

# **FIFTH INTERNATIONAL WILLISTON BASIN SYMPOSIUM**

**EDITORS:**

**C.G. CARLSON and J.E. CHRISTOPHER**

**Proceedings of a Symposium  
Held in Grand Forks, North Dakota  
14, 15, 16 and 17 June 1987**

**Sponsored by:**

**North Dakota Geological Society  
Saskatchewan Geological Society**

**SPECIAL PUBLICATION NUMBER 9  
SASKATCHEWAN GEOLOGICAL SOCIETY  
P.O. BOX 234  
REGINA, SASKATCHEWAN  
S4P 2Z6 CANADA**

**1987**



## NEW OIL FROM OLD IDEAS: AN HISTORICAL REVIEW OF WILDCATting IN "FRONTIER SASKATCHEWAN"

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### INTRODUCTION

During the summer of 1986, the author, with the support of the Saskatchewan Geological Society, embarked on a project to compile an oral history of the early days of the Saskatchewan oilpatch. The process of collecting the story is by no means complete as of yet, and this paper is meant to be a preliminary summary of the data gathered to date. It is based on conversations and written notes with numerous explorers of the time. The purpose of this paper is three-fold. Firstly, it will provide a general background summary of the events leading to the first true oil boom in the Province which occurred from 1948 to 1958. Secondly, it will look at some of these early explorers' concepts and the problems they encountered in their role as exploration geologists in "Frontier Saskatchewan." Lastly, this paper might suggest alternatives to ideas which have been drawn from their early efforts and are currently held by explorationists with respect to the barren central portion of Saskatchewan.

During this period, the frontier explorers discovered two major sources of light and medium oils in the Province, namely the Lower Cretaceous/Jurassic reservoirs of the Swift Current Platform in southwestern Saskatchewan and the Mississippian subcrop reservoirs in southeastern Saskatchewan. Subsequent to these discoveries, Jurassic shoreline sands and Mississippian subcrops have dominated the thinking of explorationists and provide the bulk of Saskatchewan oil plays (apart from heavy oil reserves). Other plays, such as the light gravity Viking oil play and the heavy oils of the Lloydminster area in west-central Saskatchewan, predate this first boom.

The Jurassic and Mississippian play concepts met with failure beyond the Swift Current Platform and the subcrop of the upper part of the Lodgepole Formation. As late as 1969, when Pheasant Exploration Ltd. drilled 49 dry holes while probing Winnipegosis reefs in central Saskatchewan, the remainder of the Province had not seen a successful oil pool discovery.

Does this mean that central Saskatchewan is barren? In large parts of the Province, the only subsurface data presently available consist of either early wildcat wells or potash exploration tests which are not specifically targeted to find oil and gas. Considering that our data base in this region is derived from these early explorers' efforts, would it not be a worthwhile exercise to understand the tools, methods, and play concepts used by these explorers when they selected their rank wildcat targets? I hope in this paper to discuss some of these aspects.

The oft-quoted geologists' proverb uttered by Wallace Pratt, namely that oil is found in the minds of men, has interesting implications. If the data we use day to day are the result of these original exploration ideas, would it not help our

understanding of a particular region's oil and gas potential if we knew what these ideas were? Much work, research and discussion remain; however, let us begin our quest.

### ANATOMY OF A BOOM

#### PRE-BOOM EXPLORATION EFFORTS

Contrary to the luck of the early wildcaters of Texas, Oklahoma, the Illinois Basin, and other oil patches of the U.S.A., the early wildcaters of Saskatchewan were not that successful. The first well drilled in the Province was at Belle Plaine in 1888<sup>1</sup>, reaching final depth in the "Lower Pierre" at 1551'. From 1888 on, other wells were drilled, but they were largely syndicated drilling efforts, punched down by cable tools and often beset by financial and drilling problems (for example, Moose Jaw No. 1 well, located in Section 32, Twp. 16, Rge. 26 W2M, which was spudded in 1913, and finally abandoned in 1932). The Coutts Syndicate, along with Coalgate Oils and Franco Oil and Gas Ltd., met with some success at Kamsack in 1937 when non-associated gas was found in the shallow Favel shales. Unfortunately, the Kamsack gas wells provided only enough methane to fuel a farmhouse, and if it was of particularly good deliverability, the farmer's barn as well.

One of the earliest explorers to mount a systematic exploration program in the Province was Imperial Oil Ltd. Imperial was not to be outdone by mere promoters, for wells were drilled at the Boundary No. 1 (4-8-1-27 W3, 1916), Fusilier No. 1 (Sec. 23-34-28 W3M, date unknown but pre-1940), and Muddy Lake No. 1 (11-7-39-22 W3, 1919) locations. These were shallow tests and all were dry. Imperial is to figure most importantly in the following portion of the chronicle.

#### IMPERIAL OIL AND THE NORTHWEST COMPANY

Imperial Oil Ltd. had vested interests in finding oil in Western Canada, especially Saskatchewan. On September 19, 1916, Imperial completed a refinery in Regina in order to supply regional western markets with fuel products. It initially processed 1500 barrels of crude per day, the supply coming from Wyoming. The presence of a refinery plus a local demand led to Imperial's initial exploration efforts in the Province.<sup>2</sup>

Imperial had first become active in the Province in the early 1900s through its Winnipeg-based subsidiary, the Northwest Company. Geologists, beginning in the Manitoba outcrop belt, had systematically worked their way across Canada's western provinces to Norman Wells in the Northwest Territories. The field mapping parties defined prospects which were

1. All references to pre- and post-1949 wells were obtained from the Government of Saskatchewan Department of Mineral Resources "Schedule of Wells Drilled for Oil and Gas to December 31, 1952," published in 1953.

2. Anonymous, "Oil in Saskatchewan," 1966, p. 40.



drilled by numerous tests, leading to the discovery of oil at Norman Wells in 1920<sup>3</sup>. Apart from this success, all the other wells were dry and abandoned.

Throughout the following years other refineries were opened, including the Hi-way Refineries Ltd. plant, located in Saskatoon in 1932, the British American refinery situated in Moose Jaw in 1934, and others. In 1935, the Consumers Co-op refinery opened in Regina, further adding to the processing capability of the Province.<sup>4</sup> During these pre-war years, Imperial's efforts had followed the Rockefeller philosophy of establishing control of pipelines, crude oil transportation, and refining capabilities. Spurred on by World War II, Imperial was to mount the most concerted effort to date to find local oil and gas reserves.

World War II had a profound effect upon industry and commerce in North America, and the oil business was no exception. Upon entering the fray in Europe, the Canadian Government realized that secure oil supplies were essential for the war effort, and began to encourage oil companies to explore. Of all the early explorers, Imperial was by far the most technically advanced in terms of subsurface under-

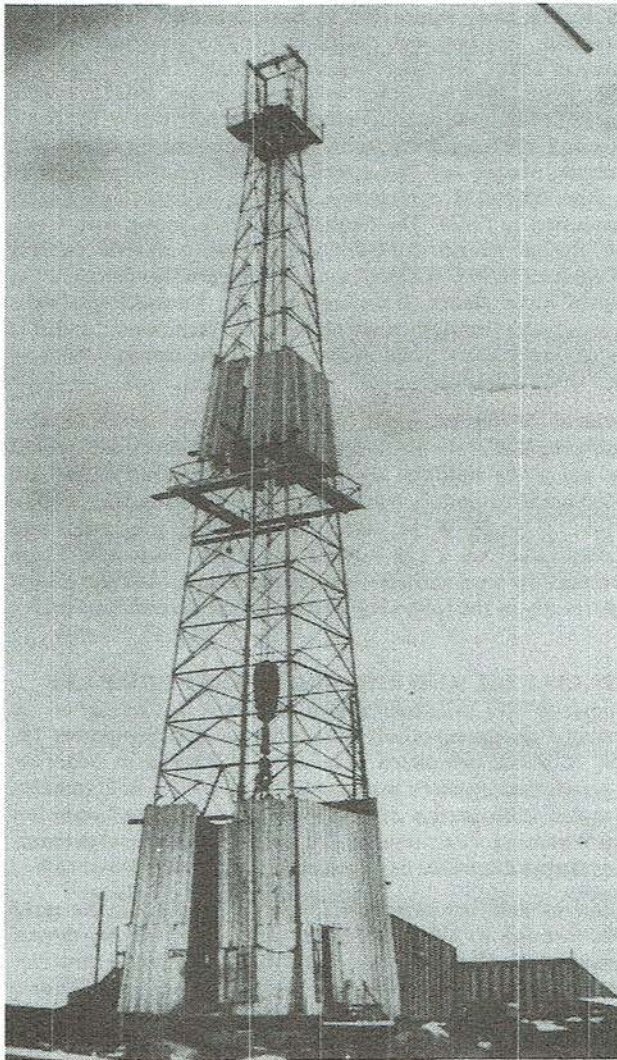


Fig. 1 A Norcanols/Imperial rig in Saskatchewan in 1944 (locality unknown). COURTESY OF IMPERIAL OIL ARCHIVES.

3. For an excellent account of Imperial Oil's efforts in Western Canada, please refer to "Oil in Canada West" by George de Mille, printed by Northwest Printing and Lithographing Ltd., Calgary, Alberta in 1970.

4. Anonymous, "Oil in Saskatchewan," 1966, p. 40-41.

standing of potential oil reserves. In 1939, huge exploration reservations were offered to the Northwest Company, a subsidiary of Imperial Oil. These Northwest Company permits, coupled with Imperial acreage picked up in 1940, 1941, and 1942, covered most of the Province.<sup>5</sup> It must be remembered that during this period, there was no formal method of acquiring exploration leases or permits from the Government of Saskatchewan. In 1942, the Northwest Company changed its name to Norcanols Oil and Gas and continued its search in conjunction with its parent, Imperial.

Imperial had assembled an expert team in Saskatchewan with Dr. J.C. (Cam) Sproule in charge of exploration. A head office was established in Moose Jaw with field parties, including seismic and core drilling crews, sent out across the Province from this base. Charlie Visser and Vern Hunter were in charge of the actual drilling. During the period from 1939 to 1946, the Imperial and Norcanols team drilled 15 wells, 8 as Imperial and 7 as Norcanols.

On May 8, 1942, the team was prepared to drill its first well.<sup>6</sup> The Norcanols (Northwest Company) Radville No. 1 well was spudded in Lsd. 16, Sec. 36, Twp. 5, Rge. 19, W2M near the town of Radville, Saskatchewan. A National Ideal Type 100 Heavy Duty Rotary Drilling Rig, under the direction of driller R.A. Burns and geologist Gordon Beard, was assigned the task. The Government of Saskatchewan, as one of the conditions of issuing the drilling license, required that all horizons carrying water, gas, and oil be noted, along with weekly drilling reports upon official forms, which Dr. Sproule found "complicated."

The first geological marker, the Glauconite "A" Zone, was penetrated at 390'. Surface casing was set within the Lea Park (Bearpaw Group) at a depth of 602'. Below this, the drilling proceeded at a monotonous rate, with the only markers of interest being various microfossil zones meticulously identified by the Imperial team, such as the "Ammobaculites Miliammina" Zone. At 3470' the bit penetrated the "Morrison" Formation (probably the Blairmore). The first Jurassic formation to be penetrated was the "Sundance" Formation. A bit of excitement was generated when a gas show was noted in the "Morrison"; however, no drillstem test was taken. The bit dug on, passing through the Seismic "C" Reflection horizon, noted to be a "Limestone Marker, in part oolitic," from 4315' to 4380'.

Then, true excitement: a carbonate sequence was penetrated, and R.T. Wickenden noted "Endothyra" in cores, identifying the rocks as being of the "Carboniferous." In the dark grey limestones of the "Charles Formation," oil was noticed. A drillstem test taken from 5070' to 5103' recovered 375' of drilling mud with some gas bubbles and oil globules. The second test run from 5070' to 5164' recovered 1700' of black sulphur water and drilling fluid. In both tests it should be noted that the actual packer settings were over a greater interval than the oil zone, thus increasing the interval of the test. This was a common Imperial practice of testing very wide intervals as opposed to trying to isolate the particular zone of interest.

Upon resuming drilling, the normal procedures of cutting cores in porous zones and meticulously logging the samples continued. The "Kinderhook," or Bakken Formation, was noted at 6190'. In the deeper Paleozoics, from the Birdbear

5. Jack Porter in interview, March 4, 1987.

6. All technical data concerning the Imperial/Norcanols wartime wells have been obtained from individual well files available for examination at the Geodata Section, Saskatchewan Energy and Mines, Regina, Saskatchewan.



Formation to the Dawson Bay Formation, the sample descriptions read:

*Buff and brown limestones and dolomites, many of them porous, vuggy, and oil stained; anhydrited; some brick red argillaceous dolomite and green shales in upper part.*

Then, another curious subsurface formation was penetrated. From 7590' to 7842', a thick salt zone was drilled. Though this salt was noted in an earlier well core from western Saskatchewan, it was not to achieve significance until revealed in this well. Ed Swain, an official with the Department of Mines, wrote in a memo to the Deputy Minister dated August 24, 1942:

*On Saturday, August the 22nd, about 11:00 a.m., I was informed by telephone that happenings of note were occurring in the Radville well and that unless visited immediately there was a possibility that the event might be missed entirely. This information was given to me by Mr. Fairley, the inference made was that the bit had or was about to encounter oil production.*

*Knowing that the horizon was either in Lower Devonian or Silurian formation which gives production in other parts on this continent, I lost no time in visiting the well. At 2:30 p.m. I inspected the mud pit and saw no signs of oil whatsoever, there was not even any odour which one could detect and I found that the bit was then at 7837' from the surface, the last 235' had encountered a solid body of rock salt.*

Swain was convinced that the well was penetrating the Salina Beds, a salt sequence present in the Michigan Basin. This correlation led to the belief that the Prairie Evaporites, including the Winnipegosis Formation, were Silurian in age. This confusion was to last into the mid-1950s. Swain also emphasized the possibility of solution mining the salt, for wartime demand for salt was high. Later, Dr. Thorvaldson of the University of Saskatchewan analyzed a pinkish mineral found in the core and found it to be potassium chloride or potash. After this point, the well was taken to a total depth of 7958'.

At this point, the records of the D.M.R. become confusing in terms of operations. Mechanical difficulties are noted on the striplog, for apparently the drill string twisted off at 7958' with the top of the fish at 4212'. Fishing continued until early September, 1942. On September 19, 1942, a whipstock was cemented at 4912' and the hole was diverted to a depth of 6062', with a 7" casing set at 5164'. Then a second fish was lost at the bottom of the deviated hole and was not recovered. The frustration of lost tools in the hole is a daunting challenge today; one can imagine the problems they would have caused in 1942.

It was decided to test the various oil and gas zones in the "Charles" and "Morrison" through perforations in the 7" casing. The first perforations were placed from 5103' to 5116'. Again, Imperial was beset by problems, for the perforations were placed directly below the zone of interest which extended from 5091' to 5104'. The zone was acidized with 300 gallons of 15% acid, whereupon the well produced sulphurous black water with oily foam at a rate of 10 barrels per hour. It was only after the test was completed that it was discovered that Halliburton had made an error in measurement and had in fact perforated too low. The perforations were cemented off; however, the equipment broke down before the cement job was completed. The second set of perforations were placed from 5080' to 5091', this time directly above the zone of interest. Again, after acidizing, the well flowed 10 barrels of sulphurous salt water along with some free oil. It was noted that the oil was 10° API, and a note was made that the test was inconclusive due to the faulty cementing of the previous perforations. The third set of perforations were higher in the

Charles, from 4950' to 4980', again placed over a large interval. Only salt water was recovered. Two zones were perforated in the "Morrison," but only salt water was recovered.

After a grueling period coupled with fishing jobs, whipstocks, and mechanical difficulties in perforating the pay zone, Imperial had perhaps made a commercial oil find in southeast Saskatchewan. Unfortunately, the evidence was inconclusive, for the oil was heavy and made no effort to flow to the surface under its own pressure. The well was finally abandoned on January 8, 1943, with 7" and 13 3/8" casing shot off and removed. The cost to October 30, 1942 for the well was \$208,380.00, quite a sum for 1942.

Driller Burns, geologist Beard, and the National Type 100 rig now moved off the Ogema. The new well spudded on February 28, 1943 at Lsd. 4, Sec. 24, Twp. 7, Rge. 23, W2M. If Dr. Sproule and his cohorts believed that the difficulties encountered at Radville No. 1 were an isolated occurrence, they were sorely mistaken, for the dreaded "Silurian" salt was to create difficulties again.

The uphole drilling was fairly routine, encountering the Bentonite "A" seismic and Limestone Marker "C" seismic reflection horizons as was expected. Again, gas was encountered in the "Morrison" (probably Blairmore) at 3466'. Though no well-developed sands were observed, a drillstem test was run over the interval 3416' to 3561', with the tool opened for a 4' interval directly below the top packer. Salt water, which bubbled vigorously with a blue odourless gas, was recovered in the test. The gas was of sufficient quantity for samples to be obtained, and it tested 83% methane and 15% nitrogen, with the remainder being CO<sub>2</sub>, and ethane by analysis at the Department of Mines and Resources in Ottawa. The closed-in pressure reached 1100 lbs. Despite this recovery, Dr. Sproule was unimpressed, for he indicated that if the show was commercial it would have made its presence known in a more dramatic fashion. This conclusion was reached despite the fact that a core cut in the interval had only 26% recovery, possibly indicating a poorly consolidated sand which may have washed out. The precise sand interval was also not determined. The show would be evaluated again later through casing.

The Charles Formation was soon reached, with the Endothyra Zone noted from 4970' to 5003'. Porosity was present, along with a thin porous dolomite in the Lower Charles which had petroliferous partings. The zone 4777' to 4823' was tested, but only recovered 44' of drilling fluid. Another oil show was encountered in the Devonian limestone sequence from 6615' to 6659', in a "light brown, porous, and petroliferous limestone in the Devonian Group". This zone was not tested. There were two other minor oil shows in samples from 5795' to 5800' and again from 5880' to 5920', but these were not considered worth testing due to the apparent lack of porosity in samples.

Drilling continued until the top of the "Silurian" salt was reached at 7317' on or about June 15, 1943. The bit made progress to a depth of 7688', where it became "frozen" upon entering the Winnipegosis Formation. Once again, the salt was to play havoc with the drilling. On June 21, 1943, fishing attempts were begun. By July 10, 1943, the top of the fish was still at 5464' with the pipe cutters milling at 5776'.

On July 28, still no progress had been made, so it was decided to cement the fish in place and whipstock the hole. Further difficulties were encountered in running the whipstock, with the final whipstock planted at 5347'. The whipstock was then drilled past on or about August 11th. The fishing attempts were complicated by numerous bridges and caving in



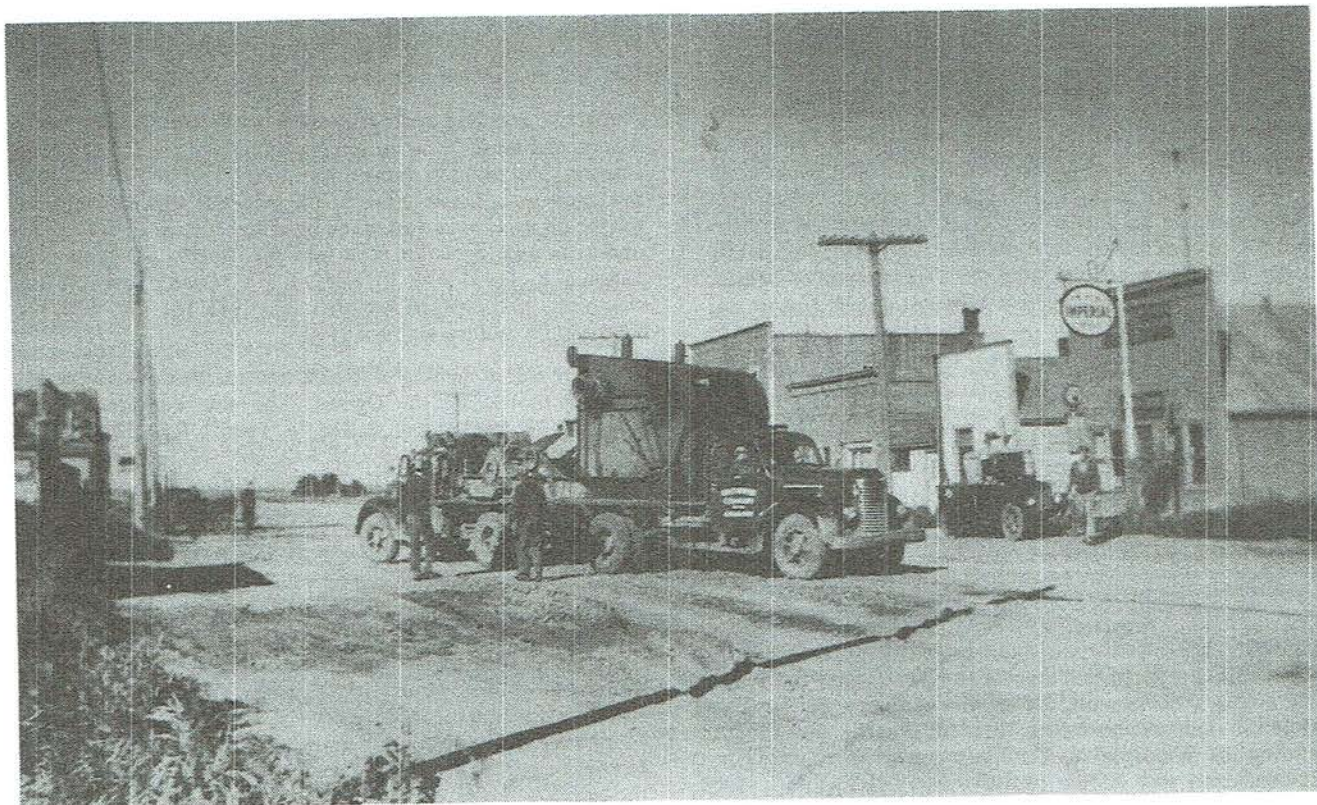


Fig. 2 Moving the drawworks through Truax, Saskatchewan (near Wilcox, Parry, Dahinda, and Ogema wells). COURTESY OF IMPERIAL OIL ARCHIVES.

the hole requiring cleanout trips and much reaming. Prior to these misadventures, Swain had felt concern for Imperial and consulted with Professor Worcester concerning an ideal drilling mud for Saskatchewan. He was thanked for this concern by Dr. Sproule in a letter dated June 8, only days before the onset of the problems.

In order to prevent a similar problem in the deviated hole, casing was run and set at 7634'. From this point, the records indicate no further difficulties. Due to these numerous problems, discontinuous Halliburton logs had to be run. Total depth in the Precambrian was reached some time during the last week of January 1944. Porous sands were noticed in the Winnipeg, so two drillstem tests were run to test the sands for any sign of hydrocarbons. Again, the tests were over wide intervals - 204' in test 3 and 120' in test 4. No hydrocarbons were recovered in either of the tests.

Imperial was now ready to begin testing the uphole petroliferous zones which were behind casing. Unfortunately, these tests were also to be expensive failures due to faulty equipment and crew errors. The first zone to be tested was the oil stained porosity in the "Devonian" from 6615' to 6650'. In the first run, out of 40 intended shots, only 3 actually fired. Further mechanical problems with the guns caused an extra 14.5 hours of time, a fact noted by the cost-conscious Dr. Sproule to his superior, Mr. O.C. Wheeler in Toronto.

When the perforations were allowed to flow the next morning, only a large mud recovery was obtained, leading Imperial to conclude that there was no cement shutoff above the perforations. A cement squeeze through the perforations was then attempted and was apparently successful. However, due to problems with a packer, the test was left unfinished. It

must be remembered that all of this was done in the middle of January in the unprotected plains of Ogema, not exactly noted for its tropical winter climate. Finally, on January 3, 1944, a hookwall packer was set but the test recovered only salty sulphurous water with no oil.

The "Kinderhook" (Bakken) was next tested but recovered only 5280' of black sulphur water. Two more tests, one of the Charles and the second of the Morrison, recovered only salt water and "sulphate" water. After this last test on February 12, the well was ordered abandoned.

It must be remembered that this well was plagued by several problems, namely:

- severe drilling and mud problems due to abundant anhydrite and salt;
- severe mechanical difficulties in perforating and cementing; and
- difficulty in obtaining the potential hydrocarbon-bearing zones due to discontinuous logging intervals, poor logs, and the masking of shows by poor muds and long test intervals.

Considering the problems that these early explorers faced, it is not surprising that oil was not discovered. These two initial wells impressed upon Imperial the nature of the beast that it was up against.

While Norcanols was undergoing its tribulations at Ogema, Imperial drilled a well on one of its own permits.

Imperial Dahinda 10-23-10-23 W2M was spudded on March 13, 1943. This well was drilled rather uneventfully due to the fact that the well did not penetrate the "Silurian" salt but



reached total depth only in the Upper Devonian. Again, no oil was recovered on drillstem tests and the well was abandoned on July 10, 1943.

Norcanols Parry No. 1, located at 16-8-9-21 W2M, was spudded on July 8, 1943, and also found the "Silurian" salt absent. Though Dr. Sproule could correlate the "Kinderhook" and the Devonian "grey" beds, the salt beds of the "Silurian" were missing. Again, the Elk Point sequence was correlated to the Silurian and not the Middle Devonian. The absence of salt in this well would lead Doug Layer, chief geologist for Imperial, to comment in later years that the salt found in the lower section of the Paleozoic was deposited in isolated pans as opposed to a widespread continuous layer. This belief would later have an impact on Bob Bishop of Sohio Petroleum and his theory on salt solution.

Dr. Sproule was also surprised at the amount of dolomite, particularly the "magnesian" variety, and the lack of limestone in this well. Anhydrite was also present in large quantities. The fact that anhydrite could be seen in significant amounts in samples suggests that Imperial was beginning to understand the role of designing muds specifically for the Williston Basin and was having some success in improving them. Four zones of "porous and petroliferous" limestone and dolomite were recorded; however, only salt water and sulphurous salt water were recovered upon testing. The "Morrison" gas horizon also present at Ogema and Parry, tested "sulphate" water. As with the Ogema well, the through-casing production tests were plagued with perforation guns that did not fire, unsuccessful cement jobs, the lack of informative logs, and the presence of fluid communication between zones behind the pipe. The well was abandoned on February 10, 1944. It had been drilled in what was for Imperial a record time, no doubt due to a better understanding of proper muds for the Paleozoic section, the immediate running of casing through troublesome zones, and the testing through pipe of prospective zones as opposed to openhole DSTs.

The veteran of Radville No. 1 and Ogema No. 1, the National Type 100, was set up at Norcanols Imperial Wilcox No. 1 at the boundary between Lsd's 15 and 16, Sec. 32, Twp. 13, Rge. 20 W2M on Norcanols Reservation No. 136 on March 19, 1944. In this well, the Imperial team was surprised to find the presence of a sand and shale sequence in the Sundance immediately underlying the Morrison gas sand. These "Sundance" sands were not present in any previous wells. A 100 foot interval was tested but only warm salt water was recovered, dampening the excitement of Imperial and a Mines Branch agent (the indomitable Mr. Swain, who seemed to love wellsites at 3:00 a.m.). The crews were ever vigilant for porosity in the limestone section, as Dr. Sproule had warned his geologists that the location of these porous zones was still uncertain. Only gross lithological similarities could be correlated, such as the "Kinderhook" (the Bakken), the Devonian red shale (the Three Forks), and the "Salt." In previous memos to Mr. Swain, Dr. Sproule had insisted on the importance of numerous water analyses of subsurface fluids, for such tests would help Imperial determine whether the fluids produced on DSTs were from the formation or if they were "put there by us." Another test was run over the "Endothyra" Zone of the Charles, and upon opening the tool, salty and sulphurous water flowed over the top of the drill pipe. The well was abandoned on June 16, 1944.

The National then moved to Norcanols Gap. No. 1 at 16-3-3-25 W2M on July 23, 1944. Total depth was 7767' and was reached and completed November 3, 1944. The well bottomed in the Devonian and did not attempt to penetrate the Lower

Paleozoic section. It appears Imperial was learning that the zones most likely to produce oil included the Morrison, the Charles, the "Kinderhook," and the upper limestones and dolomites of the Devonian.

Gap No. 1 encountered uphole problems due to cavings, and only three drillstem tests were run over the Morrison sand, believed by Imperial to be gas-prone in the region. Only one of the tests proved to be successful, as the other two ran into mechanical problems including poor packer seats and cavings jamming the testing tools. The only successful test recovered 30' of mud.

The surprise found in this well was a 1490' thick Triassic "Spearfish" formation composed of red and green argillaceous dolomites, sandy dolomitic shales and siltstones present from 5290' to 6780'. The Madison Formation, from 6780' to 6978' was not the typical "Charles" but rather dark argillaceous limestones and cherts. This caused great consternation among the Imperial group. Why was the Mississippian so thin and the red beds so thick? It would require further drilling to find an answer to this problem.

One of the precepts of the oil business is that oil is where you find it. Having found some oil at Radville No. 1, Norcanols Radville No. 2 was drilled at 16-36-5-19 W2M, 900' from the previous Radville No. 1 location. This well was intended to be a Charles test in order to evaluate properly the oil show. After all, Imperial had learned so much about muds, drilling techniques, and methods of evaluation over the past two years that perhaps this time oil would be found in commercial quantities. The petroliferous horizon was present in the Charles "Endothyra" Zone as at Radville No. 1, and upon hearing this news, Mr. Swain, ever mindful of the Province's interest, rushed out to the scene. The show must have been very impressive, for in a memo to his boss, Mr. Swain writes:

*I was present at the well continuously until 10 at night, as this is a matter of deep concern to the welfare of the Province in the case the (drillstem) test showed a commercial oil horizon.*

Unfortunately, Mr. Swain was to be disappointed for the drillstem test recovered only drilling mud, with no evidence of oil in commercial quantities. A second test was run over a lower horizon and only 2 gallons of dark brown oil were recovered along with sulphurous salt water. The well was abandoned and moved to a location at 11-20-13-13 W3M on an Imperial reservation in southwest Saskatchewan.

Imperial Swift Current No. 1 was a deep test, spudded on October 5, 1944 and completed on April 1, 1945. It was drilled down to basement and as usual intermediate casing was run. An interesting zone in the "Lea Park" (the Milk River) was discovered to have a gas show which was later tested through perforations. The well produced 11.9 Mcf/d but was abandoned because the production was not considered to be of sufficient quantity to be economical. No shows were noted in the deeper horizons.

At this point, a pivotal event occurred in Saskatchewan. In August of 1944, the Cooperative Commonwealth Federation (C.C.F.) under the leadership of Tommy Douglas was elected as the new government of Saskatchewan. The election of a "socialist" government by the people of Saskatchewan did not sit well with the Imperial management in Toronto and New York. Common legend has Imperial "moving out their seismic crews for Alberta on the night of the election," and "trucks being loaded with anything of value minutes after the election,



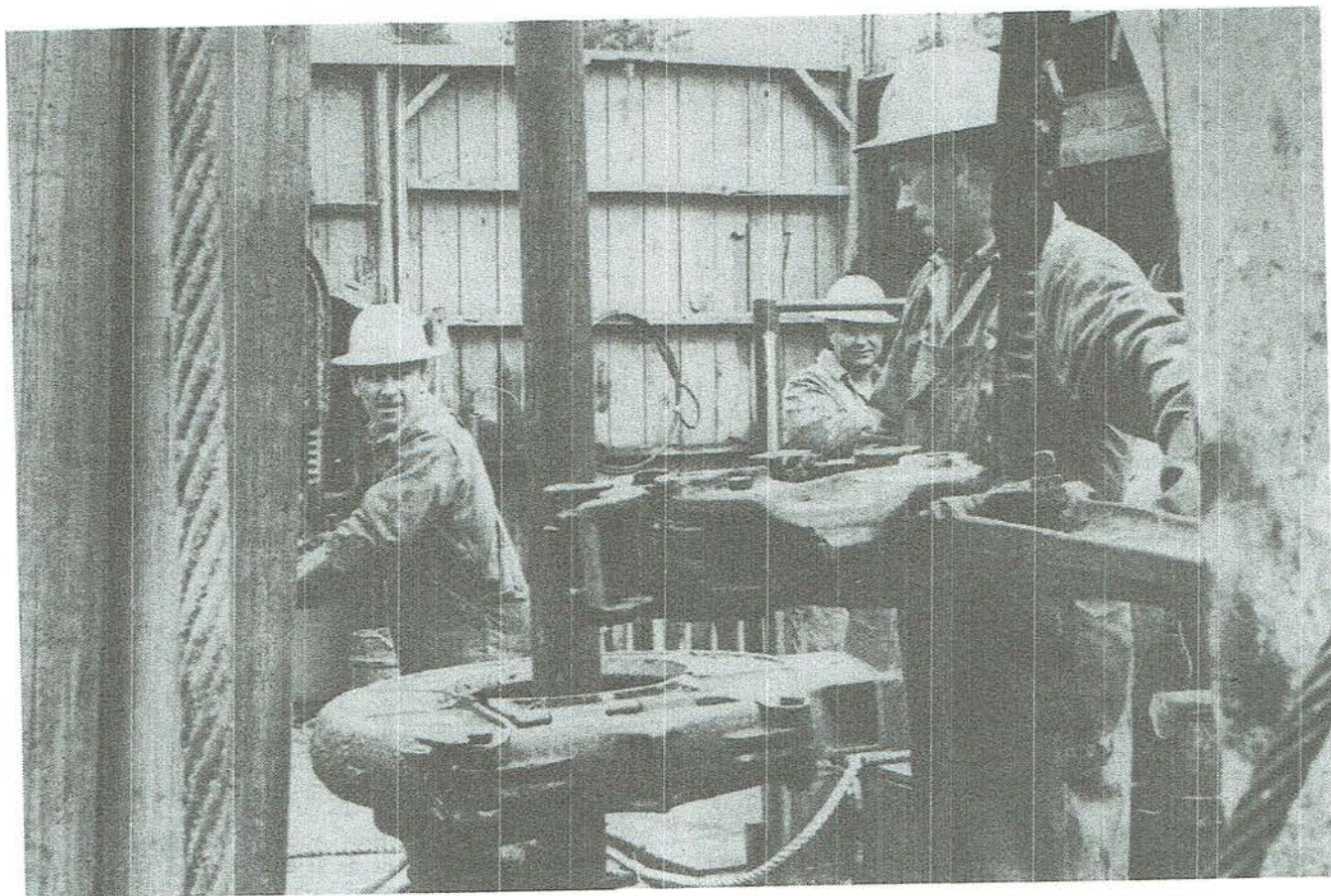


Fig. 3 Imperial drilling crew in action in Saskatchewan, 1944.  
COURTESY OF IMPERIAL OIL ARCHIVES.

all pointed to Alberta." Yet the facts do not support this myth. Imperial, including Norcanols, continued to drill wells on their permits in Saskatchewan, the remaining wells being:

Imperial Elbow No. 1, 12-25-23-6 W3M, spudded December 17, 1944;  
Norcanol Imperial Pennant No. 1, 4-14-18-16 W3M, spudded April 22, 1945;  
Imperial Morse No. 1, 1-16-18-7 W3M, spudded July 10, 1945;  
Imperial White Fox No. 1, 5-14-52-14 W2M, spudded August 11, 1945;  
Imperial Davidson No. 1, 16-8-27-1 W3M, spudded November 1, 1945; and  
Imperial Davidson No. 2, 13-10-29-2 W3M, spudded February 21, 1946.

According to C.A.L. (Vern) Hogg, the Deputy Minister of Natural Resources during this period, what actually led to Imperial's decision to leave Saskatchewan was a simple matter of the expiration of the original permits issued to Norcanols and Imperial from 1940 to 1942. According to Vern Hogg, Imperial's manager for Canadian operations (no doubt Mr. O.C. Wheeler) came out to talk to government officials during the fall of 1945 from head office in Toronto. The government under Tommy Douglas was willing to extend to Imperial essentially the same reservations, under the same terms, as had been granted during the war years. The government wanted to see economical oil and gas production established, as this would add to the wealth of the Province. Certain "cosmetic"

changes were made by the government, none of which would have materially affected the economic spirit of the deal; however, Imperial walked out on the deal extension, refusing to agree to the terms of the extensions. Perhaps Imperial allowed the permits to expire, not because of the "socialist" government, but because of its problems and lack of any discoveries of commercial quantities of oil and gas. Drilling which was done subsequent to the C.C.F. victory was simply to evaluate the remaining prospects.

The Norcanols and Imperial Crown permits, drafted under a Liberal government during a time of national crisis, were allowed to expire; however, conversations with certain key figures indicated that Imperial had enough encouragement during this early drilling to keep its hand active within the Province. Some anti-C.C.F. feelings were no doubt present for Imperial now adopted the strategy of purchasing freehold leases in southeast and south-central Saskatchewan, thereby avoiding the need to deal with an anti-business (or so they perceived) regime. Governments were not to be trusted, so better to own privately-owned lands as opposed to lands subject to the whims of the Crown.

April 1946 marked the end of Imperial's efforts in Saskatchewan. Imperial's lack of enthusiasm is noted in the Saskatchewan Energy and Mines well files, where little technical information is present. The plays also seem suspect. For example, in the case of White Fox No. 1, the justification for taking over the ongoing operations of Bobjo Mines was a reported gas seep on the banks of the White Fox River.



### COMING UP TO A GREAT LAND RUSH

After the Imperial Norcanols exploration program, but before the Great Land Rush of 1948, there was some exploration activity in the Province. The primary discoveries in the Province during this period occurred in the Lloydminster area, where numerous small companies discovered heavy oils in the Lower Cretaceous sands. Most of these companies were operating from leases, not the large exploration reservations which were to follow. Numerous pools were discovered; however, the oil was heavy, and it was very difficult to market with the purchasers buying this oil for paving and the production of lower grades of fuel oil. Heavy oil shows had been noted in the Colony Oil and Gas Co. Ltd. Colony No. 3, 5-19-49-27 W3M, spudded on October 24, 1936 within the Lower Cretaceous "Blairmore" Formation, but it was not until National Grant No. 1, spudded on November 7, 1944, at 4-14-49-28 W3M, that a commercial oil well was completed. Heavy black oil was produced from the Sparky Sand of the Lower Mannville.

Among the heavy oil pools discovered at this time were Silverdale (April 1945), West Lashburn (May 1946), Lone Rock (February 1947), Landrose (July 1948), Dulwich (November 1948) and Gully Lake (October 1949). These discoveries were largely due to previously developed oil pools on the Alberta side of the Lloydminster heavy oil belt. The vast undrilled portions of the Province were intimidating to many of these small explorers as no oil had been found in commercial quantities. All this was about to change in 1948, largely due to two factors: Leduc, and the C.C.F.'s exploration reservation system.

### THE SASKATCHEWAN OILPATCH BREAKS OPEN

Beginning in 1948, the period which follows marks one of the greatest periods of exploratory activity that the Province has ever undergone. Perhaps the best way to chronicle the numerous developments which occurred during this time is to follow the exploits of one of the wildcatting companies, namely the Sohio Petroleum Company of Cleveland, Ohio. Others, such as the Tidewater Associated Oil Company Operator, Phillips, British American, and Albercan were also active; however, it is beyond the scope of this paper to chronicle all activity. I will save this story for later telling.

In June of 1949, Robert A. Bishop, a recently independent consulting geologist, was at the Alberta Society of Petroleum Geologists Annual Golf Tournament. There he met Carl Nickle, publisher of the Nickle Oil Bulletin, who decided to give Bishop some advice:

*Go to Regina and apply for permits, any Crown Permits available. They are going fast. It will cost you \$250.00 per permit filing fee and you can sell them easily.*

Bishop was intrigued by this advice, but did not act upon it as he knew little about Saskatchewan and the Williston Basin. Besides, Joe Irwin, a prominent Calgary consultant, had advised Bob not to go out to Regina. Irwin told Bob that as a consultant, Bob had no business competing with the people he was advising<sup>7</sup>.

Bob was not to be rid of Saskatchewan that easily. Bob had sold some maps of the Peace River area to Sohio Petroleum Ltd. under the command of Mr. Harry Ross, Sohio's exploration manager in Canada. Ross liked Bob's maps so much that he offered to hire Bob as an employee. With his fledgling independent wings just unfurled, Bob was hesitant about becoming a company man. In an effort to dissuade Ross, Bob asked for the sum of \$12,000.00 per year, an exorbitant wage

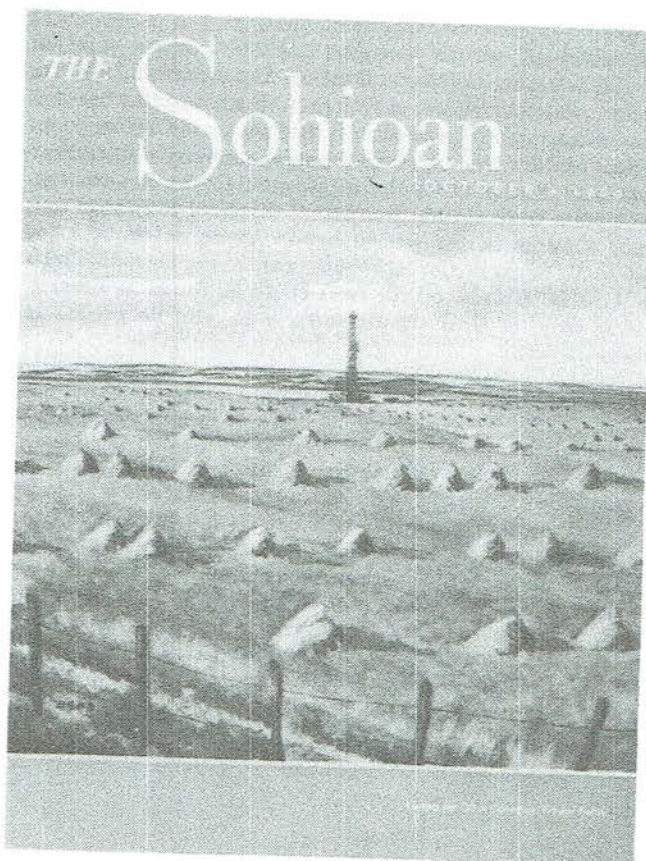


Fig. 4 Sohio displayed its interest in Saskatchewan on the cover of the October 1950 issue of the "Sohioan," the company newsletter.  
COURTESY OF BOB BISHOP.

in those days. Much to his dismay, Ross accepted, and Bob soon found himself in Regina running Sohio's exploration efforts in the Province.

Standard Oil of Ohio Co. (Sohio for short) was the original Standard company founded by John D. Rockefeller back in the mid-1800s. Sohio was primarily a refiner, marketer, and shipper of petroleum products, leaving the risky business of exploration for others. In the late 1940s, Sohio saw the need to find and develop its own secure sources of crude oil so George Buchanan, Vice-President of Exploration for Sohio, was given the task to meet this mandate.



Plans for further exploration in Saskatchewan were discussed during a recent visit of Sohio President C. T. Foster and other officials to Regina. Standing left to right: H. W. Ross, Sohio's manager in Canada; G. S. Buchanan, vice president, Sohio Petroleum Co.; C. B. Smith, geophysicist; John Benzene, geophysicist; W. A. Biller, superintendent, Canadian production operations. Seated left to right: E. D. Walker, president, Sohio Petroleum Co.; M. Foster; J. P. Smith; R. W. French, Sohio Petroleum vice president.

Fig. 5 Sohio exploration meeting, 1949.

FROM THE OCTOBER 1950 "SOHIOAN," COURTESY OF BOB BISHOP.

7. Bob Bishop in interview, February 8, 1987.



Buchanan believed that the company had to go where the risk was high, yet the potential vast. With this in mind, he initiated leasing in North Dakota, Saskatchewan, and the Denver-Julesburg Basin of Colorado. Buchanan had heard of the Leduc discovery and sent Harry Ross up to Calgary to get a piece of the action. After following the activity at Leduc and Redwater, Buchanan felt that all the good Crown Reservations in Alberta were already purchased; therefore Buchanan outlined a swath across Saskatchewan where he thought the sediments might be similar to those containing Devonian reefs in Alberta. If these profile reefs could be found in Alberta, surely they, or their counterparts, must also be present in Saskatchewan<sup>8</sup>.

This initial foray by Sohio into Saskatchewan illustrates two major reasons for getting into the Province. The first was the availability of large exploration reservations owned by the Crown and made available to explorers at low cost.<sup>9</sup> The regulations had been brought into place in 1945, and originally allowed subsurface permits of up to 34,650 acres and geophysical permits of up to 250,000 acres. The term of these permits was 21 months with work requirements attached and strictly enforced.<sup>10</sup> Under C.C.F. doctrine, the leasing of Crown Lands to the private sector en masse was not appealing, so in 1949, under the direction of C.A.L. Hogg, Deputy Minister, the "Crown Reserve" was established, whereby the Crown had the right to reserve 25% of the permits as

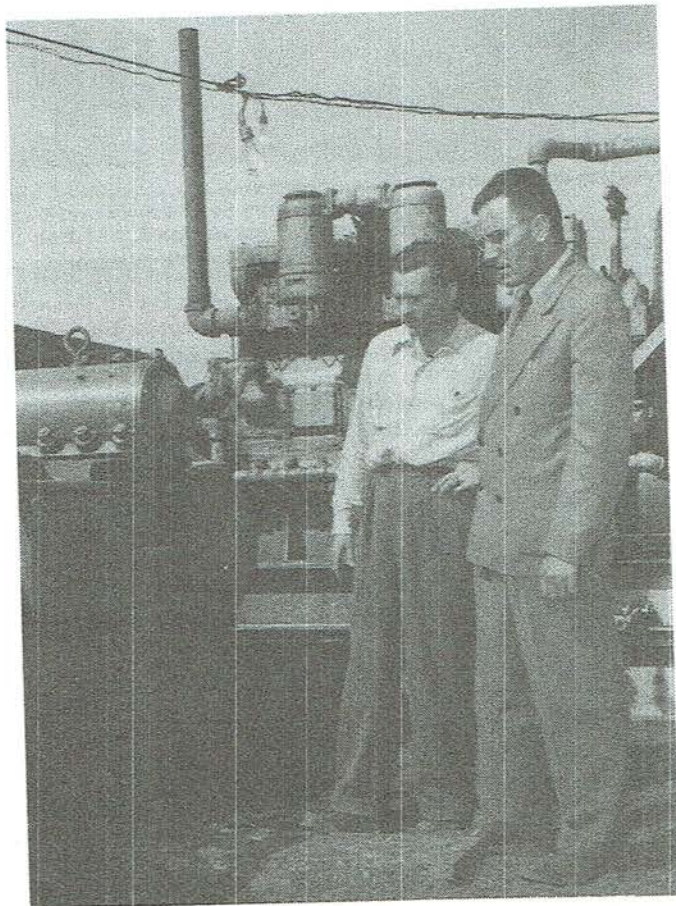


Fig. 6 Vern Hogg (left) and the late Honourable J.H. Brockelbank at rig site in 1950. COURTESY OF C.A.L. (VERN) HOGG.

8. *Ibid.*

9. Vern Hogg in interview, January 10, 1987.

10. Anonymous, "Oil in Saskatchewan," 1966, p. 52.

undisposed Crown Reserves.<sup>11</sup> The chief architect of government oil and gas regulations was C.A.L. Hogg who was responsible to the late Honourable John M. Brockelbank, Minister of Mines and Natural Resources.

Under these regulations, anyone could file for a permit, pay a nominal fee, and be given the right to explore for oil on the permit lands. Of course, the key word here is *explore* as work commitments were an integral part of the system.

Some of the big players were again becoming active in the Province. Imperial had changed its philosophy and was acquiring freehold lands in southern Saskatchewan as did Shell and certain others. The first freehold brokers, better known as leaseholders, began trickling into southeast Saskatchewan in 1947.

The second impetus to the great land rush was Leduc, discovered in 1947. Leduc proved that commercial quantities of light crude oil could be found on the Prairies. Leduc also provided an exploration concept, that of the Devonian reefs. Speculators and bonafide explorers could see the potential for deep reefs in the subsurface of Saskatchewan simply by applying the process of trendology. The students of the Norcanols/Imperial wells might have had difficulty in accepting this, as the section contained the Silurian salt and a basal dolomite which may or may not have been the "Winnipegoman" dolomite of the Manitoba outcrop. Nevertheless, those who rushed to Leduc and Redwater in 1947 and 1948 largely duplicated the experience of Sohio, and found themselves to be "Johnnie-come-latelies" in the Leduc play and therefore had problems finding choice permits. Yet in the next Province over . . .

Overnight, or so it seemed, the speculators and explorers swarmed across Saskatchewan, picking up any piece of freehold they could find and file on any permit they could post. It did not matter where or why you got your permits, as long as you got your chunk of the potential wealth. In most cases, little thought was given to applying geological knowledge to permit selection because little was known of the sedimentary sequence. One must remember that these explorers were plagued with the same problem that haunted the earlier explorers: the majority of the Province is covered by glacial drift, making the surface mapping of subsurface structures impossible.

There was, however, a problem with the permits in that they had a life span of only 21 months. If a speculator had purchased a permit in June of 1948, the permit would have to be validated by drilling or geophysics by April, 1950. By mid-1949, with over half the life gone on numerous permits, many of the speculators were facing the unpleasant option of spending vast sums of money on technical evaluations such as geophysics or drilling, or losing the permits. Unwilling to spend any more money, the speculators and small explorers began to go the "show-and-tell" route, trying to arrange farmouts to companies with the financial and technical clout to evaluate the lands properly. *Fred C. Rabbara, Gulf Securities Corp. Montreal*

It was just such a speculator who first approached Buchanan in Houston with his bag of Saskatchewan acreage. Again, seeing potential for more Leducs just east of the Alberta border, Buchanan bit the hook. The job of Harry Ross, and a newly hired geologist by the name of Earl Haines, was to mount an exploration effort on the farmouts and also to acquire some permits on their own behalf. Sohio was not acting alone in this venture, for it had seven partners, namely:

11. Vern Hogg in interview, January 10, 1987.



Standard Oil of Ohio Co. (the parent to Sohio Petroleum Co.);  
 Texas Gulf Producing Co.;  
 Union Sulfur and Oil Co. (Union Texas Oil Co.);  
 Chicago Corporation (Champlin Petroleum Co.);  
 Republic Natural Gas Co.;  
 Midstate Oil Corp; and  
 Bradley Producing Corp.<sup>12</sup>

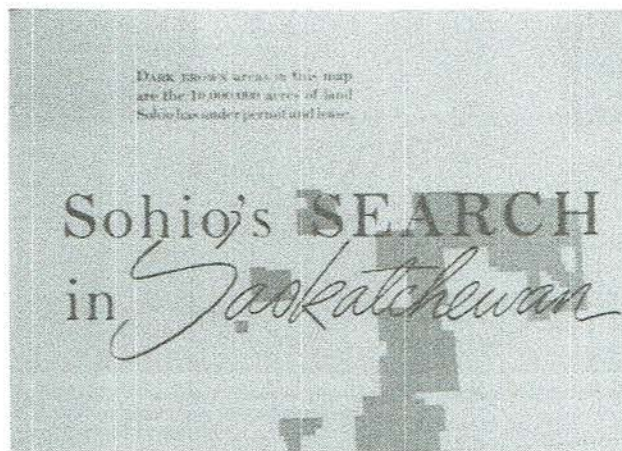


Fig. 7 This title from the October 1950 "Sohioan" feature on Saskatchewan illustrates the permit spread.

COURTESY OF BOB BISHOP.

Sohio began acting on its own in acquiring freehold and permits in April 1949. The bulk of permits filed for by Sohio was for a huge "T" centred across central Saskatchewan in an east-west direction with the base of the "T" running north-south in south-central Saskatchewan. For the most part, the permits were picked up where they could be had.

Sohio was not alone in such efforts. Tidewater Oil Co. was part of the Getty empire and was, like Sohio, a refiner, shipper, and marketer of petroleum products and not strictly an exploration company. Tidewater and its partners, the Ohio Co. (no relation to Sohio), the Atlantic Refining Co., and the Columbia Carbon Corporation, formed a joint venture known as the "Tidewater Associated Oil Company Operator" for the purpose of exploring for oil in Saskatchewan. It appears that the original entry into the Province was through farmers, for Tidewater was instrumental in changing the terms of the regulations in order to allow for an extension on time limits for its permit terms. Howard M. "Howdy" Kirk and Claude Leach were sent to Canada to head up exploration efforts on Tidewater's behalf, with Dr. R.L. Milner assigned as chief geologist.

The questions still remained: even with the permits in place, where does one begin to look? Sohio's first effort in the summer of 1949 was to conduct a vast regional gravity survey. The gravity crews took a reading at every section corner, covering almost all the permit areas by jeep, horseback, even snowshoe. The entire purpose of the survey was to determine basement configuration and detect the presence of reefs as evidenced by gravity anomalies. Sohio's second early effort was the drilling of a series of stratigraphic tests on a permit located to the northwest of Saskatoon in the Langham area. It was a beginning exploratory effort while Sohio continued to concentrate on acquiring over 10 million acres of permits and freehold in the Province.

The original Saskatchewan operation had been established by W.H. Strickler, a Mount Pleasant Michigan land broker, who had supervised the initial leasing; however, in 1950 Bishop and Ross were put in charge of Saskatchewan and began the work of exploration in earnest. Interest in the Sohio wells was keen as they represented the first wells of the "new wave" of exploration. Leasing continued, with the final permit, No. 137, purchased in October, 1949.

As previously mentioned, the first drilling conducted by Sohio comprised four wells drilled to the northwest of Saskatoon in the Langham area. Most of these wells were shallow tests of the Cretaceous which reached total depth at the top of the Paleozoic. One, Sohio Stratigraphic Test No. 3, reached a salt bed at the depth of 2959' which was correlated with the "Silurian" salt of southeast Saskatchewan.<sup>13</sup> None of the wells found hydrocarbons and all were subsequently abandoned.

Bishop and Ross were to spend the remainder of 1950 shuttling between Sohio's head office in Calgary and the newly opened office in Regina. It soon became apparent that in order to evaluate all the permits Sohio had tied up, large amounts of money, far in excess of what the original joint venturers were able to fund, were needed. Therefore, Standard of Ohio, Sohio's parent, entered into a joint venture with the original group in order to drill wells on selected partnership acreage. Another large farmout was subsequently granted to Socony Vacuum Oil in southwest Saskatchewan.

In 1950, the first wells for the definite purpose of finding oil and gas were drilled by the Sohio group. It was a new experience for some of the staff, and the field conditions were difficult, to say the least. Often, the geologist who was onsite was much more than a dispassionate observer and company representative. Bob Bishop relates this story with respect to some of the early 1950 drilling:

*When I first drove out to Findlater in January 1950, they were down around 4000'; the rig had not been winterized and was shut down. The shale shaker was under a foot of ice and no samples had been taken for a couple of thousand feet. The geologist, Earle Haines, had been on diamond drilling holes in hard rock country but had never seen a big rig before. They had him — Earle — living in his car, chasing errands, getting no sleep, making calls, doing everything a toolpusher should have been doing. I said "Earle, you are a geologist. Your job is to make a good sample log of this well, and to do that you need to catch samples...if these people can not drill this well themselves, that is their tough luck..."*

The first and best prospect that Sohio had was located near the town of Plunkett. Though considered a rank wildcat, all surveys had revealed a sprawling anomaly with good closure. It looked like a hit. The well was drilled with fresh water but increased mud salinities were measured, suggesting the presence of salt. Schlumberger suggested that a new "radioactivity" log be run, and after being run, the log showed nice character, excellent definition of lime and shale beds, and potash zones within the "Silurian" salt. This tool was to prove very useful for correlation of the Mesozoic and Paleozoic strata across the Province. Later that year, in a well near Melville, the radioactivity log was again run. Bishop was quite impressed, for the logs allowed the Devonian in the Plunkett wells to be correlated with the Devonian in the Melville well. This was considered to be a major breakthrough in subsurface geology in the Province.

Tidewater was not asleep during this period. TWAO had originally picked up a large number of permits from a Montreal speculator but time was running out on them. In order to meet the work commitments, TWAO flew a large regional aeromagnetic survey over their permits. The survey

<sup>12</sup> Anonymous, "Sohioan," October 1950. The Sohioan has two excellent articles on the company's efforts in Saskatchewan.

<sup>13</sup> Technical data concerning Sohio wells have been obtained from individual well files available for examination at the Geodata Section, Saskatchewan Energy and Mines, Regina, Saskatchewan.



**SOHIO PETROLEUM COMPANY  
CANADIAN BRANCH  
ORGANIZATION CHART  
JUNE, 1951**

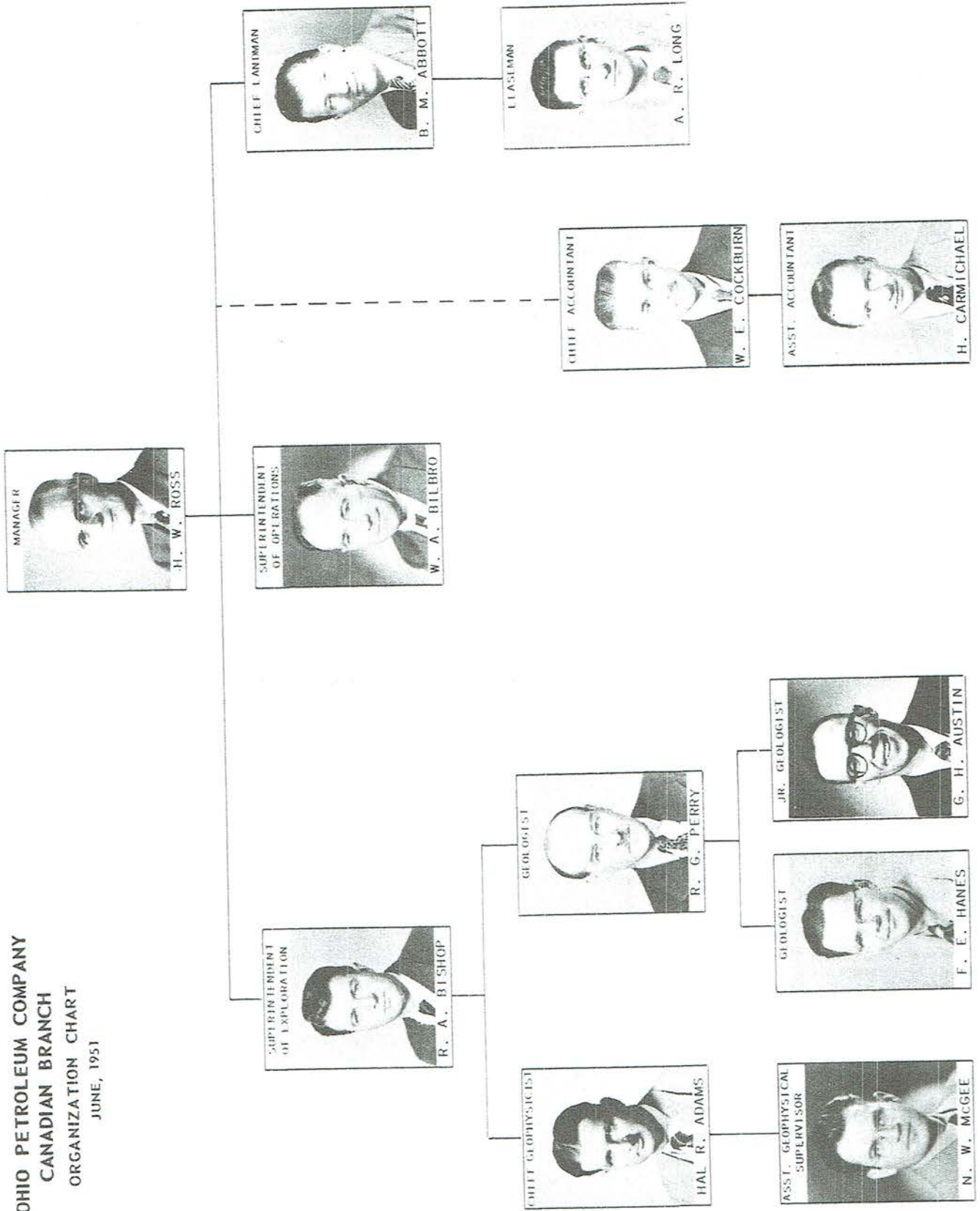


Fig. 8 The Sohio team in Saskatchewan.  
COURTESY OF BOB BISHOP.



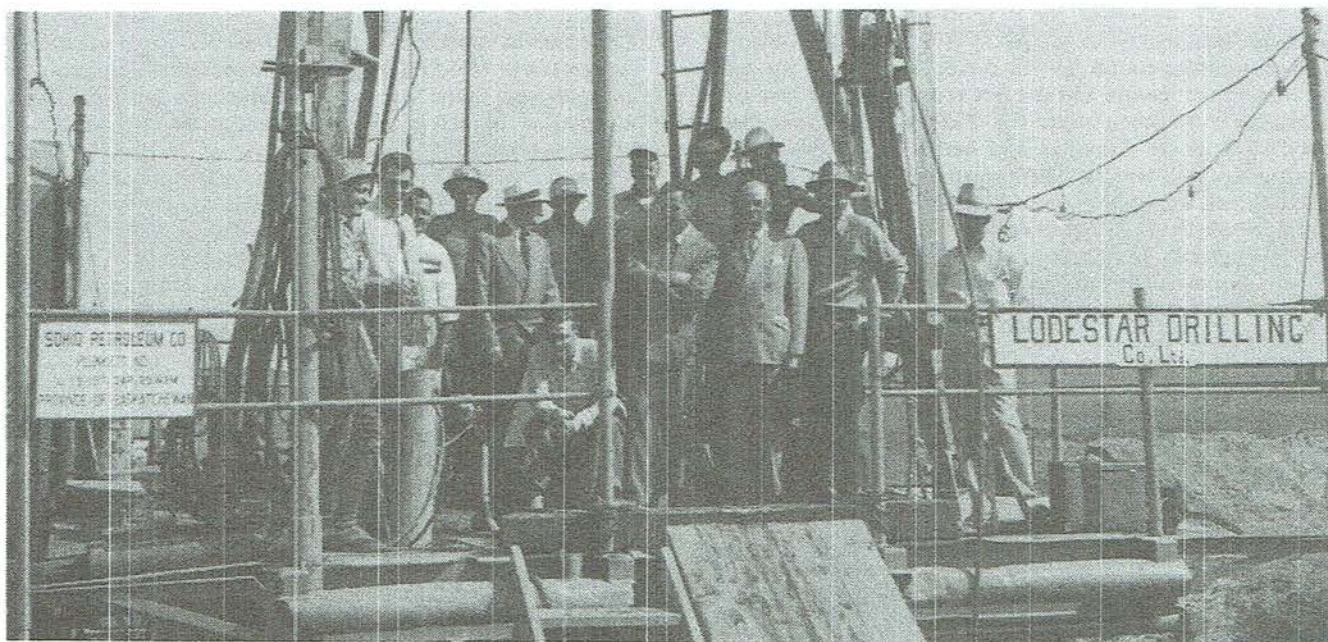


Fig.9 Sohio, Government, and Lodestar personnel at Sohio Plunkett No. 1, 15-15-34-25 W2M. Bob Bishop is second from left, Vern Hogg (seated), the late Honourable J.H. Brockelbank (on Hogg's left), and Harry Ross (on Brockelbank's left).  
COURTESY OF VERN HOGG.

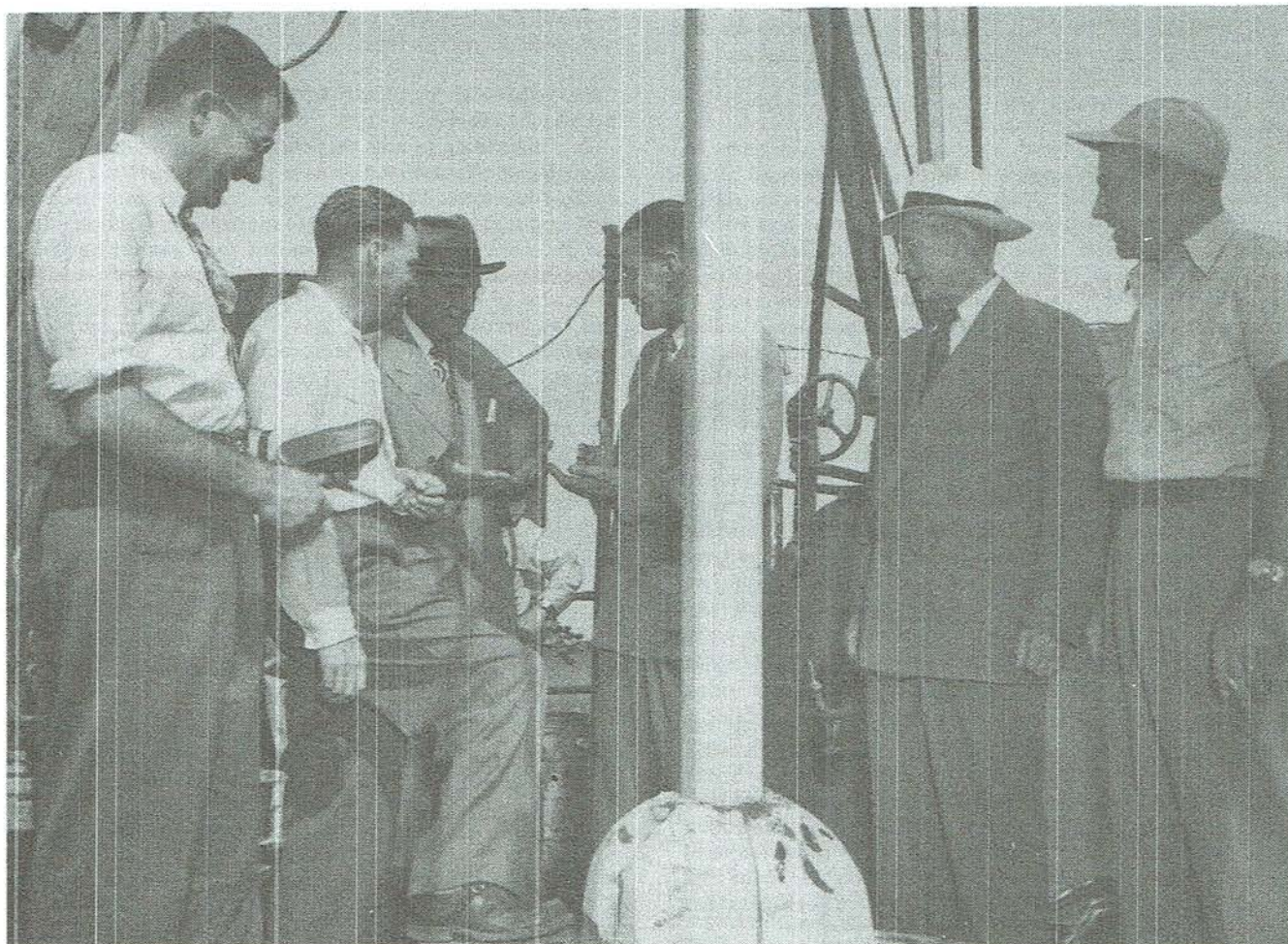


Fig. 10 On the rig floor, Sohio Plunkett No. 1. From left to right, Bob Bishop, Vern Hogg, Harry Ross, J.H. Brockelbank, the Honourable J.A. Darling, and Bill Bilbro (Sohio).  
COURTESY OF VERN HOGG.



was not very successful for it revealed that the depth to basement was 30,000' to 40,000'. TWAO was not fooled by this, only disappointed, as the survey had picked up some intra-basement feature and did not reveal depth to basement as originally had been hoped for. Tidewater had done much early work in the Province and had some excellent ideas concerning oil prospects. Their chief geologist was Dr. R.B. (Bob) Milner, a graduate from McGill University of Montreal, who had been in the Province on Tidewater's behalf as early as 1948, though this has not been substantiated. Dr. Milner was perhaps the most brilliant geologist to have worked Saskatchewan and is largely credited with establishing a system for Jurassic correlations that is still in use today. Bob Milner was a meticulous, curious, and extremely imaginative geologist. As related to Dr. Doug Paterson of the Saskatchewan Department of Energy and Mines in a letter dated November 22, 1982, H.M. "Howdy" Kirk, general manager of the TWAO group, stated the following:

*Without question, Bob Milner was the best geologist working in Saskatchewan in the 1950's. The Tidewater Group — who I worked for — hired some dozen or more young geologists just graduating from University. They arrived in Regina and Bob Milner would give them a six week training in sedimentation followed by some 6000' of well cuttings, and cores, for them to write up logs. This finished, they were sent out to sit on wells. They all came through good and moved to Alberta fields.*

Bob Milner spent a lot of time logging the cuttings and cores of the Norcanols wells. His exhaustive work gave him ideas and no doubt was a significant contribution to the further successes of the Tidewater Group in Saskatchewan. Of all the wildcatters, Tidewater and Sohio were perhaps the two greatest rivals, yet there was a sense of camaraderie between the two. Bob Bishop recalls logging Norcanols/Imperial core together with Bob Milner at the first core lab in Saskatoon. Though they were friends, they never shared their observations or interpretations.

The above is not to suggest that only Tidewater and Sohio were busy during 1950. Other groups were also active. Jack Porter, recently retired from Canadian Superior and one of the premier geologists of the Williston Basin of Saskatchewan and Manitoba, was with a small group called Rio Bravo during 1949 to 1950.<sup>14</sup> Jack was a student at the University of Saskatchewan during the war and spent his summers working with the Norcanols/Imperial Group as a field geologist mapping surface structures and sitting the occasional structure test hole. After a short stint with the Saskatchewan Department of Mineral Resources, Jack moved to Rio Bravo Oil Company and was one of the earliest Saskatchewan geologists to be based in Regina, save perhaps for Bob Milner; Rio Bravo initially became active in southwest Manitoba by participating in the Souris Valley Oil Company mapping wells in the Coulter-Lyleton area. These tests, begun in 1949, were some of the earliest deep drilling of the current boom to be punched down and involved such colourful characters as Oscar Kniseley, a promoter from Louisiana who was the main force behind Souris Valley, and Jimmie Owen, the intrepid wildcatter from Baton Rouge, Louisiana.

Jack also was involved in field work conducted along the shores of Lake Winnipegosis, Manitoba, in 1949. This work was done in conjunction with geologists from Hudson's Bay and Phillips, who were also convinced that the best prospects to pursue in Saskatchewan were the Winnipegosis reefs that might offer similar oil and gas possibilities as those found in the Alberta subsurface. McGehee (1949)<sup>15</sup> was one of the first to dispel the belief commonly held by industry geologists that

the salt and the underlying basal dolomite were Silurian. Evidence was starting to suggest that this particular subsurface sequence was Middle Devonian, as opposed to Silurian, and not equivalent to the "Salina" of the Michigan Basin. Extensive mapping of the reefs in the outcrop section led Phillips to lease extensive tracts in the north-central part of the Province in the Nipawin/Gronlid/Peesane areas. Early Phillips drilling was concentrated in this area and revealed a complex sequence of reef/off-reef sequences in the Middle Devonian, as well as a show of oil-cut mud from the Winnipegosis in a well near Gronlid. Phillips was not limited in its scope of thinking; besides chasing the reefs, Phillips was also active in the west-central portion of the Province where oil had previously been found. It concentrated on the region south of the Lloydminster heavy oils in the Eatonia/Driver area.

Also active in the central Saskatchewan reef hunt was Britalta Petroleum Ltd. Britalta drilled a number of deep tests on its permits held largely north and east of Saskatoon. Wells such as Pelican Lake, Rosthern, and Carpenter were drilled; however, all were dry and abandoned.

Other explorers were sticking to the less rank wildcat areas of the Province. In the summer of 1950, Albercan Oil Corp. made a discovery of heavy "Black" oil at Heart's Hill in west-central Saskatchewan. The well, Albercan's Heart's Hill No. 1, 2-22-35-26 W3M, discovered a show of heavy oil in the Lower Mannville but the discovery was deemed small and uneconomical. This well did establish the presence of oil away from the Lloydminster area and was thus an encouragement to explorers.

#### THE MISSISSIPPIAN OF SOUTHEAST SASKATCHEWAN

It is interesting to note that the Mississippian subcrop play of southeast Saskatchewan was largely ignored by many of the early wildcatters. There were those, however, who were not that casual about the potential of the area, for the first part of the Province that the majors moved into was the southeast. Imperial and, to a certain degree, Shell began extensive leasing programs of freehold lands in the southeast. The reason for this, as previously stated, was that the majors, especially Imperial, did not trust the socialist C.C.F. government of Tommy Douglas and would rather deal with individuals as opposed to governments. The wildcatters had flocked the Crown permit areas, seeing this strategy as a way of obtaining a large land position without too much administrative complexity and cost. The majors could easily handle several thousand individual freehold leases; a speculator, and the outsider that the speculator flipped to, could not. Some companies, notably California Standard Ltd., spent considerable energies within restricted areas. In the late 1940s, Calstan began an extensive program of freehold leasing, regional seismic, and surface mapping in southwest Manitoba. Also active in southwest Manitoba were various promoters, such as the previously named Oscar Kniseley.

One company that followed the majors' philosophy in southeast Saskatchewan and southwest Manitoba was Rio Bravo Oils Ltd., later to become Canadian Superior Oil Ltd. Rio Bravo was the exploration arm of the large Superior Oil Company of the United States. The young Jack Porter guided Rio Bravo's efforts in the Province and was among the first to recognize the potential of the Mississippian subcrop. Key to Rio's subsequent success in the southeast and in Manitoba was its participation in the early Souris Valley deep tests drilled by Souris Valley Oils Ltd. in 1949. These wells established that the thick sequence of Mississippian rocks found in the

14. Vern Hogg in interview, March 4, 1987.

15. J.R. McGehee, 1949, "Pre-Waterways Paleozoic Stratigraphy of Alberta Plains" in "Western Canada Sedimentary Basin," Rutherford Memorial Volume, Amer. Assoc. Petrol. Geol., 1954, p. 131-142.





The Williston Basin Nomenclature Committee of the American Society of Petroleum Geologists met in Bismarck on February 18. The group arrived at many decisions regarding the nomenclature of rock strata of various geological ages. The work of this committee will go before the national committee on nomenclature of the A.A.P.G. at the March meeting in Houston. Decisions will be announced in the *Petroleum Geologists Bulletin* soon after the national meeting.

Left to right, standing are: J. W. Porter, Canadian Superior of California, Regina; R. A. Bishop, Sohio Oil, Regina; Rod Tetrick, Socony-Vacuum, Pegasus

Division, Bismarck; C. A. Barkell, Shell Oil, Casper; Herb Hadley, Billings Geological Service, Billings; Mike S. Stanton, California Standard, Winnipeg; R. L. Milnor, Tide Water Associated Oil, Regina; seated: George Summers, Jr., Smith and Summers, Bismarck; A. V. Martini, California Company, Bismarck; Alex Clark, Chairman of the Coordinating Committee, President of the Rocky Mountain Section of the American Association of Petroleum Geologists, Williston Oil and Gas, Casper; Raen de Witt, Sohio, Regina; and A. J. Goodman, Socony-Vacuum, Pegasus Division, Calgary.

Fig. 11 Several of the premier Saskatchewan geologists were members of the Williston Basin Nomenclature Committee and were instrumental in defining the subsurface stratigraphy of the Canadian portion of the Williston Basin.

COURTESY OF THE SASKATCHEWAN GEOLOGICAL SOCIETY.

subsurface of the southernmost portions of the two Provinces pinched out due to erosion to the north. This suggested a large stratigraphic trap which may have trapped oil at the subcrop. The potential was recognized by the majors as well as by the government workers, such as Dr. Lillian Kerr of the Manitoba Department of Mines.<sup>16</sup> The second reason for the eventual success of Rio Bravo lay in the freehold leases. Rio Bravo began an extensive leasing program of freehold lands in a checkerboard pattern throughout the southeast Saskatchewan and southwest Manitoba. This early leasing was to provide Rio Bravo and Canadian Superior with a tremendous advantage when oil was discovered on offsetting leases owned by competitors.

In 1951, a substantial oil strike occurred. California Standard discovered 32° gravity oil at Daly, Manitoba in January of 1951. The California Standard Daly 15-18-10-27 WPM well was spudded on November 16, 1950, and was completed on January 19, 1951. Drillstem tests recovered rather poor oil shows in the Mississippian (the best test recovered 105' of flocculated mud, gas-cut with spots of brown oil, over the Mississippian Lodgepole Formation). Better shows in the wildcat areas of Saskatchewan were being ignored; however, Calstan ran pipe and completed the well. An openhole completion was attempted from 2200' to 2340', and some oil

was obtained. The well did not prove to be economical, yet Calstan did not give up, drilling Daly 10-18 in February 1951 and Daly Province 7-12 in an attempt to define the oil accumulation. These efforts by Calstan showed its fortitude and perseverance in the hunt for hydrocarbons in the Canadian portion of the Williston Basin.

The Daly discovery was actually earlier than the discovery of oil in the Amerada Beaverlodge well of North Dakota, though the Beaverlodge well was spudded earlier. The Amerada well established production from the Devonian and was ultimately to open up the tremendous production from the Nesson Anticline, a major structural feature found in northwest North Dakota. Shell was also successful in the Williston Basin, finding oil at Richey, Montana in July of 1951. It seemed at this time that the best production might be found in the southeast of Saskatchewan and the southwest of Manitoba primarily in the Mississippian and Devonian. Perhaps there was little correlation between the prolific hydrocarbon-bearing reefs of Alberta and those hunted in central Saskatchewan, but the explorers and wildcatters were not about to give up yet. Despite this fact, southeast Saskatchewan did not see the rush of wildcatting that occurred in central and southwest Saskatchewan until the discovery of Midale and other subcrop fields in 1953. Some explorers were successful, notably the TWAO

<sup>16</sup> Memos found in Petroleum Branch well files available for inspection at Manitoba Department of Energy and Mines, Winnipeg, Manitoba.



group at Wapella in October of 1952. The oil reservoir was found to be within the Lower Cretaceous "Wapella" or "Basal Quartz" sand with the structure well defined on seismic. This emphasis on the Cretaceous and Jurassic was not surprising, for in February of 1952 the Socony-Western Prairie group discovered oil at Fosterton in southwest Saskatchewan. Minds began to realize the Jurassic/Lower Cretaceous sequence to have the greatest immediate potential for oil production.

### SOUTHWEST SASKATCHEWAN

Early drilling had been conducted in the extreme southwest of the Province by Imperial, which drilled its Boundary No. 1 well at 4-8-1-27 W3M in 1916. This well was targeted to evaluate a large regional fault system that was mappable on the surface. Unfortunately, the structure was the result of thrusting induced by the Tertiary uplift and igneous activity in the Sweetgrass and Bearpaw Hills area to the south in Montana, and was to prove barren.<sup>17</sup> Marland Oil Ltd. had also conducted early exploration in the Eastend area in 1924 and 1925 but its wells were also dry. It is difficult to determine at this point in the story whether the early explorers had any indication of the subsurface Swift Current Platform and shelf; probably what guided exploration efforts were the large surface structures visible in the Tertiary and Upper Cretaceous sequences.

An interesting well was drilled by an early Saskatchewan oil pioneer at Fox Valley (Lsd 16-26-17-26 W3M) in 1946.<sup>18</sup> The well established the presence of gas reserves in what is now Saskatchewan's largest gas field, namely Hatton-Horsham. The driller of the well was a former securities salesman by the name of Tom Keyes, who picked up exploration permits guided by reconnaissance work conducted by a certain George Paul D'Aigneaux. D'Aigneaux claimed to be able to detect oil and gas at depth using certain black box methods of measuring radioactive emanations. Though dismissed as a "doddle-bugger" and "quack," D'Aigneaux outlined the Hatton-Horsham-Fox Valley and the Dollard areas as being prospective for oil and gas. Despite what one may think of his methods, the two areas were to prove to be major producing areas in the Province. Unfortunately, due to a series of financial setbacks and a dispute with the C.C.F. government, Keyes lost his permits and, along with them, the prospect of being the father of the modern petroleum industry in the Province.

The most active explorers in the southwest included the Socony-Western Prairie group, Woodley Petroleums, Albercan-Canadian Southern, Phillips (further to the north), and the TWAO group. Phillips was rewarded with some oil up near Eatonia; however, the premier big strike was made by Royalite and Canada Southern at Buffalo Coulee/Coleville in August of 1951. The pool produced oil and gas from the Viking and the "Banff" (the Mississippian Bakken) and was found by a combination of seismic and subsurface mapping. This was a new play concept as the main trapping mechanism was the presence of paleotopographic erosional remnants of Mississippian Lodgepole and Bakken surrounded by detrital and shaly sediments.

Buoyed by this success, exploration heated up and eventually led to the discovery of oil at Fosterton by the Socony-Western Prairie Group in December, 1951. Socony Western Prairie Fosterton No. 1 (Lsd 2-10-17-18 W3M) was the discovery well for the Fosterton pool. This oil strike led to an eruption of

exploration in the area. Some operators, such as the TWAO group, were extremely active throughout southwest Saskatchewan, so much so that Bob Milner was able to use only his TWAO wells when illustrating his pioneer work on the Jurassic stratigraphy of Saskatchewan.<sup>19</sup> These discoveries led to a concentration of interest upon the Cretaceous and the Jurassic in the southwest, possibly at the expense of the Mississippian in the southeast. Wapella, a Jurassic-Lower Cretaceous field in the southeast, also led to extensive Mesozoic tests in this portion of Saskatchewan, most notably in the area north of the main Mississippian producing trend.

The above is a brief, and by no means complete, history of the earliest days of the exploration boom in Saskatchewan. Perhaps we should now pause and ask the question: What were these explorers thinking and what did they find? Let us look as some of the conundrums uncovered by the early explorers.

### "BUCKET OF GUTS"

The problems and confusions facing the early explorers after their initial spate of exploration drilling can be summed up in the following categories:

- the nature and presence or absence of the Prairie Evaporite salt and the bizarre structures associated with its distribution;
- confusion in stratigraphic correlation;
- numerous and apparently discontinuous carbonate porosities;
- problems in seismic correlations and interpretation;
- basin configuration; and
- subsurface fluid flow.

I will examine two of the most pressing problems: salt solution and seismic exploration.

### THE PRAIRIE EVAPORITE AND SALT SOLUTION

As discussed previously, the early explorers believed that the deep salt section found by early Norcanols/Imperial wells was Silurian in age and could be roughly correlated with the Salina of the Michigan Basin. The fact that salt was found in some areas of the Province and not in others had led Imperial to believe that the salt was deposited in isolated pans or basins, not as a regionally extensive layer. The early drilling was to reveal a radically different interpretation.

I am about to enter into a controversial area of discussion: who first uncovered the concept of salt solution? To this day, battle lines are drawn between those who say Bob Milner of TWAO was the first, and those who claim it was Bob Bishop of Sohio. I am not about to make any judgement as to who was first, but rather will look at Bob Bishop's experiences with salt solution. Bishop was the first to publish his views concerning the theory of salt-collapse, most notably in his papers of 1953 and 1954<sup>20</sup>, though Bob Milner did present an abstract concerning salt collapse in the First Williston Basin Symposium published in 1956.<sup>21</sup> The following passages are based on Bishop's recollections concerning salt collapses.

19. R.L. Milner, and G.W. Blaklee, 1956, "Notes on the Jurassic of southwestern Saskatchewan." In "Jurassic and Carboniferous of Western Canada," John Andrew Allan Memorial Volume, Amer. Assoc. Petrol. Geol., 1958, p. 65-84. See especially cross-section D-E, p. 74.

20. R.A. Bishop, 1954, "Saskatchewan exploratory progress and problems." In "Western Canada Sedimentary Basin," Rutherford Memorial Volume, Amer. Assoc. Petrol. Geol., 1954, p. 475-485 (from private reprint). Paper originally presented at a meeting of the Saskatchewan Geological Society of October 8, 1952. Also R.A. Bishop, 1953, "Saskatchewan exploratory progress and problems," Alta. Soc. of Petrol. Geol. News Bull. v. 1, no. 8 (August), p. 3-6 (Digest by R.T.D. Wickenden and Leon Price). Also in "Canadian Oil and Gas Industries," July 1954, p. 37-42 (Digest by R.T.D. Wickenden and Leon Price).

21. R.L. Milner, 1956, "Effects of salt solution in Saskatchewan," (abstract), First Williston Basin Symposium, p. 111.

17. Jack Porter in interview, March 4, 1987.

18. Nordahl Flakstad, "Drilling Deep for Oil and Justice," Regina Leader-Post, Saturday, August 24, 1985, p. B2.



In October of 1952, Bob Bishop read a paper before the Saskatchewan Geological Society stating that some of the structures found in the subsurface of Saskatchewan may have been caused by the removal of the Prairie Evaporite salts. It was a bold paper to present, as the nature and extent of these salts was still very controversial; however, Bob was a confident fellow and thought it best to go with what he had. The paper was well received and remains the best summary of what was known about the Saskatchewan subsurface at that time. Sohio had drilled numerous wells on large sprawling structures and seismic closures, but all were dry. The Sohio team had nicknamed the structures they were mapping "Bucket of Guts" structures because these features seemed to wind and weave over a large area and displayed poorly defined lateral edges. These features also displayed a dendritic pattern as opposed to discrete closures. Bishop was not sure if they represented erosional relief structures or if they might not be reefs due to the absence of structure at deeper horizons.

What led to salt collapse as a mechanism for structural development? Bishop noted several interesting points. If a full section of salt was encountered, the contours of overlying formations described a gently dipping surface mirroring the Williston Basin. If the salt was absent, anomalously low areas were present. Never were anomalously high areas found in conjunction with the absence of salt. Also, gamma ray logs enabled the correlation of salt beds over wide areas, and mapping of these beds revealed some regions where the upper portion of the salt was missing. Salt flowage and normal faulting were considered; however, the evidence for this was absent, again due to the lack of anomalously high areas. Finally, the "Bucket of Guts" structures showing a dendritic pattern pointed to some form of paleodrainage, as opposed to deeper tectonic influences.

Mapping in the central portions of Saskatchewan revealed a widespread "zone of steep dips" coinciding with the postulated edge of the salt deposits. The theory that the structures represented paleotopography was also soon discounted when drilling revealed that there was no appreciable thinning of sediments overlying the structures; rather, drape was observed, suggesting that these structures were formed after the deposition of overlying beds.

Bishop had always been keenly interested in evaporites, and in 1949 attended a talk in Calgary given by Mr. Paul Weaver of Gulf Oil dealing with the formation of evaporite basins. He read all he could concerning evaporites, their precipitation, and flowage. A paper in the 1952 edition of "Geophysics" described the formation of sinkholes in Kansas due to the removal of underlying salts. If salt removal created shallow, recent holes, could not the solution of the deep salts have created the observed anomalies in Saskatchewan? There it was, the proverbial flash of lightning.

The real evidence that Bob Bishop was looking for was found while Sohio was drilling near Venn, Saskatchewan. In the words of Bob Bishop:

*Sohio was drilling with as many as five drilling rigs and eleven seismic crews, counting the double-shift crews, and we were busy!...C.B. Smith, geophysicist on loan to us from Sohio's Oklahoma City office, was attempting to supervise all the seismic crews, and he described what looked like an oval-shaped structure which was building at Venn. He then left to go visit the crews. A couple of hours later Harry Ross came in to my office and said "We have a rig ready to move. Where do you want it to go?" I said, "Well, we are still shooting at Venn, but a pretty fair structure is building on Line so-and-so. Let's drill there." Three days later, Smitty came back and I told him what I had done. He was quite upset and said "But that is just a hanging line. It is not tied to anything! We are not finished there!" I answered, "That's tough. We're rigging up right now!" Well, Smitty's concerns were justified; the Venn anomaly had a dent in it, and we drilled the well in the dent!<sup>22</sup>*

Sohio Venn No. 1, located at 15-16-29-14 W2M, was drilled in September and October of 1950. It came in low and, most importantly, lacked salt. The rig was moved to 4-28-29-24 W2M, and found the tops to be running high as well as encountering a full section of salt. This well was also dry. Sohio left bad enough alone and abandoned the prospect. In 1952, Consolidated Allenbee approached Sohio and wanted to drill a prospect, "any prospect".

The Venn structure had an untested lobe on the other side of the dent, and in June of 1952 a well was spudded on the untested lobe. Again, tops were high with a full salt section present. This prospect was key to Bishop's understanding of salt structures and is illustrated in his papers. Bishop's theory grew from the results of field observations from widely scattered exploratory wells and as such was not comprehensive enough to describe all the aspects of the phenomenon. Bishop was a firm believer of single (as opposed to multi-stage) salt collapse structures, and never tried to examine possible positive elements of the features.

Salt collapse made for an interesting talk, and Bishop won the A.S.P.G. Medal of Merit for the best paper presented during 1952. Not all, however, subscribed to his theory. He was to find out that salt collapse was an anathema to geologists in certain organizations, such as Socony, who were "practically forbidden by their management to even talk about such a wild theory". Imperial also felt that salt collapse was not viable, believing instead in depositional controls upon salt distribution.

Bob Milner was a believer in salt collapse. His abstract entitled "Effects of Salt Solution in Saskatchewan"<sup>23</sup> described his theory, which was similar to Bishop's except for Milner's recognition of multiple events and the flowage of subsurface waters. He also stated that the Prairie Evaporites are being removed at the present day, thereby giving the phenomenon a dynamic aspect.

Despite the controversy over the theory's first proponent, salt solution was poorly understood until the mid-1960s. It wasn't until the discovery of oil in the Upper Devonian Birdbear Formation trapped within a multi-stage structure caused by salt collapse at Hummingbird in 1966 that it became apparent salt collapse might form favourable traps for hydrocarbons. Previously, explorers were more concerned with the regional structural aspects of salt solution. One wonders whether all the old wildcats drilled on the obvious seismic features were drilled in the most prospective portion of the salt collapse structures, and whether or not viable plays may yet exist in these "barren" features.

## SEISMIC PROBLEMS

The early explorers conducted regional seismic shooting with a shot taken every mile or quarter-mile. Detailed correlation and grid shooting were conducted only over large structures defined by the reconnaissance shooting. This was simply a matter of expediency, for the huge scale of permits and the need to define them quickly and cheaply were paramount. An example of such a program is detailed in a memo dated October 6, 1954 submitted by TWAO to the Department of Energy and Mines. This memo concerns shooting near Dundurn that was conducted from 1950 to 1952 over 3 permits having a total area of 167,840 acres. Some 359 miles of continuous profiling was done on the Blocks. Computations were made "in the normal manner," meaning the use of up-hole times for near surface corrections and the referencing of data to a horizontal reference plane using a

22. Bob Bishop, written communication, 1987.

23. R.L. Milner, 1956.



correction velocity of 6000' per second. The corrected times were converted to depths using a time-depth chart. The velocities were relatively low (7000' to 8000'/sec) through the Cretaceous and considerably higher through the Paleozoic rocks. The chief reflecting horizons were the top of the Paleozoic and the top of the Lower Devonian. Unfortunately, in some areas, the only reliable reflector was the top of the Paleozoic, because lower reflectors were masked by "ground roll". These parameters were consistently used by other operators, and the generated seismic records are, at best, of only fair quality in terms of supporting valid interpretations.

Further problems in seismic acquisition and interpretation were revealed in the paper by Reasoner and Hunt published in 1952 on the Coleville-Buffalo Coulee oil pools.<sup>24</sup> A seismic survey conducted by the Independent Exploration Company revealed a structure which was drilled by Royalite and Canada Southern Oils Ltd. in 1951. Reasoner and Hunt stated that "direct seismic contouring, based on present methods of computation, cannot be used on horizons below the erosional surface because of velocity changes at the surface". Variations between the high-velocity buried hills and the lower velocity infilled valleys caused the lower reflectors to mirror the structure of the buried topography. Furthermore, they state:

*Many wells have been located throughout Saskatchewan on seismic "highs" which had been interpreted as Paleozoic structures and when drilled proved nothing more than the presence of buried limestone hills.*

Needless to say, seismic techniques and the knowledge of the stratigraphy of the subsurface were very poorly understood in the late 1940s and early 1950s. One can only guess at what was revealed in these early seismic programs, and no doubt many wildcat wells presented surprises. When the intricacies of salt removal tectonics and ensuing structural development are coupled with difficult detection methods, it is amazing that oil was found at all.

### FACING FORWARD BUT LOOKING BACK

A paper such as this cannot even begin to do justice to this fascinating story. Even after 35 years, all of those I talked to still became excited and animated when this first exploration is discussed. It was an exciting, intellectually challenging, and competitive period to be practising geology. The early geologists were truly frontier explorationists, excellent geologists (they had to be), and quite bold. Now to ask the final question: Can we, as practising geologists in Saskatchewan, learn anything from these early efforts?

I believe that we can. Perhaps the age of frontier geologists is not over. Presently in the Province of Saskatchewan, oil is produced from four primary areas: the Mississippian subcrop in southeast Saskatchewan, the Jurassic and Cretaceous of the Swift Current Platform in southwest Saskatchewan, the Viking/Bakken pools of west-central Saskatchewan, and the Cretaceous heavy oils of the Lloydminster area. Lying like a huge circular wasteland in the centre of the Province is a vast region that has been drilled by three distinct groups: the early wildcatters, potash exploration companies, and the Winnipegosis Pheasant and related "Keg River" programs of the mid- to late-1960s.

One can make the generality that in each of the four producing regions, the habitat of oil and natural gas is unique to that particular area. Each region has its own unique play concepts and reservoir characteristics, leading to the specialization of geologists working the Province. In the barren central portion of Saskatchewan, explorers have looked for

subcrop plays, Jurassic and Cretaceous shelf trends, Paleozoic reefs, and large tectonic structures; however, all these play concepts have met with failure. One could argue that either the area is geochemically immature and has thus never generated oils, or it has been flushed by meteoric waters moving from Montana in a northeasterly direction to the outcrop belt of eastern Saskatchewan and western Manitoba. Yet oil shows have been recorded in wells in this region, indicating that these precepts may not be entirely correct. Perhaps we are dealing with a different type of beast in this region.

The key concept which requires re-evaluation by present-day explorers is the theory of salt solution. In central Saskatchewan, as opposed to the southeast, southwest, or west, complex and multi-stage salt removal events have led to the creation of large structural trends in formations overlying the salt. Salt solution has been the primary geological process shaping the structural pattern and may have had a dynamic effect upon the deposition of the sediments themselves. The early explorers were able to map these various features with their imprecise tools, and drilled their wells to evaluate the highest portions of these features, not necessarily the best trapping configuration or potential reservoir. The early explorers were also unsure of the implications of multi-stage salt collapse structures, preferring to interpret the results of salt solution as single-stage structural creations. Considering the wealth of data presently available concerning oil production from salt solution structures and the availability of modern seismic methods, the re-evaluation of regional salt removal regimes may be interesting.

Regional fluid flow and flushing also may not be as difficult to assess as was previously thought, in that modern techniques of fluid geochemical analysis may be able to define separate flushing regimes or areas where the lower salinity may not be due to meteoric water infiltration. As witnessed in this paper, early formation-evaluation techniques were not what they are now, and many of the early tests must be considered suspect. Regional carrier porosities may allow the wholesale flushing of a particular zone, but one must ask the question whether indeed such regional carrier porosities exist.

The title of this paper states "New Oil from Old Ideas". Understanding our predecessors' ideas will greatly aid any re-evaluation of an area. As George Santayana stated: "Those who cannot remember the past are condemned to repeat it".<sup>25</sup>

### ACKNOWLEDGEMENTS

This paper could not have written without the assistance provided by C.A.L. (Vern) Hogg, Dave Francis, Don Stewart, Bob Bishop, Roger Edmunds, and Jack Porter, in the form of written notes and taped conversations. Others active in the early oilpatch also provided valuable insights but have not yet had their chance to speak on tape. Dr. Doug Paterson, Saskatchewan Energy and Mines, Regina, kindly allowed access to early Saskatchewan Geological Society records and files. My thanks also go to Bob Bishop of Lakewood, Colorado; Vern Hogg of Calgary, Alberta; and Imperial Oil Limited of Toronto, Ontario, for kindly providing the photographs. Molly Nichol is graciously thanked for her editing, typing of the final draft, and suggestions concerning the preparation of historical papers. Finally, I thank the Symposium Committee of the Fifth International Williston Basin Symposium for financial assistance towards the preparation of this paper, which represents part of an ongoing project to record and preserve the memories, experiences, ideas, and dreams of the early oil explorers in Saskatchewan who must be considered the true authors of this chronicle.

24. M.A. Reasoner and A.D. Hunt, 1956, "Structure of Coleville-Buffalo Coulee Area, Saskatchewan", in "Jurassic and Carboniferous of Western Canada," John Andrew Allan Memorial Volume, Amer. Assoc. Petrol. Geol., 1958, p.391-405.

25. George Santayana, *Reason in Common Sense*.