This issue of the Review is something of a birthday card to an oil discovery, mixed up with a paean of praise for petroleum generally. The reason we're doing this, and printing a few more pages than the 29 we usually run, is the discovery of the Ledoux oil field by Imperial Oil 20 years ago February 13. It was a big day for Imperial, a big day for the oil industry, and a big day for the whole country, and many happy returns are in order.

This year is also 1967, a big birthday year for everybody, and we want to keep in the spirit. To commemorate the anniversary coming up on July 1, the Review will print another special issue, celebrating the life and times that prepared us for Confederation a century ago.

Then, in the fall, the Review will do it again, with a special issue to celebrate the fact that the Review has been publishing for 50 years. That's a pretty good age for a magazine, but no record. Still, it's nice to be 50, like Frank Sinatra, and the federal franchise for women.

The issue will reflect some of the things that have happened to Imperial Oil in those years, to the Review, and to magazine publishing in general over half a century.

With such a spate of special issues, the Review will go off its usual bimonthly publishing schedule and become a quarterly for 1967. This means that it will not be necessary for a whole year to explain that bimonthly means every other month, not twice a month. That's a relief.

No oil company had ever done it before, and it is doubtful that any would ever do it again. Find an oil field? No: ask the public to come and see a wildcat well being brought into production.

It was February 13, 1947. The scene was an almost flat, snow-covered grain field 18 miles southwest of Edmonton, Alta. The temperature was 14 degrees above zero, there was a brisk, cold wind, several hundred visitors had been stamping their feet for hours and milling about in the snow. The principal actor was a 136-foot drilling derrick. Watches under the gloves showed it was shortly before four o'clock, but spectators were about to be linked to the Devonian period of 300 million years ago.
“How long do you need?” Walker Taylor, Imperial’s western Canadian production manager had asked the tool push, Vern Hunter. Hunter had been supervising the 24-hour-a-day drilling since the hole was ‘spud-ded at’ three months earlier.

“About three days,” Hunter had answered. “All right,” said Taylor, in his businesslike manner. “That means you’ll be ready at 8 a.m. on Thursday.” He notified George Lawrence, head of the company’s public relations department, and Lawrence started to issue invitations.

The two of them decided to give themselves a safety factor, and they announced it was hoped to bring the well into production about 1 p.m.

“We’ll,” Hunter recalls, “we didn’t make it at 8 a.m., and we didn’t make it at 1 p.m.—but we made it.”

Hunter could be forgiven for being late. “We weren’t used to bringing in oil,” he says. “As a matter of fact, Hunter had drilled so many holes without bringing in oil, he had acquired the nickname Dry-hole Hunter. And if the company’s luck hadn’t changed, it might have merited the nickname Dry-hole Imperial.

From 1919 until that historic day in 1947 Imperial Oil had spent about $23 million in exploration, sending geologists, seismograph crews and drillers over plain and tundra, from Manitoba to the Rockies. Not all of it had been in vain, but relatively little oil had ever been found since 1920 at Norman Wells, up near the Arctic Circle. And the need for Canadian oil was growing.

In 1946, of the 71 million barrels of crude oil refined in this country, 63 million had been imported. Canada produced eight million barrels in 1946 and 52 per cent of that came from Turner Valley, 30 miles south of Calgary. And Turner Valley, which had been brought in away back in 1913, had seen its war-induced peak production in 1942—about 10 million barrels—fall to 6.4 million a year in 1946: an annual decrease in production of rate of 10.6 per cent. Moreover demand was rising at a rate of nearly seven per cent.

Henry H. Hewstoton, president of Imperial Oil in 1946, said that spring: “Turner Valley is not exhausted but production for the whole area is down. I don’t think there will be any oil shipped out of Alberta after the end of this year.” In those days, demand had so far outstripped supply that Imperial had considered a decrease possibility: making gasoline from natural gas.

But, before committing the company to a gas synthesis operation, Hewston deferred to make sure that no possible field had been overlooked. He called together a group of 18 senior advisors whose assignment was simply to answer this question: Was there any ‘oil play’ that should be investigated before Imperial set out upon a road which was, in a sense, almost an admission of defeat? The group met in Toronto and, during several exhaustive sessions, reviewed all of Western Canada, from the U.S. border to the Arctic and from Hudson Bay to Vancouver Island. And they decided there was a possibility which should be investigated. They recommended a further program of drilling, concentrated on a suspected geological structure called the ‘Hinge Belt’ which appeared to run northwest-southeast through the Edmonton area.

Further research and meetings, involving Imperial’s top management—and many below the top—led to a decision to narrow exploration to the Edmonton area, and mineral rights to two million acres of land were acquired from the Alberta government. Seismograph crews moved in and began taking the soundings. Their surveys showed a possible place to start drilling was on the 160-acre farm of Mike Turto, 11 miles from the little town of Leduc (pronounced le-dook) which boasted a population of 982. There the seismic surveys had disclosed a structure which might contain a pool of oil and gas.

Oilers were a phenomenon in Leduc. “Most of us wouldn’t have known an oil well if it came out and bit us,” says Mayor Fred John, who was editor of the town’s weekly, the Leduc Representative, in 1946.

When Vern Hunter moved into Leduc in November, 1946, with his four drillers and 28 roughnecks—the term used by oilmen for members of drilling crews—there was neither accommodation nor much tolerance for them. The seismic crews had already been in and out with their trailers and families, and the townpeople had come to regard all oilmen as transients.

What’s more, Leduc was not prepared for an influx of visitors. Al Desnoyers, known as ‘Frenchy’, was one of the roughnecks. “Oil people got off the train and had to stay in the fire hall,” he recalls. He had previously worked on a hole at Provost, near the Saskatchewan border, and there he had built a portable two-room shack on skids for his wife and two boys. After some primitive living in Leduc, he had the shack brought in by train—eventually it was one of six such shacks and his wife, Rene, says she enjoyed living in it more than in the modern bungalow they now occupy in Edmonton.

“We had been wildcatting for about four years and we were just about ready to shut down,” says Desnoyers, recalling his work with Hunter. “We had drilled six or seven dry holes in Saskatchewan, then we came to Leduc.”

Dry-hole Hunter by that time had been with Imperial since the age of 16, starting as an office boy in Calgary. That was 1923, and he stayed in the office three years.

“I was becoming a bookkeeper,” says Hunter, “and I didn’t think I was cut out for one. As the old story has it, I learned which was the credit side and which was the debit side because I knew the credit side was next to the window. Then they changed the office around and I just couldn’t balance the books after that.”

The chance came to work on a rig west of High River, Hunter took it, even though he had to work his way up through truck driver and clerk before he was taken on as a roughneck. He became lead man in Turner Valley, working in what was called the ‘dumb corner’ of the district. “I was pretty dumb too,” he says. “Once the driller told me to go into the tool shed and get a new box—meaning a particular tool. I came back carrying a wooden box and the driller said, ‘Somewbat are you going to do with that—stand on it and pretend you’re a man?’”

Hunter was laid off during the depression and for six months he didn’t do a day’s work. “I had been buying Imperial Oil shares on a company plan, and I sold a couple of them a month at about $7 a share. He and his wife, Joan, lived in a shack in ‘Poverty Flats’ at Turner Valley and they managed. You could load up a car with food once a month for $15,” he said recently.

In 1935, he recalls, Imperial started up a couple of rigs. “Suddenly, I found myself a driller at $10 a day; from poverty to riches or so it seemed.” He was on his way to becoming tool push and finally regional drilling manager in Edmonton. He was also on his way to Leduc.

The Leduc No. 1 hole was started on November 20, 1946. Four drilling crews of seven men each worked round the clock on eight-hour shifts, the four crews making it possible for each man to work only one-day a week—it was not like 1935 when the crews worked seven days a week. But having four crews to work the three shifts was creating constantly changing hours for each man—the main reason the drilling crews and their wives found it difficult to socialise with townfolk who worked normal hours.

What were prospects for a strike during the three months of drilling the No. 1 hole? Another company completed a dry well at Wetaskiwin, 50 miles away. J. B. Webb, who was Imperial’s exploration manager in Calgary, puts it this way, ‘We were shooting in the dark, in new territory.’

Apart from the casual interest taken by local people in the strange-looking steel structure and the cluster of buildings, and the often boisterous groups of men who drove along the bumpy dirt road between drill site and Leduc in a company-provided shift truck, the general public knew nothing about what was going on until early February.

The city editor of the Edmonton Journal at the time was Don MacDougall, a newspaperman. Among his reporters were Bill Drexler, now managing editor of the Calgary Herald, and Don Manzius, now with Imperial’s public relations division in New York. Don was known as ‘Ming’ because he had spent some years in China.

As Manzius recalls it, the Edmonton’s legislative reporter, Tom Mansell, had a tip that

They came to see an oil well come in and saw history being made. This is the drill rig, on Leduc No. 1, that brought big oil to Canada on February 13, 1947.
There had been a showing of oil on a farm near Leduc, Alberta, and Dreyer was sent out by MacDougall on February 5, a Wednesday, to investigate.

"They said they were just sitting there," Meiners says, "so we found the site all right. We approached some of the farmers and asked, 'Do you find oil here?' They said yes, but they were not making any comment. We tried all around to get information, but no, not usually. We obviously had orders not to.

"Then we found Mike Turia, the farmer, and he had a gusher going. "Oh, ya," he said, "on Monday oil came shooting right up.""

There was a smell of oil in the air and some evidence of oil, so the crew hurried to Leduc where, as Dreyer remembers it, the crew were living in shacks on the old 13th Street.

"We went into the nearby hotel and found some of the drillers there off shift," Dreyer says, "We talked to them, very casually. We didn’t dare bring out a pen and pencil.

"But we didn’t really know what we were looking for. No one in Edmonton knew anything about oil.

They learned enough, however, to phone a story back to the Journal which made the front page headline: ‘Drillers Hit Oil Gusher In Vicinity of Leduc’ and announced dramatically:

‘Roaring from No. 1 Imperial Oil well near Leduc in a 90-foot gusher, an oil strike which links Edmonton for the first time with an oil producing area was made Monday.’ The story had the correct depth of the well—5,066 feet—and made a low-key prediction for what proved to be the most exciting event in Canadian oil history since Turner Valley.

‘Many farmers and others living in the Leduc district, although not sure of the details, were jubilant when they learned oil had been struck. It may mean great activity in the Leduc district, one of northern Alberta’s richest farming areas.’

It had already meant great activity. 'Leaseholds'—alert and fast-moving people who buy and sell mineral rights, sometimes at great profit—had already sniffed oil and had been moving about the countryside snapping up what they could.

The first leaseholds was a Leduc lawyer, R. H. C. Harris, who later became president of the Canadian Petroleum Association and is now manager of the Calgary Downtown Business Association. Harris had been in Leduc since before the depression, when he remembers seeking his office with barley bought for 15 cents a bushel.

Harris handled lease arrangements for one of the other oil companies. When news of Imperial’s strike leaked out he asked the other company to pay him $10,000 to buy the lease. The company paid him $300 and he started a company of his own to buy other leases.

"The oil was there, but no one knew about it," Lawson says.

Dreyer says that a stockbroker in Edmonton told him some time after the excitement that "we had told him what we knew, he could make us rich."

The day after the Journal broke the story, there was a carnival-like announcement which verified the strike but warned of possible fumes. Reports of a fire and injuries were called 'encouraging oil and gas showings.' In Calgary there was no further information to be had, other than denial of a rumor that the well had blown out of control.

The rumor of a gusher was the result of a drill stem test, the 21st conducted on the well which samples the contents of the rocks penetrated by the drill. The well’s log indicated that it was taken at the depth of 5,066 feet and produced light crude under a pressure of 700 pounds per square inch—enough to cause a plume of oil that an inquisitive person might call a gusher. It came in so fast that Franchise Denoysers, who was ‘on tour’ (pronounced tower, and meaning ‘on shift’) and got so drenched by the oil and mud that he had to buy a whole new set of clothes.

The following day, February 4, the 22nd and last test was run—this time the pressure was 600 pounds from a depth of 5,066 feet, and no further drilling was done. By this time Imperial—and probably a few leaseholds knew they had a good well. It was so good that the company moved in another rig to the No. 2 location one and a half miles away and drilled to drill before No. 1 was completed.

Rigging up for Leduc No. 2 started on January 29, and actual drilling started February 12—the day before No. 1 was brought into production.

The men on the site of No. 1 were tense on the 12th, not only because it seemed to be an important well, but because there were to be bidders of visitors the following day.

By about 4 a.m. next morning Hunter was roused by a phone call. Something had gone wrong. He rushed out to the site and found that the shaft on the swabbing drum had broken, with about 1,000 feet of line down the hole. When Walker Taylor arrived about 8 a.m. they were still trying to free the drum.

It was after lunch before they could begin swabbing the water out of the tubing.

The next day sent to Edmonton to relay the big news. The press, officials from various levels of government and some leading business men were taken to the Macmillan Hotel for a briefing. About 11 a.m. a busload and a few passengers cars started out.

The party got further and around several hundred spectators, apart from the invited guests, began arriving during the morning.

The road to the well was charged with snow, allowing only one line of cars. This was a hopelessly traffic jam on the middle of the countryside: an off-duty drunk in a Ford, Pin Lincham, and his wife Carrie, walked the last mile and a half.

Photographers began to assemble groups for their pictures. Driller George Tosh posed with a huge drill bit over his shoulder. The mayor of Edmonton, H. D. Ainsley, posed with a couple of bottles of champagne because of the danger of fire. There was a carnival spirit and a hot-dog stand could have been installed.

"Walker Taylor was nervous," Hunter recalls. "The visitors were in his hair and the drills were too. He came to me and said ‘Quit worrying. I’ll stall them away with oil.’ And he never came back to ask the drills to make it up to him. Although he was worried that we wouldn’t bring it in that day, he was too.

"He was operations manager of Imperial’s producing department and in now a vice president, had heard about the final drill stem test while far north in the muskeg at another drilling site. He hurried down and was there for the big day.

"We were afraid it wouldn’t turn out to be as good as it looked at first," he says. "No matter what the indications, you’re never sure. And even if we did get it in production, there was the real possibility we would not be able to do it that day. Sometimes in Turner Valley it took several days to get a well in. So we were taking a calculated gamble—and making a prior announcement could be the kiss of death."

"Sure, it looked good," says Maurice Paulson, who was Imperial’s field engineer then. "But I was concerned because I had worked in the Taber area where water could come in with the oil."

At one point the crowd increased to about 500 people. Since most of them had not had lunch, Walker Taylor sent to town for refreshments and the Journal noted the next day, "Fish, sandwiches, pickles, cake and doughnuts were served by Mrs. Pauline McLean of the Cottage Tea Room, Edmonton."

By about 2 p.m. the drum was ready and swabbing began. The swab is a kind of valve which operates like the plunger on a water pump. It is lowered down the production tube about 500 feet at a time, then as it is drawn back up, it flashes out and pulls the water up the tubing in about 30 minutes to make four swabs. Many of the audience began to leave—and no doubt regretted it later. After the fourth swab, which was pulled from the 3,000-foot level at 3:55 p.m., the violence of nature took over.

Captain Goyens, a Calgary oilman, shouted, "Here she comes! She’s it!" As the wellhead began to spurt, the flow was switched into the gusher and gurgling and spouting, and the spectators nervously edged farther away. But the best was yet to come.

A valve was turned and the flow was switched to a flare pipe about 200 yards away. A roughneck, Johnny Funk, lit some all-night smoking tad with the ends of the pipe, in the direction of the town. "Funk ran a long rope, swung it around his head a few times and aimed it at the pit. There was a roar of fire and the flames leaped 100 feet high, burning off the first flow of oil mixed with gas, water and contaminating mud. Dense black smoke spiralled far into the sky. Some of the crowd applauded as if they had just witnessed a feat of magic, but the sound of their clapping was lost in the roar of the flare.

The flow continued for 12 minutes, surging in 'heads', then it died down as uncleared water dished it off. The spectators began to leave. Then the pressure built up again and kicked itself off about 5 p.m., died in 10 minutes, started up again 15 minutes later then proceeded to flow steadily. Each time there was a burst of flaming gas a smoke ring wouldfloat aloft, widening as it went.

"A good omen," said one of the old oilmen. Cameras clicked, Fin Lincham took pictures of 20 rings.

At 6:10 p.m., looking as if he was taking part in a momentous historical event—as indeed he was—Hon. N. E. Tannen, Alberta minister of lands and mines, turned a wheel to swich the now steady, water-free flow into a storage tank. Imperial Leduc No. 1 was on production.

It was even better than Imperial officials had hoped. Consider the No. 1 well uncover a greater store of oil than at first suspected, in what is now the Devonian D-2 or Nisku reef, but the No. 2 well dippered at the same deeper reef, called D-3, which proved to be much more productive than the first. While the No. 1 new has to be pumped, No. 2, the many other wells drilled into the bountiful D-3 formation, still flows under its own pressure, 20 years later.

The show was over. Even experienced oilmen could not remember a better display. Russ Denoysers said, "We had never seen a flare before—it certainly made a lot of noise."

Imperial geologist Doug Laver was amazed at the well behaved so obediently for the much publicized event. Said Layer: "They don’t know how lucky they were."
Oh, it was a nasty mess. The mess was oil; oil blown by natural gas from the wildest well in Canadian history. The oil spouted 150 feet into the air. For 10 acres around the well enormous bubbles leaved up the greenish-black mud, and burst in splatters 50 feet high. The whole thing could explode into flames in a second.

And they handed it all to Tip Moroney and his organization. Which may seem strange, because the well that ran wild wasn't owned by Imperial Oil—for whose western producing department V. J. Moroney was operations manager. The Atlantic Oil Company owned that rogue well, Atlantic No. 3. They handed it to Moroney and a crew of specialists because Moroney and his men had experience in this kind of emergency.

Until that day in May, 1948, when Moroney was called in to somehow douse No. 3, Atlantic crews had thrown everything they could think of down the hole to choke the flow—and everything meant feathers, sawdust, mud and 10,000 bags of cement. Nothing helped.

Atlantic No. 3 was one of 61 wells that 39 oil companies drilled in 1948, a year after Imperial brought in Leduc No. 1, and it was just a mile northeast of Imperial's discovery well. Atlantic's drilling had gone smoothly for a month, but in late February the crew began to have a hard time controlling the pressure in the hole. It came in on March 8 with a whooshing spurt that wouldn't be tamed. Everything they pumped down the drilling pipe to plug the flow just disappeared. When they put a cap on the casing, the oil began coming out outside it, cracking and cratering the earth with the pressure of the gas that drove it. In such cases, dynamite exploded deep in the hole sometimes stuck it off. But dynamite could not be used this time; the drill pipe they would force is down had become plugged with shale.

The oil and natural gas that bubbled to the surface around the well created hundreds of gurgling craters that by early May were overflowing with up to 15,000 barrels of oil a day. The volume of natural gas was so great—as much as 100 million cubic feet a day—that the danger of explosion and fire was constant; the Alberta government even ordered airplanes to stay away from the region.

Every oil company suspended production when No. 3 went wild. Before Moroney arrived, a connection had been screwed to the drill pipe and the oil that had been spurring into the air was piped to storage tanks. The oil that bubbled up through cracks and fissures in the ground ran through ditches to a 30,000-barrel storage pond. But the flow filled the tanks and ponds, and the market could absorb no more and still the oil bubbled up. To stop it, they collected it and pumped it back into the underground forma-

In mid-May the Alberta Petroleum and Natural Gas Conservation Board asked Imperial to loan them Tip Moroney.

Moroney, now senior operations advisor of Imperial's western producing region, was then operations manager with a reputation as an efficient organizer. He was a blunt, no-nonsense boss, and his reputation made him seem to be the best man to command the task force fighting the well.

The first thing he did was to suggest that the conservation board clear everybody—residents and curiosity-seekers alike—out of the four-mile area around No. 3 because of the danger of fire. The board was in agreement but said it had no law authorizing such action.

'Well, you just get busy and make a quick law,' Moroney replied 'because we're going to close it off.' When the board found it could close the area under some clause in the Forests Act, Moroney said: 'Okay, I don't care what act you use. Just close the gate.'

Moroney himself took personal charge of one stubborn case, John Rebus, the farmer who owned the lease. Atlantic had been drilling.

He and his family were peacefully sitting on the 60-acre powder keg, cooking and lighting matches as if their fields were covered with nothing more dangerous than rainwater. They had repeatedly refused to leave. Atlantic had
tried to get them out, the conservation board had tried, even a cabinet minister had tried.

'You're going, John, there's no doubt about it,' Moroney told the farmer the day he became boss. 'You can sit here and burn yourself up, fine; but I don't want you to burn anyone else up—which is what you're apt to do.' Across the road from the farm was a cookshack run by a drilling outfit. 'What about that cookshack?' the farmer demanded.

'You just keep your eye on that cookshack for another 10 minutes,' Moroney said. While the men watched, a truck with a winch line backed up, lifted the shack and hauled it away. The rest of the cump followed.

Dumbfounded, the farmer said faintly: 'Well, I'll go maybe on Wednesday. 'You're going now,' Moroney told him firmly. 'Right now. No more cooking in this house.' 'What, where are we going to eat?' John, I don't know where you're going to eat. But you're going to get out so I can get these fellows to work over here. We've got lots of things to do and we haven't got time to sit around here talking.' 'Well, okay,' the farmer said.

'Nobody ever talked to me like that before.' 'Everybody's been out here talking to you. And you're going to move.' 'You talk to me like a man. I like that. I'll move.' 'The farmer and his family were gone in half an hour.

Then Moroney, wearing a crumpled fedora and toting a sleeping bag in the back of his car, began the campaign to kill the well. He hoped to do it before the super-choked could ignite. Any accidental spark could turn it into a lake of fire.

The plan was to set up a rig 800 feet away from the wild well and drill a new hole down a slant to intersect No. 3 and strangle it at its source. This kind of drilling is called directional. Drilling such a well a mile deep from a surface distance hundreds of feet away to hit a target less than a foot wide whose location you can't be exactly sure of is extremely tricky business. Chances were doubled by deciding to drill two directional wells, so that if the first one missed, they wouldn't have to waste three and a half months drilling a second hole from scratch. And as it happened, the two-hole plan did save time. Just before the south hole reached the oil zone, Moroney's crew tried to set casing in so that the well wouldn't blow out. No. 3 had done, but the casing stuck at 3,700 feet, a good 1,600 feet above the oil zone. The hole had collapsed, and they lost it entirely.

'We had to re-drill all the hole from 3,700 to the final total depth. It was months before we got that done,' Moroney recalled later. 'In the meantime, we had gone ahead with the west directional hole and got it completed and cased.' And always, through the long summer of drilling, there was the constant threat of fire which could start at any moment.

By the end of August, the west well was just above Atlantic No. 3's cavern of oil. The crew had tested it to discover the rate they could pump water down into it. Moroney said. They began with 1,200 barrels of water an hour, later dropped it to 500. At the same time, 12 bulldozers ripped the flaming ruin of Atlantic No. 3 and fashioned an earth wall that contained the fire within 10 acres.

For a day the fire roared over the lease, sending up a plume of smoke bigger than any fire in Canada had ever belched before, and focussing the world's attention on the oil discovery that fed it. Reporters, magazine writers, broadcasters and hand-picked camera men came to cover the fire and through their reports the world made aware of Ledua, which had received little notice before.

For six months the well had spilled oil uncontrollably, but there had been no fire. It was almost a miracle that when the fire came, the drills were ready to fight it. The water they forced down the west hole soaked off the oil and gas with its pressure, and the fire died for lack of fuel. By the middle of the third day, 60 hours after the fire began, it was out.

'The water killed the well,' said Moroney. 'You could see it die just down the second well. Before we went home we knew that between that time and sometime next day it would be dead. It went out about two o'clock in the morning, then flashed and burned again for an hour maybe, then went out again about four o'clock, and it was dead.'

The fire was done, but not Moroney's job. It was necessary to plug the wild well's hole and seal it for good. 'We tried a lot of tricks. We tried all sorts of plugging materials, some as big as door-knobs—tons of it—and they just disappeared.'

What disappeared was an incredible collection of stuffings—20,000 ninety-pound sacks of cement, 16,000 sacks of sawdust and shavings, 2,000 eighty-pound sacks of gypsum, 1,000 sacks of concrete hills, 42 yards of shale, eight railroad cars of sandwood fibers, two cars of turkey feathers. None of it did any good—not the hard materials like the cement which they hoped would harden into concrete, nor the soft materials like the feathers, which they hoped would stick in the rock's pores.

'I figured there was a cavern down there—oh, maybe about 30 feet across, with a sort of steeple on it like a church. What I wanted to do was bridge the steeple without having to fill the church,' Moroney explained. They continued to pump water into the west hole to keep the oil and gas at bay while they worked on the south hole.

So the crew invented something they called a bazooka—a 30-foot tube of lightweight pipe five inches in diameter that could be fastened to the end of the drill pipe. 'Then we got some chicken wire and made rolls of it. We got wire six feet wide, cut off pieces about seven feet long, laid a burlap bag on top of each and rolled them up into tubes that would fit inside the bazooka, yet leave a hole down the middle for us to circulate mud through. We made a series of these things, fastened with wire at the centre and loosely tied at the outside, and shoved them into the bazooka.

'We'd be sure we had this thing down exactly where we wanted it and then drop down a plug so the pump pressure would push the whole works out. You'd have a series of the wire mesh falling like link sausage, falling and tumbling and unwrapping. We put about 200 feet of these rolls in—in about 1,400 feet of fencing—but finally we got it to make a bridge for us across the hole. We cemented it so it could stand a little pressure, and then a little more until finally we had a 3,600-pound squeeze pressure on the well. That did it. Atlantic No. 3 was killed for sure.'

That was November 15. Eight months' work. The rogue well was dead. It had produced 1,750,000 barrels of oil, and about a million barrels worth $3,000,000 had been recovered or returned to the underground oil formation. Before the fire was quenched it had burned about $50,000 worth of oil a day. Tip Moroney and his men had tidied up a nasty mess.
One day, about 70 million years ago, a giant sloth was wallowing through the swamps when he went down to his hubcap in a sticky black substance that wouldn’t let go. He died there, as did countless other prehistoric creatures—camels, saber-toothed tigers, mammoths, mastodons, birds—whose bones are still preserved in tar pits around the world. They died discovering oil.

If you’re a typical 20th century person you probably thought we—or at the very outside, our fathers and grandfathers—discovered everything. You thought petroleum history began in 1858 in southwestern Ontario when James Miller Williams brought in the much-disputed first commercial oil well in the world, and everything important happened since.

But long, long before that, men in togas and tiger skins were doing with oil most of the things we have done. Not doing them as well, maybe, but doing them, nevertheless. Ever hear of Septimus Severus, for instance? In the latter Roman Empire he invented the oil heater. He simply filled earthenware lamps with naphtha, got a splendid holocaust going and heated a thermus (a sort of steam bath) for 2,000 people.

Petroleum pricing? Well, about 3,600 years before the invention of Royal Commissions, King Hammurabi, mulling over a code of laws, ruled that to caulk a boat with asphalt should cost only two shekels of silver and all you Babylonian boat-coasters better not forget it.

Oil property rights? They’re as old as 1,000 A.D. when Arab lawyers decided the sultans owned all the gold, silver, copper and oil on their property.

Petroleum at war? It dates back to at least the first century A.D. when, says the Roman chronicler Pliny, the townsfolk of Samosata, Syria, chuckling gleefully through the smoke and flame, flung burning ‘dinous mud’ on Lucullus’ attacking soldiers, who promptly ‘fired and burned in their own armor’.

If the ancients could do all this, why didn’t they develop petroleum to the extent that modern man has done in the last hundred years? For two reasons: they actually knew less about the stuff than we do; and they thought about it in a different way—mystically, as if it somehow had an individual personality, rather than scientifically, which assumes it to be a separate manifestation of basic elements all obeying the same laws.

It’s the difference between the alchemist trying to transmute lead into gold, and the chemist using oil to make rubber. This is not to sneer at alchemy; today’s chemist will some day appear just as quaint when the accelerating accumulation of knowledge leaves today’s concepts of thought just as far behind.
The Zoroastrian, a fire-worshipping cult, grew up around the burning gas wells at Baku, in what is now Russia. In Japan a Buddhist named Kobo Daishi was noted for his miracles including one called ‘everlasting fire’. Presumably, what he did make was a passover over a gas well with a lighted torch and take bowls while the multitude cried ‘Ahhhh!’

A warehouse account of King Edward III of England revealed: ‘Delivered to the king in his chamber at Calais—a lb. of petroleum.’ What would a king want with eight pounds of oil? A 15th century German explains: ‘He who has fine garments, let him place oil in his bins. They drives away moths and grubs. ’

By the 1800s Prague had oil-filled street lamps, people in the ‘Calais-light’ popularizing petroleum as an after-dinner cordial and smooth-talking Indians were selling North America’s Seneca’s oil, a rugged medicine at $20 a quart. Then it was 1857 and James Miller Smith started the modern petroleum industry when he opened a small shop in Spring, Ont. Behind him, a year later, Colonel E. L. Drake brought in a well in Pennsylvania—and the world would forget the little Canadian fields as discoveries raced through Pennsylvania, New York, Ohio, West Virginia, Indiana, Illinois. One January day in 1901 a well blow in Spindletop, Texas, spouting oil and mud a hundred feet high. It settled down to 100,000 barrels a day. At year’s end the field had 138 producing wells, mainly gatherers, and Texas bragged it could produce more oil in one day than the rest of the world combined. The outrageous legends of Texas oilmen were born.

SCENE: A Texas court house. CAST: Court clerk and Texas oil millionaire.
TOM: I come to buy a driver’s licence for my son.
CLERK: How old is he?
TOM: Ten.
CLERK: Can’t give him one. T.O.M.: He’s too young to be able to drive it successfully. I just got him a Cadillac. CLERK: Ten-year-old boy shouldn’t own a Cadillac. T.O.M.: Ain’t he gonna be on the streets? He jess gonna drive around the house! in Canada the industry moved at a gentler pace developing too slowly to create such flamboyant myths in its early years. But when the patent medicine men reached full cry the claims they made for oil itself were as extravagant as any stories out of Texas. Now the hoo-ha-burry-hurry and hear about the Celebrated Black Oil of Mr. C. G. Briggis, Hamilton, Ontario West. It was advertised as the ‘greatest remedy of the age for all diseases of Horses and Cattle and for the outward appearance complaining complaints of the human system’. Mr. Briggis liked to begin his advertisement with a kind of word for the horse, which he considered ‘one of the noblest of the brute creation, its sagacity, docility, patience and industry seem to have been bestowed on him by his creator to make him at once the servant and the friend of Man’. Possibly, also, if this sagacious beast happened to have something like spavin, windgalls, callosities, sprains, bruises, sandsock, gassy, wormy, evil, feal, wounded, lameness, mangled, retracted feet, cracked hoofs, fists, ringsome, etc., etc., you’d want to give him Briggis’ Celebrated Black Oil. It was also good for humans with chills and chapped hands.

As the industry made such extravagant claims were heard less often. More and more oil fields spotted to life around the world, and as petroleum became a science, the oil search itself, still rather a gamble, became more and more a matter of business than man’s discovery, deep in history, that the black stuff from the swamps would panic and burn, and help him to survive another day?

But let’s get back to the swamp in the swamp. The sticky black stuff that filled him was crude oil seeping up through cracks in the earth’s crust or, sometimes, a kind of tar left over from the crude-oil vaporization. Through the ages it was variously known as pitch, bitumen, asphalt, tar, kerosene, gum, asphaltum, or pitch oil. And that black stuff. But whatever he called it, man seemed to go too bad to waste.

TIME: One million B.C. SCENE: Man and wild at dinner.
HE: Pass the goulash... So what kind of day did I have?
SHE: Mother off in the black pit.
HE: Yeah? You get her out?
SHE: Nah. She went right out of sight.
HE: Oh... Pass this marmalade.... Well, I sure hope it ain’t spilled on my plate. Tellas says that black stuff’s good for somebody’s table legs. Figure to fix the logjams and do a little flaxing.

In the beginning people used it mostly for waterproofing and bandaging. They stuck together the bricks in the Tower of Babel with sand-asphalt-asphalt mortar. They used it in building King Nebuchadnezzar’s palace in Babylon, and laying ceremonial reliefs. Lining conduits. Waterproofing cracks in the Sphynx and the Pyramids.

Without petroleum Noah mightn’t have made it through the first night of the Great Flood in the Yavapai’s natural gas. Biblical and other sources say he gave the ark the two coats of bitumen on the outside and one on the inside. Mene’s mother, the Book of Exodus, strewed his basket of bulrushes with pitch. Hundreds of years before Christ, the little oil stalkers, the Phoenicians, sailed the Mediterranean in asphalt-coated boats, trading oil collected near the Caspian Sea.

All this was pretty utilitarian. Then the Chinese, drilling for brine with a cable rod tool and natural gas, were producing brine asphalt and used it for cooking. Soon every Chinese artisan coveted his own ‘freesile’. The backward barbizon was here.

The Babylonians got into the spirit of things with bricks burned on asphalt asphaltum, to keep a daisy garden, especially one he owned in Babylon who allegedly drank bitumen ale, and the Assyrians made casings for jewelry by sticking pearls, precious stones and gold filigree together with asphalt. The Assyrians prided in a powerful way of luring a lawbreaker knew he’d done wrong, pouring a jug of asphalt oil over his head.

There were some who claimed petroleum was good for disinfecting bird cages, driving excrement out of horses, to prevent a new crop of eeriness and toasting haggis, to lay eggs (you rubbed them with a little oil, sulphur and salt). Pretty soon you had to do was shout out ‘a’ asphulg and the bees started laying, wild-eyed.

In ancient Egypt they were using bitumen on mummies, chariot axles, canals with manganese, bath tubs and tallow lamps. All the little-Coptoprians darkened their eyebrows with it, used it for smelling salts and occasionally lashed it in a dash. A little Egyptian girl of three days of oldlaying equivocally a night in a hobbit plant.

A couple of millennia later the same sort of thing was still going on, with more or less the same results: the girls who made up the Roman gyn, they were shaving their faces with petroleum jelly, which gave them a handsome sheen, but had an unfortunate tendency to explode in mid-air.

In today, cosmetics are still made with petroleum, but the problem of smell has been licked. But where oil really came on strong, next to on Egyptians, was as a canny. The Romans, wrote...

‘All kinds are useful for straightening out eyelashes which inconvenience the eyes. Rubbed with soda, it combs aching teeth. Taken in wine, it boths a common cough and relieves rheumatics of frets. It cleans diarrhea. It cleans bleeding. A portion of bitumen and vinegar dissolves and removes accumulations of blood clots and gives relief in cases of lambrage and rheumatics. For quartz flour, the prescription is a drop of an aorta, and a fine weight of a mint, triturated with an oil of myrrh.

Fourteen hundred years later another Italian fish of oil’s medical report wrote that ‘it relieves stomach pains such as colic and the affected region. It is good for eyeglass. It is good for parrots if rubbed in the tars of the neck and the affected region. It is good for frightened people if applied as above. It is good for baldy FACE."

Not to be outdone, a contemporary German claimed ‘He who is poisoned, let him take half an ounce of petroleum and drink it. He will also please those who have got blue bruises from falling, or that are broken or crushed limbs, should rub the oil on and it helps. Also anybody who has got blue bruises from falling, or that are broken or crushed limbs, should rub the oil on and it helps.

In the last century as Ontario petroleum main- tained for years with the world when he thought his misfortune, ‘It makes use of the Imperial Oil to her knees’. And so do you and I, in countless medicines, ointments, salves and potions for internal and external ailments, made items heavily-priced.

But petroleum could be used to kill as well as to cure, and it sometimes employed the techniques of frightening to death to achieve its ends. One of the earliest, according to a Persian legend, was devised by a Shah who ordered his subjects to hammer together a thousand metal horns with metal ridges, coated this clanking caw with honey and then lit it. Firing downstairs at some invading foreign troops, the noise frightened them into flight.

Other early armies sometimes gave their enemies a lasting burn with needles or blazing arrows primed with petroleum. But the big breakthrough came near 100 A.D. when chemists learnt to heat the crude, then trap and cool its vapors to produce a highly inflammable liquid. From then on, it was open season for pyromaniacs.

TIME: About 60 A.D. SCENE: A Greek chemist and wife at dinner.
SHE: So what’s you invent today, dear?
HE: Well, you know that new neeps and VA-VROOM!
SHE: I’m wondering what happened to your chamber.
HE: So after I got the fire out I mixed some more neeps with bitumen and quicklime and then mixed the water and the quicklime around... I’ve got a magnificent invention.
SHE: What will you name it?
HE: Well, I guess I’ll call it... oh... well, it’s really something.
SHE: Call it Greek Fire, dear.

Greek fire—bitter as it’d be launching, or served up as a mixture of bitumen, bitumen and sulphur and quicklime which caught fire when exposed to moisture—was an unqualified hit.

The Greeks put it in stone or iron boxes and invented the hand grenades. Sometimes they just clamped an enemy’s wall and dropped grenades into it again in 1721. In 741, 11 fire-spraying Greek revolved out Prince Ignat of Russia and were worth one thousand.

The Arabs, after getting properly smoothed a few times, adopted the practice with a Cardillac.

By 1298, everybody had it. There was even a sort of instruction manual which said, in effect: Watch out how you pour it into the oil can, stuff, oiler, or it’ll go off in your fist. A 14th century Arab military handbook describes a whole list of ‘ingenious tricks and misleading pots’. These ‘naflafti’ were fire resistant suits, probably of asbestos, that enabled a man to go into a furnace and come out safe.

The naflafti starred in military parades, like the one in Baghdad when soldiers played with glass balls filled with oil that they threw about them so that the steps was filled with fire.

When Europe switched to gunpowder, petroleum went back to more peaceful pur-

The introduction whole the exalted family of petro- chemics. Almost unresolutely, oil has be- come a part of our lives. We cannot be made live comfortably without it—but we take it wholly for granted.

What a pity that most of the wonder and mystery is gone. Yet who can say that the petroleum age is more mysterious than man’s discovery, deep in history, that the black stuff from the swamps would panic and burn, and help him to survive another day?
matter drifted to the sea floor where it was buried by sediment carried from rivers to the sea. Over the centuries, mud, silts and sands piled one on top of another, compressing the lower layers into rock. During this compression the plant and animal remains contained in the sediments were partially converted to oil by heat and pressure. As the compaction process went on oil and water were squeezed out of these shale-like rocks. Some of the oil escaped to the surface and was lost, while some—the oil we use today—was moved by the water to porous formations and trapped in place by overlying dense rocks.

The oil forming process probably started some three billion years ago with the beginning of life on earth. However, because the older strata of the earth’s crust have undergone such destructive rigors as extreme over-heating and heavy earthquakes they are unlikely sources of oil deposits. Almost all commercial oil pools are found in rocks younger than 600 million years. Some oil occurs in rocks only a few million years old.

Among the main reasons scientists think oil has an organic origin is the fact that both plants and animals contain two of the essential elements of oil—carbon and hydrogen. Then there is the discovery in many crude oils of porphyrins (formed from the red coloring matter of blood and the green coloring matter of plants), as well as other biochemical substances. Most petroleum contains nitrogen and oxygen is an essential component of the protein of all living matter.

Another clue that doesn’t point directly as an organic origin, but does detract from an inorganic theory, is that the carbon found in crude oil contains isotopes very different from those found in inorganic carbon. And tying in with the theory of compressed sediment is the fact that practically all oil is found in sedimentary rocks.

Dr. C. R. Evans, a research scientist with Imperial’s western producing department in Calgary, is satisfied that the evidence favoring organic origin overweighs any suggestions of inorganic formation of oil. "Additional research is needed to fill in the gaps in our understanding of the chemical transformations that occur between the living organism and the pooled oil, but there can be little doubt these changes occur," he believes.

While the organic theory is the one most widely accepted by geologists today, inorganic theories are still accepted by some people. Dr. Paul C. Marx of El Segundo, Cal., holds that oil is formed by an electrochemical process between graphite and iron sulfide deposits some seven to nine miles underground. He explains the presence of porphyrins in crude oils by saying that the as the oil percolates up through cracks and faults it picks up organic debris from sedimentary beds. Scientific publications from Russia call for a reassessment of accepted theories following the discovery of signs of oil in igneous rock such as granite and basalt formations. Granite is formed from molten material which flowed from the earth's interior and basalt is the result of the crystallization of molten lava. Since both these rocks were forced at high temperatures, where life could not have survived, the Russians say an inorganic theory must be sought.

Traces of oil in these rocks are usually explained by the fact that sedimentary rocks are found nearby, and oil could have migrated from one to the other. However some petroleum-like hydrocarbons may have been of igneous origin, says Dr. Evans. “Personally, I believe that non-biological processes can produce complex molecules of carbon, hydrogen, nitrogen, sulphur, and oxygen, and that conditions on the earth were once favorable for the formation of these pseudo-organic molecules. Relatively high concentrations of this material in the early seas were probably a prerequisite for the development of life on earth. "However, I suspect that biological processes have dominated the production of organic materials since the start of primitive life."

Geologists are now working to close the gaps in the organic theory by looking to the area where they believe it all started—the sea. It’s not the same sea and it doesn’t support the same creatures anymore, but it still makes sedimentary rocks just as those ancient oceans did. McGill University researchers are probing the sea around Barbados in the West Indies where the sediments are being compacted into rock today. With SCUBA gear and grapplers they study the various stages of compaction, look for traces of organisms trapped in the rock, and sample the clay composition and water chemistry.

Such investigation of the sea bed and the underlying zone of active compaction says Dr. Evans, is one of the most exciting developments in research on the origin of oil. ‘For the first time the interest, the technology and the samples are all available.’

Oddly enough the National Aeronautics and Space Administration in the United States is helping too. The administration is collecting meteorites, scrutinizing their chemical contents and comparing them to sediments and oils. This work is aimed at seeking evidence of life on other planets. To do this chemically, NASA must first determine the compounds in oils and sediments which can be traced directly to living organisms.

Why does anyone want to know so eagerly? Elementary: it will help find more oil.
Prairie life
350 million years ago
Much of Alberta's oil and gas is found in a chain of reefs far below the prairie stretching from Calgary to Edmonton. The reefs were formed about 350 million years ago during the Devonian period when warm, shallow seas covered the flat interior of North America.

Today the driller's bit churns as deep as 13,000 feet through ancient sediments to tap the oil and gas trapped in these porous reef formations. As far as men know, this petroleum was formed from the remains of ancient plants and sea animals. The reefs and other fossil formations enable paleontologists to reconstruct the type of life that existed in central Alberta in the Devonian period.

Illustrated above are some of the creatures that scientists tell us lived at that time.

The biggest fish shown, the blue green arthrodir, was a real whopper. Fossilized remains indicate it was 25 to 30 feet long. Its head was covered with thick bony armor. The head shield was hinged to plates on the shoulders allowing the fish to lift the upper jaw as the lower jaw gaped open for an enormous bite. Instead of teeth it had heavy, shearing jaw plates.

The two streamlined fish ahead of the arthrodir and the one under its tail are speedy cladoselachians—primitive sharks with cartilage skeletons and no bony armor.

The blue fish at the far right with four stubby lobe fins and the one-sided tail is a Diputerus. It was equipped with a modern-type jointed spine, both gills and lungs, and leg-like fins which it used to crawl along the bottom. It is linked to the present day lung-fish which are capable of surviving out of water. It was from ancient fish like Diputerus that the first amphibians evolved, which in turn are believed to be the ancestors of all our four-legged air-breathing animals, and eventually man. One group of Diputerus relatives, the codoceans, evolved only slightly—living examples of this primitive fish have been caught recently off the coast of South Africa.

The one that looks like a crab is a swimming malacostracan crab related to the lobsters and crabs we eat today. The two bug-like couples near it are trilobites; only two of the many varieties are shown. By the Devonian period, trilobites had already been around for some 250 million years. During their heyday in the Cambrian period, they were among the world's most advanced and plentiful creatures. They probably evolved from worms and some grew as large as door mats. They could swim, crawl and roll up in a ball.

To the right of the crab is a little cluster of lump shells which proliferated in thousands of varieties. A great variety of oddly-shaped shells were formed by cephalopods—animals with head and feet all at one end like squid.
That carrot-shaped thing with eyes is a cephalopod, as is its companion with the prickly curved shell. The tightly coiled giant ammonoid near the trilobite is also a cephalopod, and had a shell up to seven feet in diameter. Surrounding it are orange-brown glass sponges and thin-stemmed crinoids or 'sea lilies'. Those lilies weren't really plants, but animals related to starfish which built jointed stalks, body plates and armslets out of lime. Most modern sponges are soft-bodied creatures, but some fossil sponges stiffened themselves with stony or glassy material, as the Devonian glass sponges did.

That creature with the spiky legs near the crest of the picture is a eurypterid, a joint-legged scorpion with a crusty shell, like a shrimp or lobster. Some of its relatives grew to a nightmarish six or seven feet and could swim as well as crawl. Some of their legs developed into paddles, others into spines, walking legs and claws.

On the left, topped by the waving orange crinoids, is a clump of various ancient corals, sponges and two big pink sea anemones. The clusters of colored daisy-like growths are soft animals, which actually built the reefs, waving their tentacles much like anemones. The thing that looks like deer antlers is a colony of Bryozoans, tiny colonial creatures much smaller than coral polyps. Bryozoans are still plentiful today.

Fish that developed lungs and rudimentary legs were ancestors of the grey-green Ichthyostega above the water. It was several feet long, had scales and sharp teeth, fins on its tail, and crept along the mud with a wriggling motion to spare its rudimentary legs and tender, stubby toes. Some late Devonian amphibians were up to 15 feet long. These early ancestors of land animals shared their new kingdom with insects (some of which developed quadruple wings two feet wide, like the giant dragon fly); scorpions, snails, and swamp-loving plants.

The first land plants became firmly established during the Devonian period and evolved into five main groups: spore ferns; seed ferns; giant jointed ancestors of the modern horse-tail reed; tall scale-bark trees from which the pine has descended; and early versions of modern conifers, with long needle-like leaves and naked seeds.
For helping in the preparation of this artist's conception of life in the Devonian period, Imperial Oil Review thanks the Royal Ontario Museum. Valuable reference material and consultation was provided by the museum's Dr. A. G. Edmund, curator of the department of vertebrate paleontology, and Dr. R. R. H. Lemon, associate curator in charge of vertebrate paleontology.
How much is there?

by Richard Dolman

The trouble with thinking about petroleum reserves is that you can’t avoid a plague of statistics. The figures are big, mean and numerosous, like a swarm of muskeg mosquitoes. And they’re not very accurate. They hover and bumble all over the target. It’s the same in oil drilling: you never know where, when or what the drills are going to strike next.

Once the drillers find oil, they can soon tell whether it’s big oil or little oil. But to measure an oil deposit exactly is as hard as tracing a outline around a puddle of quicksilver with your eyes shut. You can’t see it, there’s no way to get a grip on it, and it won’t keep still.

All the same, oilmen are willing to stick their necks out and claim that petroleum is the second most plentiful liquid in the world, after water. World oilmen say—and government statisticians agree—that there are now about 375 billion barrels of proven recoverable reserves in the ground, in deposits that have been thoroughly examined. It’s also generally agreed that the world has already consumed about 180 billion barrels, mostly as a source of heat and power in the past 100 years. Add it all up and you get 555 billion barrels.

But that’s not all there ever was. Oilmen suspect a much larger amount still lies waiting for future generations. Many billions of barrels of conventional oil are still to be found and measured in land and offshore deposits; plus hundreds of billions of barrels of heavy oil, tar sands and shale oils.

If the world’s grand total was 1,000,000,000,000 (one trillion) barrels it would be an enormous amount. For one trillion barrels of water to flow over the Horseshoe Falls at Niagara takes about three years. Even so, how long will such a supply last? Nobody knows. The answer depends on unpredictable changes in demand, supply, and economic conditions.

On the demand side, it’s a safe guess that the world will consume around 12 billion barrels this year (that much would take two full weeks to cascade over the Horseshoe Falls). This massive world appetite for petroleum has climbed on the average by nearly three quarters of a billion barrels annually in the past four years. Although the recent growth rate of about eight per cent per year will slow down to about six per cent over the next few years, the number of barrels added to world demand every year could rise to one billion by about 1980. Beyond that point, no one can be sure, because the nature of the demand is constantly changing. Petroleum products, plastics, building products, synthetic foods, agriculture, even weather control may create new demands for oil, while atomic energy, fuel cells and other technological innovations may reduce the amount burned for heat and power.

But demand could double tomorrow without beginning to deplete world oil reserves. The discovery and development of additional reserves, although it fluctuates sharply from year to year, has been raising the world’s net remaining oil supply in the past four years by an average of more than 30 billion barrels a year—two and a half times current world consumption. Some oil experts believe that the development of new reserves will continue to exceed the rate of consumption beyond the end of this century.

Meanwhile, why does anybody continue to spend millions on exploration when oil is stockpiling at such a rate? Well, from a business point of view, an oil company can’t rest assured that it will even be in existence in the future unless it has adequate reserves. And because the facilities for transporting and refining oil are so expensive, large supplies are necessary to ensure that the investment in pipelines and refineries will be worthwhile. Why not let somebody else find it? Because a company that runs refineries operates more profitably when it can refine its own crude.

Another reason lies in the simple fact that if company A doesn’t go out and find the oil, company B will. For a nation like Canada, oil is a great way to earn foreign exchange. And finally, having your own oil is essential for national defence.

How is Canada’s own progress in developing reserves of this vital and versatile raw material? Lately, it’s been excellent. Since 1944, when total reserves were only 72 million barrels, proven remaining reserves of liquid hydrocarbons have multiplied a hundred times and were increasing at a rate that would bring them above 8 billion barrels by the end of 1966. Average production from Canadian oil fields climbed in the same period from about 26,000 barrels daily to over 1 million barrels daily. National consumption climbed from 266,000 barrels daily to some 2.1 million.

What appears to be Canada’s biggest oil system yet discovered is being developed in northwestern Alberta in the area that started with the discovery at Redwater Lake two years ago. In addition, Canada will soon begin to tap one of the world’s largest single sources of petroleum, an area of 21,000 square miles in Alberta known as the Athabasca tar sands. This deposit contains an estimated 300 billion barrels of recoverable heavy oil, only 75 billion barrels less than the world’s proven recoverable reserves of conventional oil. It appears to be the only major deposit outside of conventional oil reserves which is presently within economic reach. A plant will begin extracting tar sands oil in September, 1967, at a rate controlled by the Alberta government to avoid disrupting the production of Alberta’s conventional oil. Other tar sands production plants have been planned and are awaiting permits to operate.

Whatever happens elsewhere, it’s clear that Canada has plenty of oil. Federal minister of energy, mines and resources Jean-Luc Pèpin says that Canada’s ultimate reserves, including the oil contained in the tar sands, are sufficient to last for generations come.
Imperial makes eight brands of solvents for such uses as thinning paint, dry cleaning and carrying insecticides; and two liquefied petroleum gases—one for use as a fuel, and the other to be made into petrochemicals.

Ever hear of Imperial Pole Treating Oil? It’s one of the non-lubricating oils made by Imperial, and it’s used as a carrier for the wood preservative pentachlorophenol. Other non-lubricating oils reduce coal dust loss, inhibit rust, plasticize and extend rubber, temper steel, and make it easy for builders to pry the forms off after concrete has set in them.

Imperial makes eight special products for trains, ranging from a coating for impingement type filters in air conditioning systems to a hot-box lubricant. For ships, the company makes several marine products besides Zero-Mar, including a special grease for filling sea cocks.

Imperial’s industrial oils—they are used for lubricating—range all the way from a cheap once-through lubricant that is discarded like a used Kleenex to turbine oils that have been in continuous service for 30 years. There is an oil that’s sprayed on wool to make it slip easily through the machines that turn it into cloth, then washed out when the weaving is done. There are also five cutting oils; five specialty oils (one of them used to make printing ink and another to free setted bolts); five specialty greases (one for impregnating the hemp cores inside steel ropes to keep them lubricated and free of rust); and five petrolatums used in salves and other medicines.

Greases are a numerous item quite apart from their automotive and specialty uses. Imperial makes 13 different kinds of industrial greases, and every one except Gear Cover (for open gear dressings) has an exotic name. The most masculine-sounding of the names is Ronel EP, a steel mill grease; the most alluring is Lotemp Molly, a multipurpose grease for winter use. Most misleading name is DDR Grease. Hiding behind those pithy initials is a diamond drill rod lubricant.

And then there are waxes, for candles, polishes, home preserves, waxed paper and cartons, canvas coating, waterproofing for building boards, matches, tarpaulin coating, butter boxes, fish boxes, frozen food wrap, and for dipping rose bushes in so they won’t dry out until you can plant them in the garden.

For the road Imperial makes eight different paving asphalts, and one of them comes in seven different grades. The company also makes six industrial asphalts for such uses as parquet flooring adhesive, masonry foundation waterproofing, the manufacture of shingles, siding and built-up roofs, and for taking coal dust and sticking it together in briquettes. It makes two grades of coke out of petroleum, too, for use in electro-

metallurgical processes.

And Imperial makes petrochemicals that end up in everything from fertilizers to fake fur. If you like tongue-twisters, here they are: acrylonitrile, aliphatic solvents, benzene, biodegradable linear alkyl benzene, butadiene, butylene, carbon black feedstock, ethylene, mercaptans, naphtha, petroleum additives, polyvinyl chloride resins, propylene, sulphur, synthetic heavy alkylate, tarsene and xylenes. Later this spring the company will add heptene and methanol.

The first products Imperial made back in 1880 were kerosene and axle grease. Imperial still makes them.
The thing you have to get used to about natural gas is the cold. The standard of measurement is in the mcf, and it equals a thousand cubic feet, or about the amount of space taken up by your average bedroom. In 1965 Canada produced somewhere between 1,324 and 1,444 million mcf’s of the stuff, depending on whose figure you look up, or about enough to cover Metropolitan Toronto’s 3,394 square miles under a blanket of it 216 feet thick.

What did we do with it all? Well, we used up about half of it heating homes, running factories and making chemicals; sold a little more than a quarter of it to the United States (for a total of $400 million since 1968); and the remaining fifth we stored or re-injected into the wells that produced it. Production in 1965 alone was valued at better than $1 billion.

So gas is big. It’s also beautiful. The known reserves of natural gas in Canada amounted to 44.4 trillion cubic feet in 1965. A trillion is a one followed by 12 zeros: 1,000,000,000,000. Canada’s 44,400,000,000,000 cubic feet of gas reserves are enough to keep us going at the 1965 rate of production until 2002 A.D.

But it’s not all that we’re dealing with. Natural gas is made up of many different components—methane, ethane, propane and butane. These are the basic ingredients of natural gas, each with its own properties and uses. For example, methane (CH₄) is the main component of natural gas and is a highly flammable gas. It is used as a fuel for cooking and heating, and in the production of fertilizer. Ethane (C₂H₆) is also a component of natural gas and is used as a feedstock for the production of ethylene, a chemical used in the production of plastics and other materials.

Not only is natural gas variable as it comes from the well; chemists can change its structure to make almost anything under the sun—chemicals, plastic, rubber, synthetic rubber, etc. It is a versatile resource that can be used in a variety of ways, from providing heat and light to powering vehicles and generating electricity.

The gas fuel cell, which is still in the laboratory and early development stages, may allow homeowners and drivers to generate their own electricity. Fuel cells have no moving parts. They use a catalyst to initiate a chemical reaction which makes electricity out of oxygen taken from the air, and methane derived from natural gas. The heat generated by the reaction is used to power the generator.

Natural gas is a highly prized commodity today. Production was worth nearly $200 million in 1965. But though natural gas is still valuable, it is not as valuable as it once was. The price of natural gas has dropped significantly since the 1960s, making it less attractive for industrial and residential use.

In the early days, when natural gas was newly discovered, it was not as valuable as it is today. It was used primarily for heating, cooking, and lighting. As the use of natural gas expanded, new uses for it were discovered, such as in the production of fertilizers, plastics, and synthetic rubber. Today, natural gas is used in a wide variety of applications, from heating homes and businesses to generating electricity and providing fuel for vehicles.
Well it’s not easy.

Suppose a man decides it might be a good idea to go looking for oil. He really ought to consider what he’s up against. Then he could go and find a simpler problem, like breaking the bank at Monte Carlo or winning the four-minute mile. All you have to succeed there is luck and speed. To find oil you need the speed of a roller and the luck of the Irish, but you also need the stamina of a woodsman, the patience of a neurologist, the cool of an explorer, the knowledge of a geologist, the skill of a computer, the knack of an engineer, the forethought of a corporation lawyer and the resources of a financier.

The prospector oil hunter should know that what he’s looking for is a substance between 10 million and 400 million years old. In western Canada, where most of the country’s oil is coming from these days, it’s found between 5,500 and 13,000 feet below the surface of the earth. He should also know that, despite 110 years of searching for oil under the crust of this continent, there is no sure way of telling if oil is present, short of going down with a drill and finding out. More often than not the drill finds out there is no oil down there.

The search for oil today involves hundreds of people, millions of dollars, science, experience, eternal optimism, imagination and—lives there an oilman who can deny it?—luck.

In its very, very simplest form, here’s how an oil hunt goes. Geologists seek out certain characteristics on the surface of the earth—hills, ridges, outcrops of rock. Geologists search the surface for certain types of rock that might suggest an oil formation—porous rocks, rocks preserving traces of ancient sea life, and the structural form of the exposed rock layers. Then geophysicists probe below the surface with shock waves searching for deuces inequalities in the stress which might hold oil. When the oilmen think they’ve found a geological feature of the type they’re looking for in an area where there might be oil, they drill.

The feature may be horrid, or it might exist only the remains of what was once an oil pool. The drill can find that what the geologists thought was an oil pool contains only salt water. The drill can find oil sealed so tightly in unconnected pores in a rock formation that it cannot be recovered...and only must a reservoir rock be porous; the pores must also be open in each other to let the oil flow out. It can find a lot of oil spread so thinly over an area so wide that it is uneconomical to recover. And, of course, it can find a pool like Leduc and make Canadian history.

The first step in an oil hunt is deciding where to start looking, and that’s a decision that has been based on a lot of assumptions at different times. In the early 1950’s the theory developed that there’s a better chance of finding oil near a graveyzed than there is near a swamp. That bit of lore happens to be true. Graveyards are usually on high ground while swamps are down by the water’s edge; and a hill, being evidence of a wrinkle in the earth’s strata, can indicate a trap for oil.

Using water divisions fences and trying to locate oil by interpreting dreams was also a common practice a century ago, but it wasn’t good enough for a young American civil engineer named John H. Carr. Carr wanted to find out what there was about oil-bearing areas that made them that way. In the mid-1930’s he travelled through the New York and Pennsylvania oil country talking to men who had drilled dozens of wells as well as producing wells. Through his research Carr established that oil was found in porous rock formations. His research quarrel the idea that oil forms in underground rivers or lies in subterranean lakes, and confirmed the fact that an oil “pool” is actually made up of billions of tiny droplets of oil held in porous rock.

That rock is usually sandstone or limestone formed from the sediments of ancient seas. And man today knows what areas were once covered by ancient seas. So it’s a piece of cake from here on in, right?

Wrong. Take Canada as one example.

by Fred Amesley
among the many oil-bearing countries of the world. Almost all of the country from the Rockies to Halifax and far up into the North-West Territories was under the sea 400 million years ago and could be oil country. The search can be narrowed somewhat by the Precambrian Shield which covers most of the eastern provinces, northern Manitoba, less than half of Saskatchewan, a little bit of Alberta and a chunk of the Northwest Territories about the size of Quebec. Because this area of igneous rock has no sedimentary covering—whatever there was has been eroded away—it is considered an unlikely source of hydrocarbons.

But the remaining broad belt of old ocean bed leaves us with an awful lot of sandstone and limestone underwater—most of it with no oil in it at all. This is the oil geologist’s hunting ground, a barren-seeming area that offers few leads. But what the oil geologist lacks in clues, the seeder makes up for in skills.

Among the sciences combined in the search are stratigraphy (correlation and interpretation of stratified rocks), petrology (the study of rock origin, structure and change) and paleontology (the study of fossil animals and plants from an earlier geological age). Oil exploration requires so many highly-trained people that some oil company employees are beginning to look like faculty lists. Nevertheless the oil searchers must operate on assumptions; their assumptions are back-ed with considerable evidence, but they are assumptions nonetheless. The first assumption concerns the origin of oil itself. The most widely accepted theory states that it was formed from a mixture of the bodies of prehistoric sea creatures, and the remains of plant life. It is thought that the rock formation in which this organic matter was originally entombed was a fine-grained, relatively impervious shale or limestone that geologists call source rock. As the source rock was compacted by the weight of successive layers above it, the oil was squeezed out, like water from a sponge, and forced into the pores of the sedimentary rock reservoirs in which it is found today.

The geologist searches for signs of source rock among canyon walls where erosion has exposed the subterranean layers and in mountains where earth-movements have raised the layers up above the surface. Should he find encouraging evidence he searches for an oil trap begins. An oil trap is formed where an impervious rock stops the progress of the migrating oil, a common example is the anticlinal dome, a sort of underground inverted bowl. Traps can also occur against faults where a shift in the rock strata brings an impervious layer of rock in line with an oil-bearing stratum to stop the progress of the flowing oil, and in other situations even more complicated.

Surface hints of possible anticlines and faults sometimes show up in aerial photographs. As a result, scientists have recently taken an interest in space photography as a means of detecting oil traps. But frequently there is no indicator on the surface that an oil trap exists. To get some idea of the shape of the rock layers below the surface without actually going down there the oilmen find the gravitymeter helpful. This device may give clues to possible traps by measuring the pull of gravity at various locations. A magnetometer is also used to interpret subterranean rock patterns by measuring the downward pull of the earth’s magnetic field.

These instruments give an indication of the depth rock strata lie below the surface. If the depths vary at different locations the readings can be used to plot the contours of subterranean layers.

The seismologist does the next best thing to drilling by probing below the surface with sound waves. By exploding small dynamite charges in surface holes about 50 feet deep and recording the time it takes the shock to echo back to the surface, seismologists can locate features in the underground rock that could be oil traps. The recorded data, when fed into a computer, can map these structures.

Before a large search for oil is launched, with its attendant widespread speculation among rival oil searchers and promoters, the searching company applies for rights to the minerals. To keep their costs down the oilmen try to guess the extent of the area where they think the oil lies. They want to obtain rights to as much productive land as they can, but not more than is necessary. And then they drill.

But when the drill goes down where science and all the instruments indicate a trap, there may not find oil. The oil may have escaped long ago. Many of the traps never hold oil; only water. Or drillers may find oil in a formation of such low porosity that it cannot be recovered.

Or the drill can miss. ‘It can miss a pool by a foot,’ says G. A. Purdy, Imperial engineer and petroleum historian. But such odds can’t dampen a driller’s enthusiasm.

A ‘drilling site,’ says Peter White, Imperial’s general manager of producing, who’s been well site geologist on five of them—all dry holes, ‘pessimists are hard to find. Everybody’s hoping for a well and most of them believe they will find one. Oilmen are eternal optimists.’

They have to be. Imperial drilled 133 dry holes before Leduc was found. In western Canada today the average cost of drilling a well is about $100,000—to say nothing of the time and money spent from the moment the geologist appears in the geologist’s eye until the decision to drill is taken. The total cost of drilling a well in Canada, including all the detective work, comes to about $60 per foot, and 65 million feet of exploratory wells were drilled in western Canada up until 1965 at a cost of $3,973 million. That paid for 14,124 wells, most of them dry. Exploratory drilling still stands only one chance in seven of bringing in a field large enough to warrant production and only one in 500 discovers a major field of 100 million barrels or more.

With that kind of money going down the hole, somebody has to say when. Though the geologist may remain convinced there is oil down there, other considerations must put a limit to the amount of money that it is prudent to spend on any one prospect.

Knowing when to say when can be as tricky a problem as deciding where to drill. One of Canada’s major oil fields, Redwater, in Alberta, was discovered by Imperial shortly after another major outfit stopped exploring there without drilling a well.

The need for surer methods of finding oil is becoming acute as exploration costs climb. Rising wages and expensive treks into remote areas have pushed the cost of conducting a seismic survey in Alberta up 25 per cent in the last 19 years. Alberta’s biggest oil field, which first became known as the Redwater, was drilled by Imperial.

But the oil geologist’s greatest skill is the one which he has to use every day. The ability to0 judge this elusive object, for his success depends on it. The oil geologist’s skill is the ability to judge the invisible by means of the visible in such a way that the invisible is seen.

As long as he can see the oil trap, the seismologist can see the oil. But if the trap is blind, the geologist must judge it is blind. And he has to judge it right. The oilmen don’t have a second chance. They can’t do it over. If they make a mistake, they have to bear the cost of the error, whether or not it can be computed. They have only one chance to get it right.

The oil men don’t want to drill blind. They don’t want to drill a dry hole. They want to drill a well. They want the oil they are looking for. They want it now.

The oil men don’t want to see anything else but the oil. They want to see the oil. They don’t want to see the trap. They want to see the oil. They want to see the oil.

The oil man wants to see the oil. He wants to see the oil.

He wants to see the oil.
The petroleum industry has had an enormous effect on Canada. It has made this country self-sufficient in balance in a commodity that is essential to a modern industrial society. The commodity is hydrocarbon energy, and in Canada oil and natural gas supply more than twice as much energy as all other sources combined — 71 per cent of all the energy used. Twenty years ago they supplied little more than a quarter of the total, most of it in the form of imported oil.

As the industry has grown, particularly since the discovery of the Leduc oil field in 1947, the country has grown with it. The oil industry helped to open Canada's northland, as exploration crews probed such remote areas as the Mackenzie delta and the islands of the Arctic Ocean. The massive infusions of capital, men and knowledge that developed the industry transformed the economy of western Canada, and particularly that of Alberta. Twenty years ago Alberta was a farming province with a dormant economy and a population that was shrinking. The developing oil industry changed that. Today Alberta's population is almost double the 1947 figure, the economy is tough and flexible with an industrial base, and its outlook is confident.

The rest of the country has profited too, although the effects of petroleum on the national economy are not as marked as they are on Alberta's. Even so, the industry has spent $13.7 billion seeking out and developing oil and gas fields, building pipelines, refineries and other facilities in the past 20 years — that's almost enough money to build 20 Peace River dams.

Since Leduc the oil industry has spent $7½ billion on exploration for and development of oil and natural gas. Only since 1962 has annual revenue from oil and natural gas production begun to exceed the amount spent on exploration and development, and the present net deficit still exceeds $2 billion.

But the industry owes something else too — it adds knowledge and technical ability which will have value far beyond the oil industry. For instance, knowledge of how to get around in muskeg may one day help to overcome this formidable barrier to our northern development. And the oil industry's ability to drill holes thousands of feet into the beds of oceans from ships floating in water hundreds of feet deep will provide knowledge and skills that will help us to penetrate the mysteries that still shroud this planet's oceans.

The industry's skills affect every one of us, in the prices we pay for petroleum products. Spurred by extremely competitive world markets, technology has kept ahead of rising costs in the petroleum industry to such an extent that some of the products, notably gasoline and home heating oil, cost — excluding tax — less today than they did 10 years ago.

A measure of the value of cheap and plentiful supplies of petroleum can be found in the uses we make of it. In Canada it runs nearly seven million cars and trucks, heats almost three million homes, powers all the planes, trucks, tractors, and nearly all the trains and ships, lubricates everything that would squeak without it, and provides petrochemicals to make almost anything from a cradle to a casket.

Canadians use more petroleum products than anybody else in the world — equivalent to 777 gallons for every man, woman and child per year. The high standard of living we enjoy — a standard that is exceptional for a country with such a small population — is largely due to our ability to use energy on so large a scale. Power is wealth, and petroleum is power, the extent to which we use that power is a measure of our wealth. Here are some measures of the size of petroleum's power and some results of its use. Some of them are from the Dominion Bureau of Statistics, some are Imperial Oil estimates. Much of the material on Alberta is taken from published statements by Dr. E. J. Hanson of the University of Alberta, and by Dr. J. E. Weinrich, formerly of that university.

To take care of Canada's increasing needs for petroleum products the petroleum industry adds the equivalent of another 50,000-barrrel-a-day refinery every year. Among other things, a refinery this size requires 6,000 tons of steel in its construction, or enough to build 5,741 cars with 131 pounds of steel left over.

The petroleum revenues have provided, on the average, about two-fifths of the total revenues of the Alberta government during the past 15 years. In addition, the provincial government has accumulated a surplus which is in excess of one year's revenue.

Through the petroleum industry Alberta has become a region with all the challenges and opportunities which the modern industrial society can offer man.
The level of employment in the petroleum industry has increased three-fold over what it was in 1949, twice the rate of increase of the all-industry composite for Canada.

In 1966 the oil and gas industry invested $1,100 million in Canada; between 1946 and 1966 the total reached $13.7 billion, or enough to build 44 Expo 67's.

Canadians consumed just over four thousand trillion BTU's of oil and gas energy in 1965. If we got that energy from men instead of from oil and gas, every single one of us would have to hire 34 men to work 40 hours every week of the year, or 136 men for the average family of father, mother and two children. Oil and natural gas now supply about 71 per cent of Canada's energy needs.

It appears that the development of the petroleum industry has practically doubled the size and multiplied the complexity of the Alberta economy.

Canadian per capita consumption of petroleum products is equivalent to 777 gallons each, the world's highest.

Unemployment in the prairie provinces in the period 1949-1965 has consistently been below the Canadian rate and has consistently shown the lowest rate of unemployment of any region of Canada. Here the contribution of the petroleum industry must be recognized.

The petroleum industry appears to be responsible for not far from half the employment of labor in Alberta.

Since 1947, when the Leduc oil field was discovered, the net revenue from the oil and gas produced in Canada has increased almost 50-fold, from $191 million in 1947 to $937 million in 1966. Even at today's prices, that would feed a family of four for half a million years.

In 1946, before Leduc was discovered, Canada produced only enough oil to meet 11 per cent of the total need, and exported none. In 1966 production reached about 85 per cent of demand, although we didn't use it all; more than one-third went to export markets.

Canadian oil production was about a million barrels a day last year. To import this amount at current posted prices would cost well over a billion dollars, or two-end-a-half times what we'd get in that $400 million wheat deal with China.

We import oil into Canada, but we export it, too, and this year the value of our oil and gas exports will balance that of our imports.
It is estimated that were it not for oil and gas revenues accruing to the provincial government, Albertans would have had to pay an additional $170 to $200 per capita, or $600 to $800 per family in 1965 to maintain the existing level of government services.

The long-run world-wide demand for oil doubles every 12 years. As a producer, Canada stands to benefit by this increasing demand.

The petroleum industry upgrades the labor force. Professional and technical people comprise 12.1 per cent of the labor force in Calgary, compared with 9.7 per cent nationally.

In spite of the enormous investment required to develop Canada’s oil industry, technical progress and intense competition have kept price increases to a minimum. Despite substantial increases in road taxes, the average retail price of gasoline is no higher than it was in 1957. Household fuel oil costs less than it did in 1957.

The petroleum industry contributed only about two or three cents of every dollar Albertans earned before 1947. In 1964, it contributed about 47 cents.

For every 100 new jobs in the production of oil and gas in Alberta, 234 additional jobs are created in other sectors of the economy. In Calgary, every 100 oil industry jobs create 651 other jobs.

Crude oil is now the leading mineral in Canada in value of production, being worth $793 million in 1966. Copper was second at $464 million, and gold away down the list at $124 million.

In fiscal 1966, taxes collected by all the provinces of Canada totalled $3,969 million. (Dominion Bureau of Statistics estimate.) The taxes on motor fuel and fuel oil made up $736,128,000 of that amount, or roughly a third of it. In the years from 1956 to 1966 motor fuel and fuel oil taxes amounted to $5,259,686,000. That’s five billion, two hundred and fifty-nine million, two hundred and eighty-six thousand dollars.

Between 1947 and 1965 Alberta’s total annual revenue from petroleum has risen from a little over one million dollars to $245 million. In the last two decades, the exploration and development activities of the petroleum industry have been the prime generator of Alberta’s economic growth, and it appears that this will continue to be the case for years to come in the future.