



ARCHIVES

Newsletter of the Petroleum History Society

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P.H.S. Luncheon – Wednesday, October 2nd, 2024

Turner Valley's 1924 Royalite No. 4 and Canadian Petroleum History by David Finch and Dustin Brodner

Very few wells can be considered to have been so pivotal in the history of the Canadian petroleum industry that they warrant special attention. Amongst these are Leduc #1, Atlantic #3, Dingman #1 and Hibernia. A key member of this list is Royalite #4, a deep test drilled in 1922-1924 that discovered wet sour natural gas in thrust-faulted Mississippian strata at Turner Valley. The presenters at this luncheon will describe what happened there and why it was so important in the evolution of our exploration activities in the basin.

Please see pages 2 and 3 for talk abstract and bios.

Time:	12 noon, Wednesday, October 2 nd , 2024
Place:	Calgary Petroleum Club 319 - 5 Avenue SW, Calgary (Trophy Room) Dress – business casual.
Cost:	P.H.S. Members and Student Members \$40 and Guests \$45 (most welcome). Only cash or cheque at the door. Payment can be made in advance by Interac or PayPal transfer to treasurer@petroleumhistory.ca Please advise payment method with reply.
Lunch:	Soup, sandwiches and cookies. Gluten-free? Vegan? Advise with reply.

NOTE: Instructions for registering for the Luncheon

**Reply, if you wish to attend, to Ian Kirkland via his email
treasurer@petroleumhistory.ca**

The deadline for registration is Monday, September 30th at noon.

**Please be advised that those who register but do not attend or cancel after the
deadline, will be invoiced.**

Those who do not register by the deadline may not be accommodated.

These restrictions are related to our obligations to the Petroleum Club in terms of catering and seating.

Luncheon Speakers' Abstracts

Our luncheon will feature two very knowledgeable individuals who will provide their perspectives on this important well that changed the face of the Western Canadian petroleum industry. Historian David Finch will lead off and explain the role of the 1924 discovery well in the story of Alberta oil in his overview. Dustin Brodner will follow up with some previously unrevealed aspects of the well that will help us understand what actually happened.

David: Myth and mystery surround the Royalite No. 4 story, with suggestions that the find was accidental, located by conjecture and that it should never have happened because the drilling crew had been ordered to shut down operations and secure the dry hole. Actually, this first Imperial Oil Company exploration drilling effort in the Turner Valley Field was already famous because the discovery of wet gas in 1914. It was a carefully planned initiative. The Northwest Company that did the drilling between 1922 and 1924 was an exploration and drilling company – mostly owned by Standard Oil with a minority share by Imperial. And so it was a vertically integrated American behemoth that drilled the “Wonder Well” that filled newspaper headlines in the mid-1920s. The drilling location was not accidental or a wild guess. Research for this presentation discovered the name of the widely respected senior consulting geologist who applied the most sophisticated geological knowledge available to the still poorly understood Turner Valley oilfield region. And the well was not ordered shut down and declared dry - another myth that is much less interesting than the actual story. The account of the decisions made by the senior and very experienced drilling supervisor from Ontario’s Petrolia oilfield is full of twists and turns – resulting in success. Royalite No. 4 proved that Turner Valley Field hosted a major petroleum accumulation and that there was indeed Oil In Alberta.

Dustin: This talk is intended to be a historical technical synopsis of the drilling and production operations of the Royalite No. 4 “Wonder Well” between September 1922 and October 1924. The main points are as follows:

- Brief review of cable tool drilling operations.
- Description of the operations specific to Royalite No. 4.
- Description of the discovery of petroleum in the Palaeozoic Mississippian.
- Description of harnessing the well and early production of the well.
- Summary of the technical and economic significance of Royalite No. 4.

Luncheon Speaker Biographies

David Finch is a consulting historian, holds the M.A. in Post-Confederation Canadian History from the University of Calgary and is the author of books and articles and is a frequent contributor to programs on television and radio.

Dustin Brodner is a semi-retired Petroleum Engineering Technologist that spent his career in production operations, completions engineering, and completions operations. He has worked throughout the Western Canadian Sedimentary Basin and in the Canadian Arctic.

He has been employed by a number of companies over his 35+ years in the industry including Petro-Canada, Taqa North, and Crescent Point. His last position with Crescent Point involved

managing downhole operations in the Turner Valley Field which led to an entirely new education avenue for him – learning about the process of cable tool drilling.

Dustin is the third generation of his family to work in the Turner Valley area. His mother's family lived on Royalite land right beside the Royalite Gas Plant and the Dingman No.1 discovery well by the Sheep River. His grandfather, Lewis, blacksmith and welder, started working for the Royalite shop in 1928. Dustin had 5 uncles (two welders, two drillers and a gas plant supervisor) that worked in the Turner Valley starting in the 1930's. His father, Byron, started his 36-year career in the Royalite #1 and Purity gas plants in 1950 and later with British American and Gulf Canada. He has a deep family connection with the oil industry and Turner Valley area with its rich history. He collects oil books and ephemera as a pastime and is always researching various topics involving the dawn of the Western Canadian Petroleum Industry.

Dustin has spent the last three summers working for Alberta Culture as a Historic Interpreter at the Historic Turner Valley Gas Plant. He and his colleagues are passionate about educating the public and industry groups on the history and significance of the Turner Valley Field and the first Natural Gas Processing Plant in Western Canada.

The Bull Wheel



Next P.H.S. Luncheon Meetings: Please mark your calendars for the 2024 fall season Petroleum History Society luncheons: October 2nd, October 30th, and November 27th at the Petroleum Club.

Call for contributions and speakers: The Petroleum History Society values your input. If you have an article that you'd like to see in *Archives* or if you have a talk that you'd like to give, please get a hold of us. Contact President Clint Tippett or Editor Bill McLellan at the email addresses indicated on page 3.

Donations and endowments: We would like to ask members to consider adding a small donation to our Society as a part of your estate planning to ensure the preservation of Canadian petroleum history and enable us to promote the contributions made to the Canadian economy by our petroleum industry and by the many dedicated individuals who have been and are involved in it. As you are aware, the P.H.S. does not have charitable status with the Canada Revenue Agency and therefore cannot issue tax receipts – but that does not detract from the worthwhile nature of our endeavors. Thank you for your consideration.

Free Student Memberships Available: The Petroleum History Society offers free membership to full-time students until the end of the year in which they graduate. They will receive the same benefits as regular members – *Archives* newsletters and invitations to our events. Membership applications are available at: www.petroleumhistory.ca/about/index.htm#join.

Editorial Comment: Please note that unless otherwise indicated, all contents of this newsletter have been created and/or assembled by P.H.S. Vice President and *Archives* Editor, Bill McLellan.

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by the Petroleum History Society for Society members.**

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Back issues are archived on our website at <http://www.petroleumhistory.ca/>

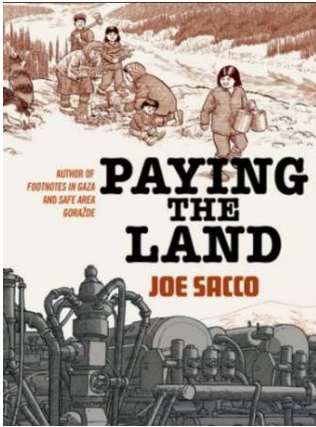
Contacts: contact@petroleumhistory.ca

President: Clint Tippett – clintontippett88@gmail.com 403-208-3543

Editor: Bill McLellan – mcllellaw@telus.net 403-288-9089

Book Review

The following book review was submitted by P.H.S. member Calvin Sikstrom for inclusion in Archives. Our thanks to Cal.



PAYING THE LAND by Joe Sacco. First Edition. New York: Metropolitan Books, Henry Holt and Company. 2020. English. 264 p. with notes on Dene Languages and on Trout Lake. Hardbound. Cdn\$39.00. Comic journalism format.

Another Norman Wells veteran recommended this book to me. I purchased it at what seemed to me a high price. I immediately understood the price as it has a superb cover and 260 pages of comic journalism illustrations. This is no comic book though: It is a serious treatment of what Sacco sees and hears during his investigation into the lives and recent history of aboriginal people in the lands west and north of Yellowknife.

Another matter to get out of the way, is Joe Sacco's name (pronounced sae coo). He appears to have written nothing else about Canada until this book. He is a journalist who brings an air of detached observation to his subject. He was born in Malta in 1960 and grew up in Australia and the USA (California and Oregon) before starting a career as a journalist. His previous works are generally related to Middle Eastern politics and the wars in the Gulf, Bosnia, and Palestine.

So why Canada? Another book review describes his subject as "colonial cultural genocide, residential schooling, treaties and capitalism." This book represents what he learned about a century of Dene and Mackenzie Valley development history during his visits to NWT. He recounts the stories that he hears from leaders, politicians, business men and others who are generally familiar to many of us.

He travels with a guide on the winter road from Yellowknife to Norman Wells. Later he visits the lower Mackenzie Valley: Fort McPherson too, and Inuvik. At some time he visits the Liard River valley communities of Fort Liard and Trout Lake.

The book is written in six parts beginning with "You Find Yourself in a Circle". This is the story of reverence for the land as told by Paul Andrew of Tulita. He describes the moose skin boat experience which is also a National Film Board movie. I, myself, have paddled down the Keele River and paid tribute to the land at the spring of Red Dog Mountain. ⁱ

Part II "This is a Winter Road" leads to Tulita and Norman Wells and the problems of economic development. Fred Andrew talks about the CANOL Project. Oilfield development hopes and dreams are contrasted with the realities of stalled development. Willard Hagen, Executive Director of the Mackenzie Valley Land and Water Board, talks about boom-and-bust as the story of the north.

Part III “Paying the Land” is introduced by Fred Andrew. The circumstance of treaties and the proposals for Mackenzie Valley development are viewed from the perspectives of Frank T’selie, Stephen Kakfwi, Rene Fumoeleau, Justice Morrow’s Paulette case; Justice Berger’s inquiry; Politics of the Dene Nation by Stephen Kakfwi.

Part IV focusses on the troubles of a “Dying Culture.” The problems of Etchinele, Yakaleya, Beaulieu, William Greenland. Truth and reconciliation comes into the discussion here.

Part V “No Road to Anywhere” takes us into the Liard River Valley and the trouble of Trout Lake First Nation and Fort Liard. Dolphus Jumbo talks at length. Pointed Mountain Gas pipeline development is the catalyst.

Part VI sums up the problems of looking for an economy. The circle is closed back in Yellowknife with the story of arsenic and the legacy of Giant gold mining. Traditional life still exists and celebrated by Dene games, independent hunting, self-belief and the memories of good life in the bush. Sacco closes his book with a final discussion with Paul Andrew at the Dene games. Eugene Boulanger tells a story about returning to Tulita and shooting a caribou after 22 years. He closes the circle with the souls of his ancestors.

Sacco’s artistic skills at representing their stories are impressive. Friends of mine recognize the images of people who he talks about: finely detailed images of northern camps and communities are recognizable.

The book has no table of contents, index or list of sources or references. His short notes on Dene languages and the Trout Lake naming are somewhat helpful. Readers may find his two-page list of acknowledgements of most interest, as they name his key interview subjects.

Anyone who worked during the early years of northern hydrocarbon development may be reminded of their own involvements on such projects as Polar Gas, Cross Delta, Canadian Arctic Gas Study Limited, Mackenzie Valley Pipeline, Norman Wells Project, Pointed Mountain Gas etc. So many others could have been interviewed for broader perspectives on what occurred during all those years. My main impression is how little has changed after so many years. I am reminded of a ship beam carving in an early Northwest Passage stranded ship, “Today is as yesterday. And as is today, so will be tomorrow.” I hope not.

¹ Sikstrom, C. B. 2000. Paddling the Keele in Rubberskin Boats. Kanawa Magazine. Summer: 61-67.
Yakaleya, Raymond. 1982. The Last Mooseskin Boat. The National Film Board of Canada. 28 minutes.
https://www.nfb.ca/film/last_moosekin_boat

Whence Came the Hydrocarbons?

Editor's Note: The following paper, "**Whence Came the Hydrocarbons?**" was submitted to Archives by the author, Sabrina Perić. It is an abbreviated version of her oral presentation to the Petroleum History Society at our 2024 Annual Meeting at the Petroleum Club on March 27th. This paper examines the work of petroleum scientists in general, and Canadian/American geologist Ted Link in particular, in speculating about and discovering the organic origins of petroleum.

In the mid-20th century, debates surrounding oil exploration focused on uncovering the genesis of hydrocarbons, which could facilitate the location of new petroleum reserves. How did hydrocarbons form? Were hydrocarbons biotic in origin – that is, the product of decomposing organic matter on our planet? Or were they abiotic – the product of physical processes either deep in Earth's core, or within other extraterrestrial bodies, such as the asteroids or comets that had crashed into the Earth and brought the hydrocarbons with them?

This talk examines the work of petroleum scientists, and the ways in which hydrocarbon genesis debates extended resource frontiers from the centre of Earth's layers to our whole planetary system.

I'm going to focus on one scientist in particular, Ted Link, a Canadian/American geologist at Imperial Oil, and the work he did to advance the biotic, or organic origins of oil, which is nowadays, generally accepted as fact. He was part of a wider group of North American scientists who promoted biogenesis over abiogenesis, which was more popular amongst Soviet scientists. North American geologists and scientists described a planet comprised of geological layers, one of which was the critical Devonian period, a geologic period of the Paleozoic, spanning 60 million years to the beginning of the Carboniferous. Bituminous content emerged, they argued, from the reefs of the Devonian period.

I. The Devonian origins of hydrocarbons:

Ted Link completed his degree in geology at the University of Chicago and, in 1918, was hired for exploratory work at Imperial Oil¹ in Canada. Link's biography and experience was fairly typical for the time: many geologists were Americans, trained at American universities, and they quickly found jobs at either rapidly expanding Canadian petroleum firms, or bi-national (Canadian and American) firms that operated around the globe. In the case of geology, American and Canadian science were deeply intertwined, and many of its actors moved back and forth across the border.

Link originally applied to work in Colombia for Imperial – where his brother, Walter, also worked. Instead, he ended up unexpectedly in Canada. Ted Link became one of Imperial's star geologists, participating in two major oil field finds within 20 years of one another – the first in Canada's Northwest Territories in the area today known as Norman Wells, and the second in northern Alberta, in a town called Leduc². In between these two finds, he returned to the University of Chicago and completed his Ph.D. in geology. At Imperial Oil, he rose through the ranks, and oversaw the discovery of the Leduc field as Chief Geologist for Imperial.

¹ Ted Link Collection, M-9449-1, Imperial Oil Archives, Glenbow Museum.

² Ted Link Collection, M-9449-31, Imperial Oil Collection, Glenbow Museum.
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As Chief Geologist, he put in great effort to systematize the process of exploration. In a 1947 report, Link argued that the question of the origin of oil was critical for petroleum industry: “if the locale and mode of origin of hydrocarbons could be solved, the finding of it would be greatly facilitated³,” he wrote. Link asserted that the most critical factor was the persistent search for oil possibilities in the Devonian layer⁴. Most important about Link’s assertions, however, was the idea that oil could be found wherever there were massive amounts of organic marine material. The productive Leduc Oil Field was an “example of bioherm growth”, as he put it, essentially, the fossilized remains of Devonian-era marine organisms; the remains of ancient reefs⁵. Bioherm growth”, as he put it, essentially, the fossilized remains of Devonian-era marine organisms; the remains of ancient reefs⁶.

By the 1940s, there were still fiercely competing theories about the origins of oil and other subterranean resources. Link was one of a group of scientists in the first half of the 20th century that expounded on the organic origins of oil. Because all major US shales at that point were found in Devonian strata, American petroleum scientists, along with Canadians and Brits, were amongst the most important promoters of organic origins. Alongside ideas about organic Devonian reef origins, non-organic, or abiogenic, theories of petroleum were also common amongst geologists, especially those in the Soviet Union, many of whom rejected organic origins. By the 1940s, there had already been competing theories about the origins of oil and other geochemical subterranean resources, and biotic origin stories were not uncommon. The earliest organic idea actually came from 18th century Russian scientist Mikhail Lomonosov, who, in his *Slovo o roshdenii metallov ot traseniya zemli*, wrote that “rock oil originates as tiny bodies of animals buried in the sediments which, under the influence of increased temperature and pressure acting during an unimaginably long period of time, transform into rock oil⁷.” So, some of the earliest biotic theories were actually Russian, but that shifted. Russian scientists began expanding non-organic theories in the 19th and 20th centuries. In the 1870s, Dmitri Mendeleev proposed that petroleum was actually created in the depths of the Earth from chemical reactions between water and iron carbides. But the real proliferation of abiogenic theories though occurred during and after World War II.

In 1951, Nikolai Kudryavtsev published *Against the Organic Hypothesis of Oil Origin*⁸ in response to a report published by Ted Link on the Devonian origins of what were then called, Alberta’s Tar Sands. Kudryavtsev argued that it was impossible for the organic hypothesis to account for the sheer amount of oil globally⁹. He argued instead that petroleum had to be formed through physical processes¹⁰. Kudryavtsev drew on the work of N.V. Sokoloff, who in 1890 argued that bitumen is of cosmic origin, formed initially during the consolidation of the planet, and enclosed within the Earth. In support of this idea, he cited the occasional finding of hydrocarbons in meteorites, which seemed, for him to exclude the possibility of an organic origin¹¹. Kudryavtsev and other Soviet scientists advancing abiogenic ideas, also found unlikely allies: Canadian astronomers, who ridiculed Link’s writings about the formation of oil in the Devonian period. In his text, *Frontiers of Astronomy*, Canadian-American astronomer Fred Hoyle wrote that “the presence of hydrocarbons in the bodies out of which the Earth is formed would certainly make the Earth’s interior contain

³ Ted Link Collection, M-9449-33, *Whence came the hydrocarbons?* Imperial Oil Collection, Glenbow Museum.

⁴ Ibid. Link asserted in fact, that the Leduc field “vindicated the belief of so many Alberta geologists that the Upper Devonian had promising oil possibilities.” (pg. 2)

⁵ Ibid, pg. 3-4.

⁶ Ibid, pg. 3-4.

⁷ Lomonosov, M. V. "Slovo o roshdenii metallov ot trjaseniya zemli." *Polnoe sobr. soch* 11: 1741-1763.

⁸ Кудрявцев, Н. А. "Против органической гипотезы происхождения нефти." *Нефтяное хозяйство* 9 (1951): 17-24.

⁹ Ted Link Collection, M-9449-33, Link-Kudryavtsev Correspondence, Imperial Oil Collection, Glenbow Museum.

¹⁰ Кудрявцев, Н. А. "Против органической гипотезы происхождения нефти." *Нефтяное хозяйство* 9 (1951): 17-19.

¹¹ Ted Link Collection, M-9449-33, *Whence came the hydrocarbons?* Imperial Oil Collection, Glenbow Museum.

vastly more oil than could ever be produced from decayed fish – a strange theory that has been in vogue for many years¹². Hoyle went on to argue against the idea that oil was a *finite* earth-bound resource. Instead, it was available infinitely everywhere. He wrote: “on the Earth, it is clear that water has been dominant over oil. On Venus the situation seems to have been the other way round, the water has become exhausted and presumably the excess of oil remains - just as an excess of water remains on the Earth¹³.” “On the basis of this research, I assume that Venus must be rich in petroleum gases. If and as long as Venus is too hot for the liquefaction of petroleum, the hydrocarbons will circulate in gaseous form¹⁴.” So basically, many Canadian astronomers at the time believed that Venus was a burning ball of steaming oil. And that petroleum as a basic building block of planets.

While the abiogenic theory of oil is thought of as a predominantly Soviet theory, and biogenic as North American, thus recreating stereotypical Cold War divides, it is important to note that Soviet and North American scientists both extensively corresponded and collaborated with one another. It is especially important to note that Canadian-based scientists, like Ted Link, played a crucial role in this discussion. Much of what I am talking to you about today emerges from archival documents that represent a 10 year correspondence between Kudryavtsev and Link, where they debated not only competing ideas about hydrocarbon genesis, but also how to best exploit new petroleum reserves in Alberta’s oil sands. Link shared information and engaged freely in his correspondence. I won’t have time to get so much into this today, but northern Alberta and its unusual deposits were a critical scientific site of engagement and did much to fuel scientific debate across the Cold War divide.

Despite the diversity of their opinions, Link and Kudryavtsev discursively extended the landscape of resource extraction, and petroleum-derived energy beyond the confines of our planet, to the far reaches of the solar system and beyond. To be clear, I am arguing that petroleum geologists, but perhaps resource scientists as a whole, have long been engaged in a kind of not only planetary thinking, but indeed beyond-the planet thinking, solar system thinking. And it was related to oil’s origins, location, and future extraction.

One of the difficulties, at that time, for both Link and Kudryavtsev was the fact that there was no ability to experiment and to successfully test their respective theories.

II. Lack of proof and laboratories:

Oil exploration, in the mid-20th century, was still largely a game of guessing and testing carried out by industrial geologists in often remote field settings. In an effort to more effectively locate potential oil deposits after World War II, North American and Soviet geologists did undertake laboratory experiments, in tandem with geochemists and physicists, to reproduce the conditions of oil’s genesis. These laboratory experiments were complete failures, and could not provide any evidence for either the organic or non-organic origins of petroleum. Link and Kudryavtsev even spoke of their futility in their correspondence. Ted Link wrote: “The question as to how much significance can, or should be placed on results obtained by performing laboratory experiments supposedly simulating conditions in nature is difficult to answer. Certainly I do not expect any of you to be naïve and to believe that the nature of the forces applied in the laboratory and their

¹² Hoyle, Fred. *Frontiers of astronomy*. London: Heinemann, 1955, p.38.

¹³ *Ibid*, p. 71.

¹⁴ *Ibid*, p. 369.

intensity, was in the same proportion to the size and texture of the deformed mass, as those which have [given] rise to the Foothills or Rocky Mountains¹⁵.”

In the history of science, laboratories are still privileged as critical sites of knowledge production and verification¹⁶. Even largely field-based sciences still find corroboration in laboratory work¹⁷. However, for processes that are planetary in scope – such as the formation of a geological layer, laboratories are less helpful – especially when there is not only a question of geographic scale (the planet) but also temporal scale (millions of years) and the scale of planetary forces (pressure, for example) that are unable to be reproduced in the confines of a lab.

In the case of biotic vs abiotic oil, because laboratory work could not confirm either genesis hypothesis, scientists had to rely on other tools to advance ideas about oil: their firsthand field experience and observations in oil-rich regions, but also their reputation.

III. *The Scientist-Illusionist in the Cold War*

So how did Ted Link work to help convince the scientific and broader public on the organic origins of oil?

First of all, Ted Link was a very prolific academic writer in his period. Despite having no further evidence than his success in locating oil deposits in Devonian layers, Link continued to publish (and republish) many of his arguments from his first papers about the origins of oil in the 1940s. He continued publishing his biotic theory of hydrocarbon origins in peer-reviewed journals, and he presented his ideas at peer-reviewed conferences and major symposia. He did this at both the annual conferences of major academic societies – the American Geophysical Union, Geological Society of America, American Association of Petroleum Geologists and so forth – but also major industry conferences – the American Association of Petroleum Producers and so forth.

Ted Link was also a prolific photographer – who meticulously documented all of his exploratory work in the field, photographing extensive evidence of what he stated was proof of organic oil. His prolific writing (yet largely unsubstantiated writing) accompanied by his thorough photographs brought his Devonian reef theory to life and gave it the power of (scientific) community acceptance.

Link’s science *sounded like a lot the other science* of the period. The logic and writing style that Link employed in this period very much operated within the acceptable scientific constraints of his discipline. Link was a proponent of organicism – an important philosophical perspective, especially amongst geologists of this period, that the planet was one living whole, a living organism that linked all parts of itself to the central life impulse of the world. Like his contemporaries, Link rejected theories of the Earth as modified by the outside (for example, he did not like this idea about hydrocarbons being brought to the Earth via comets, meteorites or other interstellar interlopers). Instead he favoured the authority of slow, progressive and internal

¹⁵ Ted Link Collection, M-9449-31, Imperial Oil Collection, Glenbow Museum. These arguments are actually pulled from a collection of reports read by Link at difference academic conferences from 1946-1947, especially including: Interpretations of Foothills Structures, Alberta, Canada, March 1947. Here there is a very interesting discussion on the last page, of what it means to replicate geologic movements in the lab, the lab as opposed to what happens in nature.

¹⁶ Latour, Bruno, and Steve Woolgar. *Laboratory life: The construction of scientific facts*. Princeton University Press, 2013; Traweek, Sharon. *Beamtimes and lifetimes*. Harvard University Press, 2009;

¹⁷ Helmreich, Stefan. *Alien ocean: Anthropological voyages in microbial seas*. Univ of California Press, 2009.

planetary change. This was also very much in line with Darwinian narratives about the slow progressive change of the Earth. The influence of Darwinian evolutionism and organicism are very much present in Link's writing. He even made a lot of the younger geologists at Imperial read Charles Darwin's *On the Origin of Species*. On the origin of oil, Link wrote that he favoured "the idea that the oil was not only reservoired in the bioherm, but was also generated within the reef itself." When one considers that in bioherms conditions ideal for the growth, death and accumulation of countless generations of countless organisms exist, why is it necessary to look for outside sources to explain the oil found within them? The concept of an environment where organisms would die because of unusual or catastrophic conditions, and thus wipe out an ecological assemblage to account for the generation of hydrocarbons, does not appeal to the writer nearly so much as the more plausible concept of an environment conducive to the natural growth of a fauna and/or flora, so that generation after generation would live and die by natural causes and accumulate almost in situ...¹⁸

Ted Link, in both his writing and his public speaking, was aware of the importance of performance and the creation of spectacle. He used this to great effect when advancing the biotic nature of oil. He dramatically tied the importance of oil exploration to any potential war effort, reflecting on his experience working on the CANOL project¹⁹. Link advanced the idea that Canadian oil fields should be exploited and pipelines built in the event of future war. In op-eds in papers like the Calgary Herald, he asserted that during the Second World War, North America was unprepared to meet its energy demands, and could therefore suffer if any future conflicts broke out²⁰. He therefore continually asserted the importance of determining the exact origins of oil for the purposes of oil exploration, which in the public's imagination, needed to be tied to the threat of war.

Link was himself a showman – a performer, especially during conferences. His talks drew attention, and he was referred to as a "salty" speaker by the president of the American Association of Petroleum Geologists (AAPG). He was known for his talks that drew large audiences²¹. But his showmanship was not only about his own oratory or other skills, but also about his skills at *organizing conferences as well*. He organized a massive conference in Calgary in 1960 that brought together Canadian, American and Soviet scientists to discuss advances in petroleum geology²². At the age of 63, Link organized one of the largest scientific conferences across the Cold War Divide, and, as a result, many became familiar with his work.

Scientists, for Link, were judged on the merit of ideas and not on their citizenship. Link was willing to converse and correspond with Soviet scientists – this alone made him an important hub for scientific exchange, and drew those like Kudryavtsev to discuss their theories with him.

In an important work, *Whence Came the Hydrocarbons?*, first published by the Bulletin of the American Association of Petroleum Geologists, Ted Link extensively engaged with both Soviet petroleum geologists and fellow Canadian and American astronomers. In this extensive piece, which then also featured several responses by prominent geologists and astronomers, Link attempted to synthesize key ideas from the hydrocarbon origins debate. Most extensively, he engaged the astronomers and attempted to join ideas about the extraterrestrial origins of oil with

¹⁸ Ted Link Collection, M-9449-31, Imperial Oil Collection, Glenbow Museum. Foothills Report, page 8.

¹⁹ Ted Link Collection, M-9449-26, Imperial Oil Collection, Glenbow Museum. See documents on March 14, 1949.

²⁰ Ibid.

²¹ Ibid, especially important to note is his impact at the AAPG meeting of 1957.

²² Ibid, see Calgary Herald article, January 11, 1960.

his own. In this piece, Link asserts that he can only agree with the extraterrestrial origin of hydrocarbons, if those hydrocarbons on meteorites, on comets formed much in the same way as they did on Earth. He writes: "If the reasoning submitted is sound and acceptable, we then are in a position to explain and make sure of the long established fact that hydrocarbons are found in meteorites, and this leads to the conclusion...that meteorites could be the fragments of a former much larger body, within our own solar system on which, before its disintegration, there existed hydrocarbons as we know them, and if hydrocarbons existed on them life must also have existed²³." Link was indeed suggesting that, if there were hydrocarbons on other planets, there must have also been, at some point, life on those planets from which hydrocarbons would have formed. Much like on Earth.

IV. Space: The Final (Resource) Frontier

In this talk, I've tried to show how Link's multi-decadal engagement with the biogenic theory of hydrocarbons created and authorized key words, forms, styles, communities in petroleum geology – especially about the formation of oil from marine organisms of the Devonian period.

I do want to mention that, while biotic hydrocarbon origins have become the standard fare in university geology textbooks, the debate over *abiogenic hydrocarbons never actually died*. The literature on Peak Oil caused a responsive resurgence of abiotic theories of hydrocarbons amongst scientists who even today contest the idea of Peak Oil, of climate change, and who also contest the non-renewable nature of fossil fuels. Recently, J.F. Kenney, a longtime petroleum geologist who has not only worked with all of the major petrocorporations based in Houston, but who is also a Fellow at the Joint Institute of the Physics of the Earth at the Russian Academy of Sciences, wrote that the theory of abiotic petroleum needs to be revisited for *it is not a matter of debate*. He emphatically argues that it was never actually disproven²⁴. Kenney writes that "The errors involved in predictions about the future availability of petroleum, [were] inevitably occasioned by an inappropriate application of the rococo hypothesis that petroleum somehow miraculously evolved from limited volumes of biogenic matter, [and only from this have we obtained] the very notion of such as a "limited, fossil" material²⁵." Kenney is not alone in advancing these ideas – there are quite a few geologists²⁶ and policy makers²⁷ now assert that the oil industry needs to consider other non-biological forms of petroleum reserves, and that "the extent of abiotic processes in hydrocarbon production is hardly known²⁸" (1827) – you can find these assertions through back issues of the journal *Energy Policy* over the last 10 years.

The most important proponent of abiotic oil, and a big fan of Kudryavtsev's work was astrophysicist Thomas Gold. In the 80s and 90s, a group of investors, including Sweden's national power company, Vattenfall, and the Gas Research Institute, provided Gold with resources to test his theory by drilling deep boreholes into the earth in central Sweden, in search of abiogenic oil. While the deep drilling did not offer conclusive proof for abiogenic oil, many of Gold's proponents, especially in private industry, are still pursuing his ideas in experimental form. In *The Deep Hot*

²³ Ted Link Collection, M-9449-33, *Whence came the hydrocarbons?* Imperial Oil Collection, Glenbow Museum, p 1398.

²⁴ Kenney, J. F. "Considerations about recent predictions of impending shortages of petroleum evaluated from the perspective of modern petroleum science." *Energy World* 240 (1996): 16-18.

²⁵ *Ibid*, p. 6.

²⁶ Höök, Mikael, Ugo Bardi, Lianyong Feng, and Xiongqi Pang. "Development of oil formation theories and their importance for peak oil." *Marine and Petroleum Geology* 27, no. 9 (2010): 1995-2004.

²⁷ Tsatskin, Alexander, and Oded Balaban. "Peak oil in the light of oil formation theories." *Energy Policy* 36, no. 6 (2008): 1826-1828

²⁸ *Ibid*, p. 1827.

Biosphere, Gold asserted that hydrocarbons are known to be abundant on other planets where no life is presumed to have flourished in the past. There must therefore be nearly limitless pools of liquid primordial abiotic hydrocarbons at great depths on Earth.

Industry has also been intermittently interested in abiogenesis. Shell Canada, under Clive Mather's tenure as CEO, engaged in abiotic research. In a television interview on ABC news entitled: Myth: The World is Running out of Oil, Mather, discussed Gold's work and stated that we had not explored all possible routes for hydrocarbon formation, and that "the solar system's supply of bitumen hydrocarbons was [surely] almost infinite".

So, in the hydrocarbon origin debate – understanding oil as biotic, as a finite resource, as well as abiotic, and potentially infinite – both sides of the debate actually were involved in and successful in conjuring a broader interplanetary scale, where humans could exploit resources to serve their own energy needs. It was actually through this debate over the whole 20th century that resource frontiers and imaginings extended beyond our very local energy projects, to a landscape where the substances of energy – hydrocarbons in this case – make up a fundamental universal fabric. This is also a legacy of Ted Link's – he very much contributed to the creation of today's much broader resource frontiers. When we discuss the exploitation of resources 'underground,' we can safely say that 'underground' is not a literal demarcated separated space. To the contrary, it is expansive, both under the ground, and out in our solar system.
