cost to the State Geologist . . . and such cores as are taken shall be preserved and forwarded to the State Geologist, free of cost, when such are requested by him.” Today, NDAC 43-02-03-38.1 reads, in part, “Sample cuttings of formations, taken at intervals prescribed by the state geologist, in all wells drilled for oil or gas or geologic information in North Dakota, shall be washed and packaged in standard sample envelopes which in turn shall be placed in proper order in a standard sample box; carefully identified as to operator, well name, well file number, American Petroleum Institute number, location, depth of sample; and shall be sent free of cost to the state core and sample library within thirty days after completion of drilling operations . . . Unless specifically exempted by the director, all cores taken shall be preserved, placed in a standard core box and the entire core forwarded to the state core and sample library, free of cost, within one hundred eighty days after completion of drilling operations.”

As a result of Wilson Laird’s foresight and his spearheading of these rules and regulations, North Dakota has a nearly complete set of cuttings from every oil well that has been drilled in the state and a high percentage of the core. Although we have a dozen or more sets of samples from wells drilled in the 1920s and 1930s, the best records and most complete sets of samples come from wells drilled after the rules and regulations were adopted in 1941. The oldest core we have on record comes from the Aanstad Stratigraphic Test #1 drilled in Ramsey County in 1949.

Core and Sample Library Filling to Capacity

Everything connected with the North Dakota oil and gas industry has undergone record activity in recent years and the core and sample library is no exception. In the last four years (2011-2014), more core and sample boxes have come into the core library for archiving than in the previous 20 years (1991-2010). At the same time, we also set records for the amount of core we pulled from the shelves for industry and academia to study.

For years we have been keenly aware that the Wilson M. Laird Core and Sample Library was filling up. That is why, ten years ago, we began a reboxing campaign to enable us to consolidate core and sample boxes, thereby saving space. By reboxing more than 340,000 feet of core (85% of the existing core) and 28,000 sample boxes (70% of the existing sample boxes), we generated a space savings of 30%. Had we not done so, the core library would have filled to capacity three or four years ago rather than the current estimated fill date of 2017. We also discarded some 8,000 boxes of sediment and rock that were either not identifiable, moldy (wet sediment or rock cuttings had been placed into cloth sample bags and then sealed in cardboard boxes), or of lower priority. Discarding of the latter material was truly unfortunate.

The Financial Impact of the Wilson M. Laird Core and Sample Library

Over the years we have been asked the value of the core library. Those questions became more frequent in the late 1970s when we were contemplating building the present facility as well as the last few years when we began discussing the need to expand it. The obvious answer to those of us that are geologists or engineers was that a significant number of the oil and gas insights, innovations, and discoveries in North Dakota could be traced back to the study of cores or cuttings in our core library. We had anecdotal evidence that this discovery or that came from this person or that company looking at cores etc., but all too often those connections were vague and difficult to document and quantify. Imagine our delight when we opened the April 2012 American Association of Petroleum Geologists Explorer Magazine and discovered an article by Louise S. Durham entitled “*NOT Middle Bakken or Three Forks! Rocks Led the Way to Sweet Pronghorn Spots.*” The article focused on interviews with Whiting Petroleum Corporation geologists regarding the importance of core studies in the exploration of oil, specifically to Whiting’s Pronghorn oil play in Billings and Stark counties in North Dakota. The following are some of the comments from Whiting Petroleum Vice President of Geosciences Mark Sonnenfeld and Senior Geoscience Advisor Lyn Canter as quoted in Durham’s article:

“Detailed core and detailed log evaluation across the basin identified this extra package of rock that ultimately became this Pronghorn zone, which is not present at Sanish-Parshall,” Canter said.

“We ran across a core that was very obviously different than anything we had seen,” Sonnenfeld said. *“In trying to understand it and map it out, this area fell out of that effort. One of the elements of this story we’re trying to get across is that this was*

not an accidental discovery at all," Sonnenfeld noted. "It was very much something we converged on through our mapping, integrated with core data. For us, informally, the moral of this story is geology matters."

Canter noted they had studied nearly every Bakken-Three Forks core available in the basin. "We go to the North Dakota Geological Survey in Grand Forks twice a year deliberately to see newly released cores . . . We had evaluated more than 150 cores when we came across this new information, so we were able to recognize that it was different, because we had the context to put it into and to understand what it meant in terms of a new play. We have a dynamic look into the Bakken because of our dedication to evaluating as much rock data as possible . . . Our focus is a basin-scale effort and not just small project areas."

Whiting Petroleum drilled 217 oil wells in Billings and Stark counties targeting the Pronghorn Member of the Bakken Formation from 2010-2014. In their own words, they drilled these wells and pursued this oil play based upon their work in the Wilson M. Laird Core and Sample Library. As of November 2014, these wells had produced 19,542,147 barrels of oil. Using just the oil extraction tax and a conservative price of \$40/barrel, Whiting's Pronghorn oil play has generated more than \$50,800,000. That is more than three times the \$13.6 million core library expansion. In November 2014, Whiting Petroleum's 217 Pronghorn oil wells produced 558,412 barrels or 18,613 barrels per day. These wells generated \$48,400 in extraction taxes per day (at \$40 per barrel). At that rate, the extraction tax pays off the Wilson M. Laird Core and Sample Library expansion project in 280 days.

Core Library Expansion

Two years ago we were given funding by the Governor and the North Dakota Legislature to draw up plans for a core library expansion. Since the core library is located on the University of North Dakota campus, we held a number of meetings with them and obtained their approval to expand as well as approval from the North Dakota Board of Higher Education. In 2014 the Department of Mineral Resources signed a 14-point Memorandum of Agreement with the University of North Dakota regarding the core library.

During the 2015 North Dakota Legislative Session, we presented the core library expansion plans and costs to both the Government Operations Subcommittee of House Appropriations as well as the Senate Appropriations Committee. The \$13.6 million construction costs were added to our appropriation bill along with an emergency clause so we could start work right away which would enable us to complete demolition of the old lab and office area prior to the start of classes in the fall. Quite fittingly, the money to pay for the core library expansion is coming out of the Strategic Investment and Improvements Fund, the source of which is the oil and gas extraction tax. To their credit, the Industrial Commission and the North Dakota legislators recognized the important role the core library has played in the development of oil and gas resources in the Williston Basin and, most importantly, the important role it will continue to play in the future made possible by this expansion.

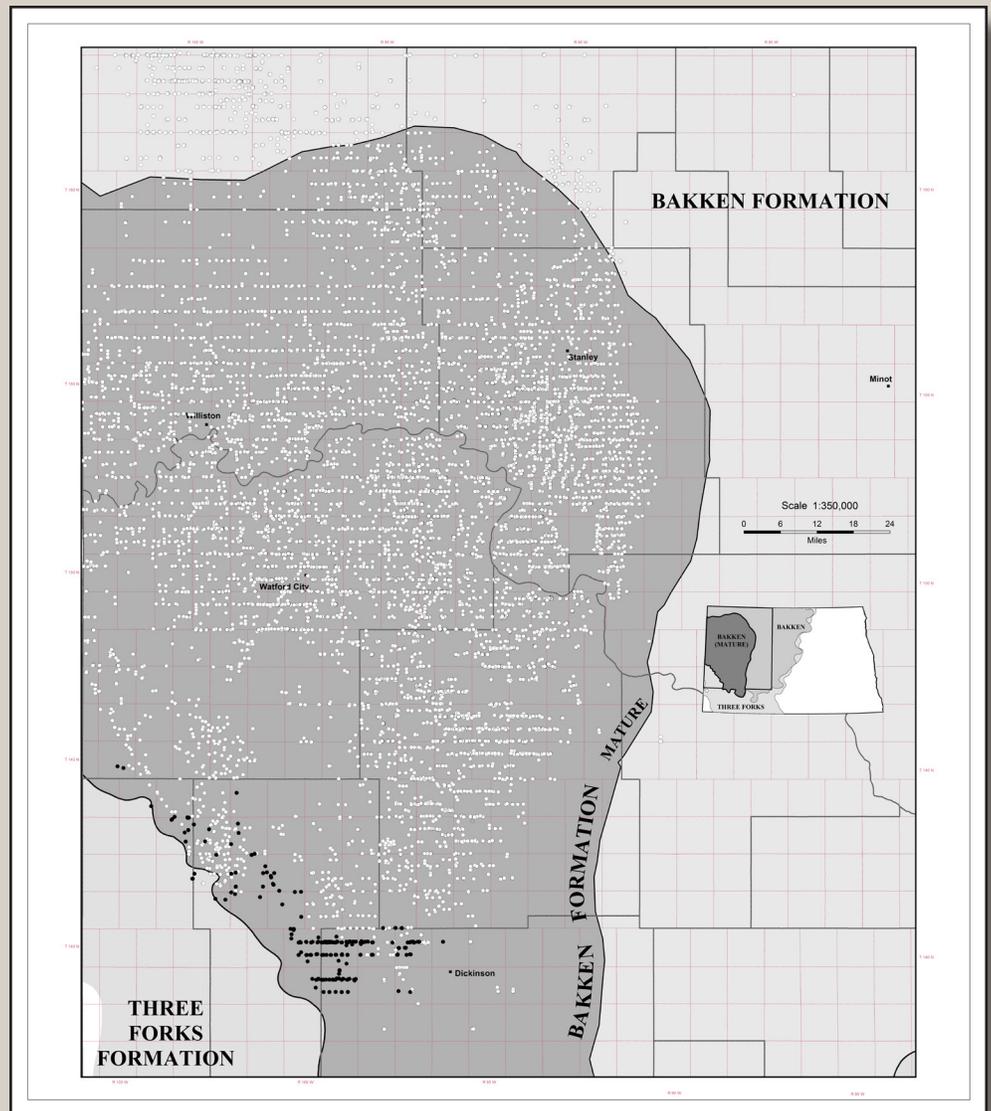


Figure 3. Horizontal oil wells (dots) that are producing or have produced from the Bakken Petroleum System. The Whiting's Pronghorn wells are in black. Other companies have followed Whiting's lead and drilled Pronghorn wells in the vicinity of Whiting's play.