EARLE GRAY

ONTARIO'S

PETROLEUM LEGACY:

The birth, evolution, and challenges of a global industry

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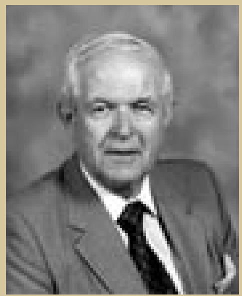
ABOUT THE AUTHOR



Earle Gray was editor of *Oilweek* magazine in Calgary for nearly 20 years. In the 1970s, he was director of public affairs for Canadian Arctic Gas, a consortium of major oil and gas companies that planned and researched a multi-billion dollar gas pipeline from Alaska's Prudhoe Bay and the Mackenzie River delta and Beaufort Sea in the Canadian Arctic. He is a former publisher, editorial consultant, and speech writer. He has written for such publications as the *Canadian Encyclopedia, Maclean's, Financial Post, Toronto Star,* and others. He is the recipient of numerous business writing awards, and a lifetime achievement award from the Petroleum History Society. He is also the author of seven books about the energy industry: *The Great Canadian Oil Patch, The Impact of Oil, The Great Uranium Cartel, Wildcatters, Super Pipe, and Forty Years in the Public Interest: A history of the National Energy Board*, as well as editor of and lead contributor to *Free Trade, Free Canada.*
His second-last book, *The Great Canadian Oil Patch: The Petroleum Era from Birth to Peak*, was published in 2005—a book that McGill University historian Desmond Morton says "rivals Pierre Berton's national dream."
Gray is a native of Medicine Hat, Alberta, but grew up on the West Coast and lived in Alberta and British Columbia for 41 years before moving to Ontario in 1972. He has deep family roots in the two western provinces and in Ontario. His work as a journalist and author has taken him to every province and territory of Canada, from St. John's to Tofino, from the 49th parallel to the northern tip of the Arctic Islands.

ONTARIO'S PETROLEUM LEGACY:

The birth, evolution, and challenges of a global industry

PREFACE

Ontario's Petroleum Legacy: The Birth, Evolution, and Challenges of a Global Industry has been a labour of love not only for the author, Earle Gray, but also for all of us who wanted to see the 150th anniversary of Canada's petroleum industry celebrated through new scholarship.

It would not be an overstatement to say that Earle has spent a lifetime studying the rich history of the oil patch—not only the events and people but also the science, technology, and economics. This is a difficult area of research and there are few good industrial historians. Sadly, it would appear that many historians do not view this field as important, although industrial development and economics impact and shape political decision making.

With respect to the life of communities, however, industrial histories are invaluable since they chart the progress of innovation as well as boom-and-bust cycles. Such histories are also important as educational resources because they help present and future generations to understand where we came from and, hopefully, better chart where we are going. I have personal experience of this as the Science and Technology Editor of *The Canadian Encyclopedia* from 1980 to 1984. Unless something is written about, it does not become a part of the narrative of nation building and, therefore, is less real and less important.

Not only does Earle tell a compelling story from the coming in of the first commercial well in Petrolia in 1858, he also places it in an international context. In an age in which "firsts" are so important, he gives many Canadians their rightful place on the international stage.

It is most appropriate that he chose to complete the story with a bridge to the present and future. There is no doubt that the petroleum industry today benefits Canadians and gives us economic power internationally. We also have an opportunity to tackle and address issues of environmental degradation.

How wonderful it would be if this book, and other 150th anniversary activities, were to inspire Canadian leadership at both the government and industry level in resource management and environmental protection and control. The book is a powerful incentive for designation of Oil Springs, Petrolia, Lambton County, Sarnia, and all of the those iconic names of importance to the foundation of this important industry as a UNESCO World Heritage Site.

Like any great enterprise, this work would not have happened without the vision and passion of many. This began with Earle and Robert Bott approaching me as Executive Director of the Heritage Community Foundation to become involved in a range of commemorative activities. A year of telephone and email chats resulted in the creation of a series of proposals for funders. The financial support of Charlie Fairbank, Canadian Petroleum Hall of Fame, and in-kind support of JuneWarren Publishing has made this book possible.

Adriana A. Davies, Ph.D.
Editor-in-Chief
Heritage Community Foundation
and the **Alberta Online Encyclopedia**
www.albertasource.ca

SARNIA REFINERY IN THE 1890s
Credit: *Glenbow Museum Archives*

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AN ENDURING LEGACY
This field in Oil Springs, still producing oil today, was awash in crude oil after a "gusher" in 1862. Credit: *Robert Bott*

PROLOGUE

The Oil Heritage Road

The main north-south highway through Enniskillen Township today is County Road 21, now known as the Oil Heritage Road. This modest rural highway, bounded by farms and acreages and woodlots, cuts right through the birthplace of the Petroleum Era in North America. Less than 30 kilometres to the west and northwest one finds the mature offspring of that humble birth—a vast complex of refineries and petrochemical plants along the St. Clair River between Corunna and Sarnia. Ontario's second refinery centre, at Nanticoke, is on the Lake Erie shoreline of the Petroleum Peninsula, 180 kilometres east and a little south of the Sarnia refineries and petrochemical plants.

No matter how we travel the region—by car or bus, on foot or bicycle, or if we fly overhead—petroleum has become so much a part of what we do that it seems invisible. Gasoline, diesel, and jet fuel are all made from crude oil, of course, and so is the synthetic rubber in the tires of motor vehicles, bicycles, and the soles of shoes. Petroleum literally greases the wheels of modern life. The pavement underfoot is either asphalt made from crude oil or cement made using natural gas. Petroleum also provides the molecular building blocks for everything from fabrics to pharmaceuticals, from plastic pipes to shopping bags. Future generations may regard petroleum as "too valuable to burn," but they will most likely still treasure its non-energy uses.

A boggy frontier

In the mid-19th century, most energy came from wood, coal, and the muscles of humans and animals. At that time, Enniskillen Township was considered a frontier area of Canada West*, largely overlooked in the first wave of settlement. It consisted of 86,800 acres (350 square kilometres) of tangled oak, walnut, elm, and black ash forest.

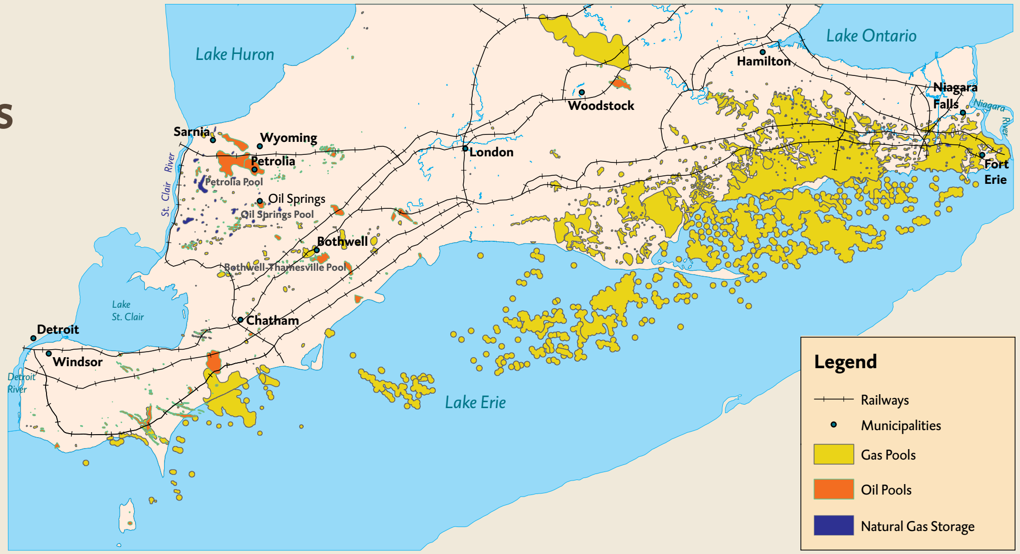
The barrier that faced settlers was water standing on a surface of nearly impervious clay†, up to 24 metres thick, deposited as silt on the bottom of a glacial lake near the end of the last Ice Age, about 18,000 years ago.[1] When it rained, the water could not soak into the ground. The land was so flat that the water had nowhere to run, except at the edges of Bear Creek that cut across the northern part of the township and Black Creek to the south. Water puddled on the surface and turned the heavy loam, known as Brookston clay, into gumbo that mired men, horses, and wagons. The worst part was at the eastern end of the township where the "Great Enniskillen Swamp" was wet and impassable in spring and fall, becoming a hard, dry crust in summer. Because of seasonal standing water, the forest of Enniskillen was relatively thin. The ground was covered by a shin-busting tangle of fallen trees and branches. The first settlers "found it hard to get into Enniskillen, and difficult to get out."[2]

* Present-day Ontario was known as Upper Canada from 1791 until 1841 and then Canada West until 1867.

† Geologists classify most of the near-surface soils in Enniskillen as "alluvium," which is a term for silt, clay, sand, and gravel deposited by running water—in this case water running out of glaciers. Because of the high proportion of fine sediments, early oil explorers called all of the alluvium "clay" and that term is generally used in this text.

Principal Ontario Oil and Gas Fields

Ontario's Petroleum Peninsula



Eliakim Malcom led a dozen men who hacked their way through "brushwood and fallen timber [that] were very thick," to survey Enniskillen township in early September 1832. They camped the first night on Black Creek, then so dry they could find no clean drinking water. Six weeks later, Malcom recorded in his journal: "The ground was so very wet we were obliged to build a bridge of poles to lie upon." The following week, the creek that had only a few inches of stagnant water when they arrived, had "risen to the height of seven feet."[3]

Fourteen years after Malcom completed his survey, there were still only 34 settlers in Enniskillen. These pioneers cultivated fewer than 400 acres, according to an 1847 assessment.

Dim and flickering light

The first settlers of this area lived in a type of dark ages, as did most early Canadian settlers. Rough fireplaces were used for lighting, heating, and cooking. Some evenings there was light from a few tallow candles, but usually settlers needed all the pork and other fat they could collect from their animals for food and making soap. Store-bought candles and lamp oil were too costly and too difficult to haul into the area.

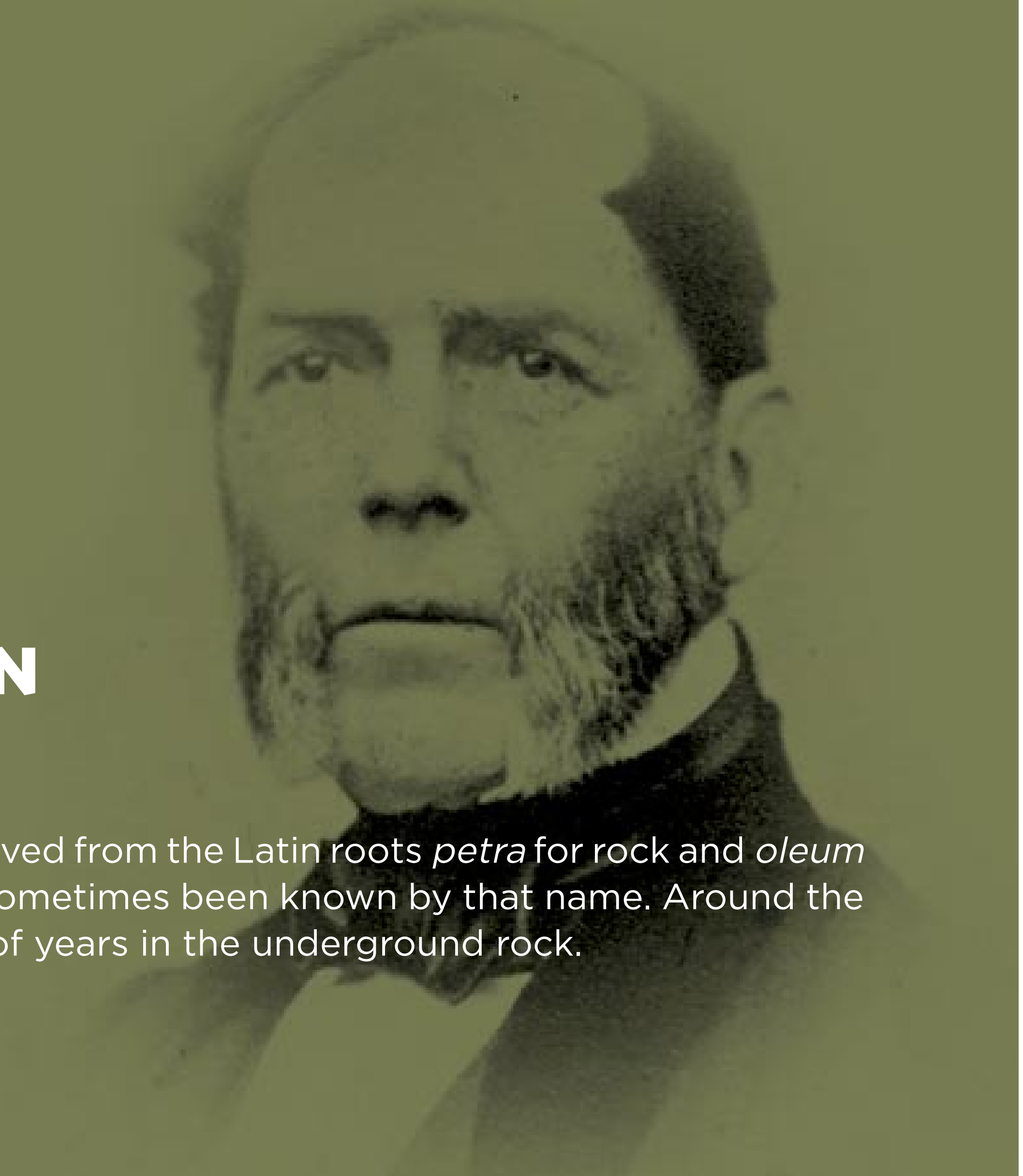
In the towns and villages of that era, light came from both tallow and beeswax candles. The soft tallow candles tended to melt near the hearth or in summer heat, and they were readily devoured by mice and rats. Beeswax candles were better, but more costly. An eclectic array of lamp designs burned lard oil, olive oil, fish oil, or even camphene—an explosive mixture of alcohol and redistilled turpentine. (The turpentine was distilled from pine resin.) The dangerous camphene killed many: 45 in one fire alone that destroyed a theatre in Quebec City, on the site of today's Chateau Frontenac. Many of the lamp oils were smoky and smelly. The best lamps burned whale oil, especially the prized oil from sperm whales. Whale oil had become prohibitively expensive—sperm oil in the United States fetched $1.77 a gallon in 1856, equivalent to about $42 in 2006 U.S. dollars—as sailors hunted whales to the edge of extinction. Gas made from coal was just being introduced for street and building lights: in Montreal in 1836, Toronto in 1841, and Hamilton in 1854.

The fireplace light and the few tallow candles in the Enniskillen cabins at the mid-point of the 19th century were soon to be replaced by a new fuel that would light the lamps of the world. Within a decade, a giant global industry would make its North American start here, the hard task of moving through impassable swamp and the gumbo of Brookston clay would be overcome, and near the banks of Black Creek would rise a new town, more brightly lit than anything else that had ever been seen.

CHAPTER 1

THE LONG EVOLUTION OF AN INDUSTRY

It came from rocks: the word "petroleum" is derived from the Latin roots *petra* for rock and *oleum* for oil. Petroleum is literally "rock oil" and has sometimes been known by that name. Around the world, trillions of barrels of oil lay for millions of years in the underground rock.



ABRAHAM GESNER
Abraham Gesner (1797-1864) developed a process used to distill kerosene from bitumen, coal, shale, and finally from crude oil. A short-lived U.S. coal oil industry based on his work laid the foundation for the petroleum industry.
Credit: *New Brunswick Museum, X10722.*

It has been called oil, bitumen, gum bed, tar, pitch, asphalt, and, in the Bible, slime. But whatever the name or form, people have been using petroleum for many purposes from before recorded history.

Rock of Ages

Oil actually is contained in the pores of rock. Some pores are big enough to stick your finger in; others are as tiny as the spaces between the grains of sand on a beach. Some oil-bearing rocks have been found at the surface or a few metres below; other deposits lie five kilometres or more underground, or under the beds of oceans and lakes. When oil was deeply buried, the weight of the rock above created enormous pressure, and the oil moved upward by capillary action, like sap in a tree, unless it encountered an overlying impervious layer. Reservoirs of oil were created where cap rock prevented the fluid from migrating to the surface. In the reservoirs, the oil was often squeezed between a layer of saltwater below and a layer of natural gas trapped above. But some oil escaped to the surface in areas where there are cracks in the cap rock, or where the overlying rocks are permeable. At the surface, these "oil seeps" polluted wells, springs, and creeks.

Over long periods of time, bacterial action, water flows, and evaporation converted much of the escaped oil into a tar-like substance known as bitumen. The bitumen was often mixed with sand or other materials, or impregnated in surface or near-surface rocks. Some bitumen is found at the surface; other accumulations have been buried in recent times—in geological terms— by deposits from glaciers, oceans, rivers, or wind.

Pumping is often necessary to recover oil from a well dug or drilled into the oil-bearing rock, much as water is pumped from water wells. Sometimes, unless controlled, the oil rushes to the surface and into the air with great force, like an artesian water well: "And the rock poured me out rivers of oil," says the Bible (Job 29:6). The pressure from natural gas, dissolved in the oil or trapped above it, can accelerate the flow.

It has been called oil, bitumen, gum bed, tar, pitch, asphalt, and, in the Bible, slime. But whatever the name or form, people have been using petroleum for many purposes from before recorded history.

First uses

What might be called the world's first petroleum industry developed more than 5,000 years ago in Mesopotamia (now Iraq). Mesopotamians used petroleum to pave the streets of Babylon, and to waterproof their baskets, ships, and mats. They also used it as cement for pottery and mosaics, as medicine, to make paints, to fumigate their buildings, and as a magic potion to ward off evil spirits. Criminals were punished with molten bitumen poured on their heads.

MEDICINE SHOW ELIXIR
In the 19th century, crude oil and bitumen were used as medicine before fuel uses were discovered. This is an exhibit at the Petrolia Discovery
Credit: *Robert Bott*

In the Bible, Noah was commanded by God to "make thee an ark" and "pitch it within and without with pitch" (Genesis 6:14). The "pitch" might have been bitumen, but it might also have been resin similar to the mummia used by the Egyptians to embalm mummies. The basket that hid the baby Moses among the reeds of the Nile would have been waterproofed with bitumen or resin. Roman historian Pliny reported that bitumen was used as a medicine to check bleeding, heal wounds, straighten eyelashes, treat leprous spots and gout, and cure chronic coughs and diarrhea.

Petroleum was distilled at least as early as the first century AD at Alexandria. The resulting naphtha was used in a weapon of war known as Greek Fire. Arab and Mongol armies deployed some form of Greek Fire in grenades and flame throwers. The Shah of Persia is said to have used hollow iron horses filled with burning oil, possibly derived from petroleum, to defeat an Indian army mounted on elephants. Some 20,000 jars of Greek Fire helped feed the flames that destroyed Cairo in 1077. Surface and near-surface deposits of crude oil and bitumen have also been used locally for various purposes for at least a millennium in places such as Burma (now Myanmar) and the Caspian Sea region of Asia.

In the Western Hemisphere, no less than elsewhere, crude oil and bitumen were used for medicine and waterproofing. In the late 18th century, Alexander Mackenzie found the Cree Indians using bitumen from the vast deposit of the Alberta oilsands to caulk their canoes. In Mexico, bitumen was used as a toothpaste and chewing gum.

Spanish explorers in 1526 were the first Europeans to find bitumen in the Western Hemisphere, in Cuba. Drake, Raleigh, De Soto, and other sailors caulked their ships with bitumen from Cuba and other bitumen deposits along the Gulf of Mexico, in Peru, and from Trinidad's famous asphalt lake.

The European distillers

While Greeks and Arabs started distilling petroleum as early as AD 100, Western Europeans first found out about this method a thousand years later from the Arabs who had invaded Spain.[1] In the following centuries, Europeans experimented widely with new methods of distilling and refining or treating new types of petroleum products for which they found new uses.

One of the first European "oil men" was Martin Eele who, with Thomas Hancock, and William Portlock, obtained an English patent in 1694 to produce "pitch, tar and oyle out of a kind of stone." This process involved grinding petroleum-bearing shale and then using hot water to separate the oil from the rock—an early version of the method later used to separate bitumen from Alberta oilsands. Eele's British Pitch Works at Benthall produced tar used for coating the hulls of ships as well as a medicinal oil.

French physician Jean-Théophilus Hoeffel (1704-1781) in 1728 began six years of experiments with distilling a sulphurous crude oil skimmed from the water of a spring in Alsace. Hoeffel produced various oils used as medicine and "extremely inflammable"[2] naphtha, which he is reported to have burned in a lamp. Archibald Cochrane (1749-1831), the ninth Earl of Dundonald, may have been the first to distill a liquid fuel from coal. He burned it in a lamp, but no commercial development followed.

Ozokerite, a mineral wax dipped from shallow pits dug in the Carpathian Mountains of eastern Europe, was burned in the street lights of Krosno, Poland, as early as 1500. It was also used to lubricate wagon wheels, treat leather, and, of course, as a medicine. Between 1810 and 1817, Joseph Hecker and Johann Mitis sought to establish a business selling a lamp fuel that they distilled from Polish ozokerite. They obtained a large order from the Town Council of Prague to light

The 19th century was time of great scientific and technological advance. Clever tradesmen, mechanics and miners, gentleman scientists, entrepreneurs, and academics rushed to extend and apply the growing knowledge of geology, chemistry, physics, and engineering.

the city streets, but their business failed from lack of capital and the difficulty of delivering their product over bad roads to Prague.

From 1830 to 1834, German industrialist and scientist Carl Ludwig von Reichenbach (1788-1869) experimented with the distillation of coal and wood to produce a number of new hydrocarbon compounds, including creosote, paraffin, compounds used in perfumes and antiseptics, and a liquid fuel similar to the types that would later burn in lamps.

While most efforts focused on producing liquid fuel or medicine from crude oil, bitumen, ozokerite, or coal, Scottish engineer and inventor William Murdoch (1754-1839) in 1792 distilled coal at much higher temperatures to produce a volatile gas. A cotton mill in Manchester in 1805 became the first building entirely lit by Murdoch's coal gas*, and for more than a century, coal gas was a major source of light on streets, in factories, and homes. Murdoch even used his coal gas to fuel a portable lantern, according to his friend William Fairbairn. The two faced a long walk over bad roads on a dark night. "Mr. Murdoch," Fairbairn wrote, "went to the gasworks where he filled a bladder which he had with him, and, placing it under his arm like a bagpipe, he discharged through the stem of an old tobacco pipe a stream of gas which enabled us to walk in safety."[3]

Around 1835, French chemist, Alexander Selligue, heated a coarse metamorphic rock, schist impregnated with bitumen, to distill a volatile liquid that was first used to enrich coal gas. In 1838, Selligue patented his oil as a lamp fuel, and within a few years was operating three small refineries in France producing oil used both as lamp fuel and to enrich coal gas.

* Coal gas, also known as town gas or syngas, is a mixture of hydrogen, carbon monoxide, methane, and other volatile hydrocarbons (plus small amounts of non-combustible nitrogen and carbon dioxide). Coal gas was used widely for lighting, cooking, and heating until it was displaced by electricity and natural gas. Some coal gas or "syngas" is still produced in the United States.

Polish pharmacist Jan Józef Ignacy Łukasiewicz (1822-1882) is often cited as the first to distill and refine a lamp fuel from crude oil, rather than from coal or bitumen, although his initial raw material may have been ozokerite. His achievement was announced in 1852. Refining at this time primarily meant treating in various ways the initially distilled product with sulphuric acid and alkalines to remove impurities and reduce objectionable odours.

The 19th century was time of great scientific and technological advance. Clever tradesmen, mechanics and miners, gentleman scientists, entrepreneurs, and academics rushed to extend and apply the growing knowledge of geology, chemistry, physics, and engineering. This knowledge spread rapidly through lectures, correspondence, and publications. It was not surprising that similar innovations often emerged almost simultaneously in Europe and North America[†].

A decade before Łukasiewicz' announcement, Nova Scotian Abraham Gesner had begun experiments to produce a similar lamp fuel from bitumen, and later from coal and from a bituminous mineral called albertite. Gesner first demonstrated his product in 1846. Gesner named the product "kerosene[‡]" (from the Greek word for wax, *keros*). Łukasiewicz said he was inspired in his efforts by Gesner's work. Łukasiewicz also invented a prototype kerosene lamp, demonstrated during an emergency operation in the hospital at Lwow. By 1856, he built the first oil refinery near Jaslo, producing kerosene from crude oil, while others were at work operating,

† In the United States, for example, Pittsburgh industrialist Samuel M. Kier was distilling crude oil from surface oil seeps as early as 1851 or 1852. He relocated the operation from Pittsburgh to Lawrenceville in 1854. His product may have been sold mainly as medicine since it did not appear to have made an impact in the lamp oil market. Kier's small still is in the collection of the Drake Well Museum in Titusville.

‡ Kerosene, also known as coal oil or stove oil (or "paraffin" in Great Britain), is a liquid mixture of hydrocarbon molecules that contain 12 to 15 carbon atoms. It is denser than gasoline but lighter than diesel fuel. During fractional distillation, kerosene condenses between 150°C and 275°C. The most common use of kerosene today is jet fuel for aircraft.

JAMES YOUNG
James Young (1811-1883) followed on the heels of Abraham Gesner in developing a process to distill oil from coal and shale, but obtained a U.S. patent before Gesner. U.S. coal oil refiners were obliged to pay royalties to Young. Young became prosperous while Gesner died impoverished.
CREDIT: *University of Strathclyde, Glasgow.*

building, or planning coal oil refineries to produce kerosene[4] At Rifov, Romania, Theodor Mehedinteanu started another small crude oil refinery in 1856.

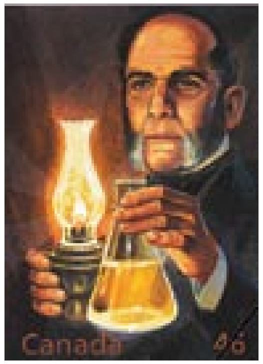
By far the most commercially successful of all European distillers was a Scottish chemist, James Young (1811-1883), who built the first truly commercial, large-scale coal oil works, acquired a fortune, and became a great philanthropist. He was also the nemesis of Abraham Gesner.

Young got into the oil business in 1848, collecting oil that flowed slowly from a coal mine in Derbyshire, England, and selling it as lubricating oil. The supply of oozing oil was soon exhausted, and the following year Young began experimenting with the distillation of coal and oil shale as an alternate supply. He obtained a British patent for his distilling and refining process in 1850 and the next year opened his first oil plant in Scotland, using oily "bog coal" (torbanite*) from a nearby mine. His plant produced lubricating oil, a solvent used with rubber to make a waterproofing compound, and ammonium sulphate fertilizer—but no lamp fuel for at least five years.

Others soon began producing lubricating oils and solvents from coal and shale, and quickly found they were forced to pay royalties to Young, who vigorously enforced his patent rights.

In the United States, Luther Atwood used coal tar, a byproduct from the manufacture of coal gas, to produce a lubricant he called "coup oil," which he patented. A Glasgow firm, George Miller & Company, hired Atwood for technical assistance in building a coup oil plant in Scotland. While working for Miller, Atwood experimented with Young's lubricating oil, re-distilling it to yield a water-white,

* Torbanite, also known as cannel coal or boghead coal, is a type of coal derived from algae, and it is similar in geological age and properties to the albertite found in New Brunswick. Slow distillation of torbanite produces paraffin oil and paraffin wax, which can be used for heating, lighting, and industrial purposes.



ABRAHAM GESNER
Abraham Gesner (1797-1864) developed a process used to distill kerosene from bitumen, coal, shale, and finally from crude oil. A short-lived U.S. coal oil industry based on his work laid the foundation for the petroleum industry. Credit: *New Brunswick Museum, X10722*.

> "The progress of discovery in this case, as in others, has been slow and gradual. It has been carried on by the labours, not of one mind, but of many, so as to render it difficult to discover to whom the greatest credit is due."
> –**ABRAHAM GESNER**, 1861, on the development of coal oil refining[6]

bright-burning lamp fuel. On a visit to Miller's office, Young saw his re-distilled oil burning in a lamp. That was when he decided that, in addition to lubricating oil, solvent, and fertilizer, he would get into the business of producing and marketing lamp oil.[5] That was in 1856. In New York, the first North American coal oil plant was already producing kerosene for lamp fuel, based on the work of that Nova Scotian man-of-all-trades, Abraham Gesner.

Gesner and the coal refineries

Abraham Gesner, in Nova Scotia and New York, and James Young, in Scotland, were the towering figures, and antagonists, in the large-scale commercial development of kerosene refining. Gesner was first in the field and died impoverished. Young followed, and he died wealthy.

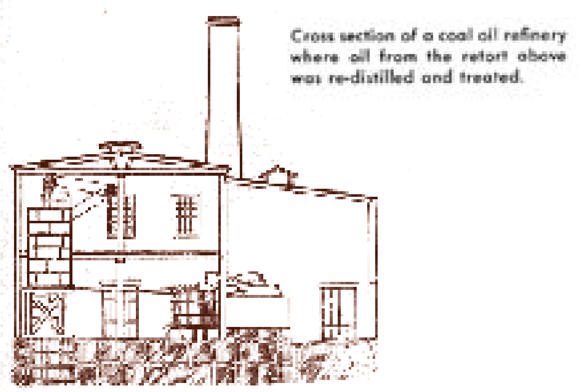
Gesner's long and winding road began with a youthful adventure in horse trading and ultimately led to the study of *Coal, Petroleum and Other Distilled Oils*, as he titled his landmark 1861 treatise that would become a bible for oil refiners for nearly half of a century.

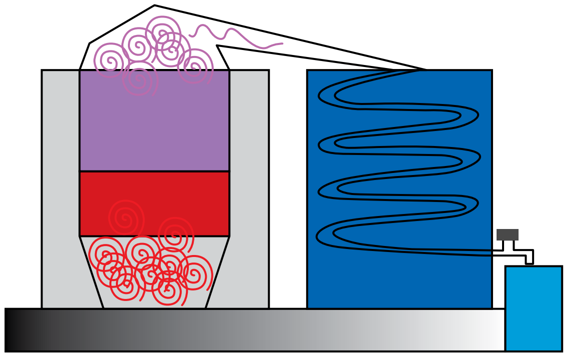
The story begins in 1816, the "year without summer." The Mount Tambora volcano in Indonesia exploded the year before with a blast that was heard 1,900 kilometres away, killing an estimated 71,000 people, spewing heavy ash into the atmosphere, cooling temperatures, and causing the Northern Hemisphere's worst famine of the 19th century. Worst hit were northern Europe, northeastern United States, and eastern Canada. Crop failures in Europe caused some 200,000 deaths. Quebec City was buried under almost a foot of snow at the end of June. Ice was seen on rivers and lakes in July and August as far south as Pennsylvania. Nova Scotians knew hunger. With lack of feed, their horses were slated for slaughter.

To rescue the horses and provide some money for the Gesner family and neighbouring farmers around Chipman's Corner on the Bay of Fundy, 19-year-old Abraham launched an ill-fated career as a horse trader. His plan was to ship the hungry horses to be sold in the West Indies. Gesner sailed with the horses as a deckhand. He returned home in mid-winter with no money, but he also brought a cargo of rocks, minerals, shells, curios, and a pile of bitumen from the "pitch lake" in Trinidad that had caulked the ships of Sir Walter Raleigh and others. Two succeeding voyages were greater disasters—both ended in shipwrecks.

Following the footsteps of his father, Gesner turned to farming, married the daughter of a prominent local doctor, and fathered 11 children. Insatiably fascinated by natural history and all things scientific, he perhaps spent as much time studying "scientific farming" as time behind the plough. He fell into debt and was in danger of imprisonment. He was rescued by his father-in-law who sent him off to London to study medicine. He returned as a doctor who had also studied geology and chemistry in London.

Back in British America, his career as a doctor was soon overshadowed by his many other roles: New Brunswick's first provincial geologist; author of more than 20 books, papers, and reports; a popular lecturer; founder of what became New Brunswick's provincial museum; and inventor of one of the first electric motors, a wood preservative, a machine for insulating electric wires, and a process to pave highways with bitumen.





COAL OIL REFINERY AND STILL DIAGRAM. The diagram of the coal oil refinery is based on G.A. Purdy's *Petroleum: Prehistoric to Petrochemicals*. A retort with a gooseneck spout can be seen in the refinery diagram. The still diagram shows such a retort in more detail.

Finally, Gesner turned his attention to distilling the bitumen he had brought from Trinidad, the first of some 2,000 distillation and refining experiments he conducted. He began his experiments seven years before James Young. The Trinidad bitumen gave only a low yield of smoky, smelly oil. Gesner then turned to a thick bed of solid hydrocarbon that he had found in Albert County in his geological survey of New Brunswick. He called the deposit albertite*.

Five years after his first experiments, Gesner publicly demonstrated his oils distilled from albertite at Charlottetown, Prince Edward Island, on June 19, 1846. He named the oils kerosene A, B, and C. Kerosene A was the most volatile, essentially gasoline; Gesner thought it might be used in a pressurized gasoline lamp, as it later was. Kerosene B, he suggested, could be blended with the other two. Kerosene C was destined to become the standard fuel for coal oil lamps, and today's jet aircraft.

Gesner, along with others, was focused not on lamps fuelled with a liquid, but on gas light. He envisioned kerosene being converted to a gas that would give a superior, brighter light than the coal gas then lighting so many streets and buildings in Europe and North America. Those who witnessed his demonstration at Charlottetown that day, and others that followed in the Maritime Colonies and in New York City, saw kerosene heated in a retort producing gas that bubbled through water to remove impurities and through a regulator to the burner tip or lamp.

Gesner was still ahead of his Scottish rival James Young, who would not start his distillation experiments for another two years. By that time, Gesner's work was fairly well known, as witness the Polish chemist who used Gesner's process to produce kerosene from crude oil. But in commercial application of his work, Gesner would fall well behind Young, with disastrous results for his always precarious personal finances.

There were two problems: one was that Gesner, in mid-1854, was late in securing a U.S. patent for his distilling and refining processes. Young secured his British patent in 1850 and his U.S. patent in 1852. The second problem was that Young commercialized his processes immediately, while Gesner faced delays and difficulties due to his lack of sufficient funds to develop and market his inventions.

Gesner organized a company he hoped would provide Halifax with kerosene gas distilled from albertite, but the city fathers awarded a franchise to a competitor. Undaunted, Gesner took out a lease to mine the albertite bitumen. Another group, somehow exempt from giving the customary public notice, obtained a coal lease for the same deposit. In a heated court case that followed, the jury decided that albertite was really coal—which it clearly was not—and Gesner lost the right to mine the deposit he had discovered.

In search of backers with money, Gesner then moved to New York, where he had earlier demonstrated his kerosene and garnered substantial publicity. Here he found help from a 28-year-old promoter with the appropriate name of Horatio Eagle who issued an eight-page circular entitled, *Project for the Formation of a Company to Work the Combined Patent Rights of Dr. Abraham Gesner, Nova Scotia, and the Right Hon. the Earl of Dundonald of Middlesex, England*. The circular offered for sale $100,000 in shares of a new company at first called the Asphalt Mining and Kerosene Company, later the North American Kerosene Company. The circular listed a wide range of possible uses for the kerosene oils: waterproofing, paving, insulating underground telegraph wires, making paints and varnishes, as solvents, "burning fluids," and to produce gas "for lighting manufactory."

* Albertite is an unusual solid hydrocarbon, resulting from degradation of the kerogen (partially formed crude oil) seeping out of shales. It shares some characteristics with coal, oilsands bitumen, and "bog coal" or torbanite, but is distinct in its origin and properties.

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For Gesner, there were two flies in the ointment. Having assigned the patents to the company, Gesner was merely an employee, the chief chemist, hired "at a modest salary," as the circular pointed out. A greater problem was that his first patents had been issued by the State of New York and were subsidiary to Young's 1852 U.S. federal patent.

Construction of the Kerosene Company's New York coal oil plant—the first in North America and the world's largest—began in 1854. By early 1856, the firm was in the market selling kerosene for lamp fuel. It was the same year that James Young made his first shipment of lamp fuel. Within four years, some 70 coal oil plants had sprung up in the eastern United States. The North American Kerosene Company's plant was still the largest. As described by the *New York Commercial Advertiser* in 1859, it was a plant that cost $1.25 million, employed 200 men, used 30,000 tons of coal per year, and was able to turn out up to 5,000 gallons of kerosene per day. The latter figure, equivalent to 119 barrels per day, seems inflated, unless the plant operated fewer than 250 days per year. It is unlikely that refining a ton of coal would yield more than a barrel of kerosene.

The plant eventually fell into the hands of one of John D. Rockefeller's Standard Oil companies and continued to operate until 1951 when it was sold for scrap.

Gesner, too, seemed tossed on the scrap heap. Young brought suit against the North American Kerosene Company for patent infringement and won, forcing payment of royalties, as he did with many other coal oil producers. With that, little more than a year after the plant started producing, Gesner was fired. His replacement as company chemist was Luther Atwood, who was also chief chemist for a rival coal oil producer in Boston and the man who had unwittingly inspired James Young to add lamp fuel to the products of his Scottish shale oil works. Gesner

GESNER MONUMENT
The body of Abraham Gesner, widely credited as the father of the North American petroleum industry, lay in an unmarked grave in Halifax for 39 years, until this monument was erected by Imperial Oil in 1933.
Credit: *Imperial Oil Collection, Glenbow Museum, ip=1a-67*

By the late 1850s, it was widely recognized that bright-burning kerosene could be made from liquid crude oil at a fraction of the cost of producing it from bitumen or coal. Now, all that was needed for the petroleum industry to emerge was a significant supply of crude oil.

remained in New York for a few years, practising medicine and writing his famous treatise on coal and petroleum refining. He returned to his native Nova Scotia to accept a position as professor of natural history in late 1863, but died five months later, on April 29, 1864.

The legacy that Gesner left was his key role in creating conditions for a petroleum industry that, one historian has said, was just waiting to happen.[7] Though the existence of petroleum and the basics of distilling it had been known for millennia, it was the coal oil industry that made the Petroleum Era inevitable. The coal oil industry created the product, the technology, the refineries, the distribution, and the sales network. As society urbanized and industrialized and became more literate, the need for light was almost insatiable—on city streets, in factories, shops and homes, railways, ships, and lighthouses. By the late 1850s, it was widely recognized that bright-burning kerosene could be made from liquid crude oil at a fraction of the cost of producing it from bitumen or coal. Now, all that was needed for the petroleum industry to emerge was a significant supply of crude oil. A carriage maker and mining promoter in Lambton County, Canada West, would be the first in North America to provide that supply. ■

Imperial and metric measurement

In 1979, Canada, including the Canadian petroleum industry, adopted the metric system of measurement—officially known as the Système International d'Unités or SI. Until then, Canada used the Imperial system, which is similar but not identical to the system still used in the United States.

To avoid the awkwardness of translating the many historical measurements, and to preserve the original context, we have used Imperial for all units in chapters 2 through 5. It should also be noted that some Imperial units such as barrels, cubic feet, and acres remain in common usage in the Canadian petroleum industry, although government authorities generally use metric.

Some common Imperial units (and metric equivalents) are: inch (25.4 millimetres), foot (30.48 centimetres), yard (91.4 centimetres), mile (1.61 kilometres), acre (0.4 hectares), pound (454 grams), barrel (159 litres), Imperial gallon (4.55 litres), and cubic foot (0.028 cubic metres).