The Oil Sands Pioneers of Alberta*

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Introduction

Wildfires might be what come to mind when most people think of northeastern Alberta, owing to recent news coverage of the record evacuation of about 88,000 people from the Fort McMurray area. Current events notwithstanding, however, northeastern Alberta is historically best known for its huge bitumen resources.

Here the world's largest bitumen accumulation occurs, with initial established reserves of 177 bbl, and remaining established reserves of 165 bbl. The largest bitumen deposit is in the Athabasca oil sands area, which includes the Fort McMurray area (Figure 1).

Early Exploration and Entrepreneurs

Although debatable, there is some evidence that "pre-contact" First Nations people used the heavy oil seeping from bitumen outcrops for waterproofing of clothing, canoes and heating.

One of the first Europeans to see oil sands was Chief Factor Henry Kelsey at the York Factory trading post on Hudson's Bay in Manitoba. In 1719, a Cree native guide named Wa-Pa-Su gave Kelsey a sample of bituminous sand. Later in 1778, the notorious explorer Peter Pond was credited – along with charges of killing two people while dueling – for giving the first recorded description of the Athabasca oil sands.

In 1848, the Scottish explorer Sir John Richardson did the first geological assessment of oil sands along with his expedition in search of his fellow explorer Sir John Franklin, who had gone missing during his 1845 expedition in search of the Northwest Passage (the wreckage of his two ships wouldn't be discovered until as recently as September 2014 and September 2016, respectively, the latter owing to local Inuit oral history and knowledge).

Richardson identified the principal component of the oil sands as quartz and correlated them to the Devonian Marcellus Shale of New York. From the late 1800s to early 1900s, the Canadian Dominion Department of Mines sent field parties to drill and map the oil sands. This work

was led by Sidney Ells (Figure 2), an engineer who located and mapped all of the bituminous-sand outcrops, drilled hundreds of shallow cores and took bulk samples for testing. Ells' work became the key baseline study for all the following detailed work in the area.

By the mid-1900s, an early oil sand industry included the Abasand plant within Fort McMurray and the Bitumount plant about 90 kilometers north along the banks of the Athabasca River.

One of the more colorful characters at this time was Count Alfred von Hammerstein (Figure 3). Originally born in Germany, he came to Canada for the Klondike Gold Rush in the Yukon. He only got as far as northern Alberta where he saw the bituminous-sand outcrops along the Athabasca River. He then moved back to Edmonton, and in the summers he and his team drilled for oil beneath the "tar sands." In 1906, they used a cable rig to drill for oil in the Devonian limestone along the banks of the Athabasca River, hoping to find "pure oil pools" beneath the degraded, oil-sands outcrops.

They never found oil, but did find salt; so they set up a salt extraction plant. Hot water was pumped down a vertical well to dissolve the subsurface salt, which was then pumped up through a producing well to the surface. The salt brine was then evaporated and transported by rail for use as table salt.

Another prominent promoter was R.C. Fitzsimmons (founder of Bitumount), who saw many uses for bitumen, including pavement, fuels, roofing and medicine. However, he had to shut down operations at Bitumount due to insolvency and in 1938 fled Canada to avoid his creditors.

Max Ball was the founder of the Abasand plant. He graduated from the Colorado School of Mines, where he studied engineering, then worked for the U.S. Geological Survey, mapping coal in Wyoming. In 1930, Ball was in Edmonton when the Alberta Research Council (ARC) plant closed, and Ells convinced him to prospect for oil sands on the Horse River. Ball purchased the old equipment from the ARC plant, moved to Fort McMurray and started building the Abasand plant in 1930 and completed it in 1936. Abasand produced more than 250 tons of oil sands per day and was only shut down after World War II, when demand for bitumen products declined. Ball later became director of the Oil and Gas Division of the U.S. Department of the Interior.

Later University, Government and Industry Work

John A. Allan, a professor of geology at the University of Alberta, published on the oil sands in early government reports on the mineral resources of Alberta. In 1929, Karl Clark at ARC (along with Sidney Blair) patented his hot-water process for extraction of bitumen from the oil sands. In 1930, Clark started producing bitumen at the Bitumount plant, pumping up to 300 bpd. The product was used for paving roads in Edmonton and Jasper and as roofing. In 1949, Clark made "The Athabasca Tar Sands" known to a world audience by publishing a popular article in Scientific American. That same year, a commissioned detailed government report by Blair confirmed that bitumen recovery from the oil sands could be profitable.

In 1947, Ned Gilbert, a junior and the only Calgary employee of Sun Oil (now Suncor Energy), developed prospects in northeastern Alberta, obtaining the first two oil sands permits in the Bitumount area and later leases in Suncor's present Firebag in-situ area. Gilbert heard a rumor

that the Sun Oil head office in Philadelphia was planning "to get out of the oil sands leases." As a very young junior he had the courage to write to the leadership team in 1951 to persuade them to acquire more than 50,000 acres at a bargain price of $1.40/ acre. The estimated resource was 800 million barrels of bitumen.

In 1957, Maurice Carrigy joined the ARC and began working with the geology department. After decades of work, the detailed bedrock geology of northeastern Alberta (Map 240) was published by Green, Mellon and Carrigy (along with a number of ARC reports and bulletins). This became an updated baseline geology that, together with Ells' earlier work, provided the basis for much of the later geology, exploration and development in the Athabasca oil sands area.

A Changed Game

Throughout the 1970s, most of the oil sands industry was surface mining. However, in Alberta, only 20 percent of the oil sands are in areas with thin overburden such that it can be surface-mined; the remaining 80 percent is too deep and would need to be recovered by in-situ technologies. In 1978, Carrigy and Clement Bowman (founding chair of Alberta Oil Sands and Technology Research Authority, or AOSTRA) heard about Roger Butler's work on thermal in-situ technologies.

Butler (Figure 4) developed his ideas while at Imperial Oil in the 1970s and later took over as head of technical programming for AOSTRA. Butler is considered the "Father of SAGD" (i.e., steam-assisted gravity drainage). At the time of early development, industry considered SAGD a "boondoggle." However, AOSTRA embraced the concept with the building and running of the AOSTRA Underground Test Facility (UTF) northwest of Fort McMurray. The results from UTF made a "game changer" for in-situ oil sands recovery, and a success story of technological breakthrough for unconventional energy development.

In all cases, with the development of the oil sands industry in Alberta, it was the collaboration of the entrepreneurs, the government, university scientists and industry-players that brought this unconventional energy-industry to fruition. Without the entrepreneurial spirit and dogged determination, this development would not have been as successful as it is to today. It is the multidisciplinary approaches and collaboration, particularly with the AOSTRA model, that make this a success story.

Author

Frances J. Hein (Figure 5) is with the Alberta Geological Survey (Alberta Energy Regulator) where she has worked on oil sands for about 19 years. She was co-editor of the AAPG Studies in Geology 64 on oil sands and heavy oil; in 2014, she received the Canadian Provincial and Territorial Geologists' national award for her work on oil sands and other unconventionals.

Key Reference

Hein, F.J., 2016, Oil sands pioneers: How scientists & entrepreneurs made the unconventional more "conventional." Website accessed January 1, 2018, http://ags.aer.ca/document/Presentations/CON_AlbertaOilSandsEntrepreneurs.pdf.

Selected Reference

Green, R., G.B. Mellon, and N.A. Carrigy, 1970, Bedrock geology of northern Alberta: Research Council of Alberta Bulletin, 7, 62p.Map accessed January 1, 2018, http://ags.aer.ca/document/MAP/MAP_024.PDF,

Selected Websites

http://www.history.alberta.ca/energyheritage/sands/sources.aspx. Website accessed January 1, 2018.

http://www.history.alberta.ca/energyheritage/sands/unlocking-the-potential/the-federal-government/sidney-ells.aspx. Website accessed January 1, 2018.

http://www.history.alberta.ca/energyheritage/sands/underground-developments/in-situ-development/roger-butler.aspx. Website accessed January 1, 2018.

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Figure 1. Topographic map of Alberta, with highlights showing the Athabasca, Cold Lake, and Peace River oil sands deposits.

Figure 2. Signed photograph of S.C. Ells, at “McMurray Tar Sands,” 1928 (from Provincial Archives of Alberta A12023).

Figure 3. Alfred von Hammerstein (from Alberta Heritage, 2000).

Figure 4. Roger Butler, “Father” of SAGD” (steam-assisted gravity drainage).

Figure 5. Frances J. Hein, Alberta Geological Survey (Alberta Energy Regulator).