



MINES BRANCH  
DEPARTMENT OF MINES,  
OTTAWA, CANADA.

A WORLD SURVEY OF RECENT OIL SHALE DEVELOPMENTS

by

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In many parts of the world there are very large deposits of what are known as oil shales. These deposits consist essentially of mineral matter of a clayey or slaty nature, containing widely varying quantities of organic matter, which, when heated, undergoes decomposition with the production of crude oil and ammonia. Many attempts have been, and are being made, to obtain oil from oil shales in commercial quantities and it is the more recent of these developments that are the subject of this paper. Generally speaking, the greatest activity has taken place in those countries which must depend on imported petroleum for their requirements, and has been prompted by the desire to render themselves less dependent on foreign supplies of this important commodity.

World Production: The accompanying table<sup>1</sup> has been compiled to show the production of oil shale since 1919 in the various countries that are exploiting or attempting to develop their oil shale resources. With the exception of Scotland and Esthonia, and possibly Manchuria in the near future, the production is still quite small, but more countries are commercially interested in oil shale than is generally realized. It will be noted that in 1919 the Scotch production was about 95 per cent of the total, but less than 80 per cent by 1928-9. During the same period the Esthonian production had risen from almost nothing to nearly 18 per cent, the remaining 2 to 3 per cent being mainly from France and Spain. The recent developments in the different countries are reviewed hereunder.

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1 "Mineral Resources of the United States, U.S. Geol. Sur., (Annual reports).

"Annual Reports of the Secy. for Mines, Mines Dept., (Great Britain).



WORLD PRODUCTION OF OIL SHALE.  
METRIC TONS.

Mineral resources of U.S.  
and other publications.

	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
New South Wales	25861	21341	33009	23844	12226	652	-	-	-	-	-	-
Tasmania	610	142	882	41	1119	1601	853	2161	3201	2637 (6600)	4368 (4630)	-
Estonia	9664	46111	95514	138922	214099	233631	288104	431678	397600	446216	518000	-
France	49127	69000	64693	61000	62142	70968	67127	69190	X	X	76000	-
Germany (Bavaria)	-	-	-	33	1202	530	400	10	480	670	603	-
Italy	10563	16325	3030	5476	5662	2987	2700	10290	12090	7388	1331	-
Russia	4533	30366	19300	18500	29799	11684	1130	4095	9434	562	-	-
Spain	5527	X	X	X	X	X	67500	X	54337	54110	54900	-
Sweden	-	-	(328)	(353)	(158)	(nil)	(12)	(51)	(22)	-	-	-
England	620	1750	-	-	71	-	-	-	-	-	-	-
Scotland	2807615	2886455	1896860	2645790	2902960	2504390	1991250	2047000	2038000	2023609	-	-
Canada	-	-	100-200?	-	-	26	-	-	-	100?	-	-
United States	X	8975	2062	X	9300	21200	X	5500	7600	1929	1767	-
Manchuria												
TOTAL	2914120	3071490	2113816	2893959	3221953	3246259	2932204	2514135	2531764			

X DATA NOT AVAILABLE. FIGURES IN BRACKETS REFER TO SHALE OIL.

BRITISH EMPIRE

Canada. During the last 2 or 3 years there has been a renewal of interest in the oil shales of the Maritime Provinces, three companies having erected experimental plants - one in New Brunswick and two in Nova Scotia - for treating these shales.

In New Brunswick the Maritime Education Company, which was organized to develop the deposits near Rosevale in Albert county, completed the erection of their plant in 1928, but owing to various legal and financial difficulties, never got into production. The layout consists of crushers, retort house with a lead-jacketed cylindrical retort, Cottrell precipitators, condensers, storage tanks, and a small "Wade" hydrogenation or cracking unit. In addition there is a boiler and power house, machine, carpenter and blacksmith shops, as well as living accommodation for about 50 men. Financial reorganization has taken place and it is hoped to obtain the capital necessary for starting operations in the near future.

In Nova Scotia, the Torbanite Products, Limited, completed the erection of their plant in 1930, the first run being made in July of that year. This plant is on the outskirts of New Glasgow, close to an exposure of oil shale into which a tunnel has been driven, and comprises crushing and hoisting equipment, Ginet retort, condensers and storage tanks, as well as pulverizers and bagging equipment for the spent shale, for which the company claims to have a ready market. The company, however, had a bad fire, resulting in the loss of most of their buildings, soon after they started operations, and at the present time it would appear that their future plans are still indefinite.

At McLellan Brook, about five miles from New Glasgow, The Canadian Torbanite and Oil Products, Limited, erected a small experimental unit in 1929, which operated for two or three months. The equipment consists of laboratory building, retort house with two small internal combustion retorts, condensers and storage drums. Most of the work in 1930 consisted of refining studies of the crude oil produced in 1929, and according to a press report British interests contemplate the erection of a 1000-ton a day plant here during 1931<sup>1</sup>.

England. In England,<sup>2</sup> the only recent development reported was the unsuccessful attempt in 1919-20 of the English Oil Fields, Limited, to exploit the large shale deposits of Norfolk. A large plant was erected and a certain amount of oil was produced, but the company went into liquidation after operating for a short time.

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"Engineering Institute of Canada News", Jan. 15, 1931.

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"Pet. Times", London, Vol. 4, p. 261 (1920), Vol. 4, p. 239.,  
"Oil Paint & Drug Reporter", Vol. 99, No. 5, p. 18 (1921).

Scotland. In Scotland<sup>1</sup>, the distillation of shale started about 1850, and was carried on with great success till after the Great War when rising costs and falling prices caused a curtailment of operations. As a result of an amalgamation with the Anglo-Persian Oil Company, under the name of Scottish Oils, Limited, distillation of shale is still carried on in conjunction with the refining of imported crude. The refineries at Grangemouth and Uphall, with capacities of 2,000 and 3,000 barrels a day respectively, refine imported Persian crude and refineries at Pumpherston and Oakbank with a total capacity of approximately one million barrels a year handle shale oil exclusively. The position of the Scottish shale industry has improved greatly since the spring of 1928 when a duty of fourpence per gallon was imposed on imported gasoline. Cracking units have been installed in order to increase the gasoline output at the expense of the heavier oils, the first one starting operations in 1930, but the decrease in the value of the other products, namely, ammonium sulphate and paraffin wax, has largely nullified the good effect of high gasoline yield. According to a recent press report the British Cabinet were considering an 'oil quota' plan for aiding the Scottish shale industry, whereby consumers would be compelled to use a certain proportion of home-produced gasoline. The present hopes for the Scottish shale industry are based on the vigour which is being displayed in devising new methods to meet changing conditions.

Australia. In Australia<sup>2</sup> no permanent industry has as yet been established in spite of the fact that the rich oil shales of New South Wales were worked as long ago as 1865. In 1908 the Commonwealth Oil Corporation began the construction of a plant at Newnes, consisting of a bench of 64 Pumpherston retorts, which operated from 1911 to 1912. In 1914 this company was reorganized as John Fell and Company. New retorts were installed and with the assistance of a shale oil bounty the company continued operations till 1923-24 when it became unprofitable due to high labour costs and low prices of crude oil. It is reported that the Broken Hill Syndicate and associated companies have an option on the plant at Newnes and are organizing a company to resume operations. It is also reported that successful tests have been conducted at Epping, New South Wales, of a new type of retort, and that a company is being organized to erect four of these retorts at Newnes, which, it is expected, will produce 10,000 gallons of crude oil per day. The grant of 100,000 pounds that the Australian Government has set aside to assist in restoring the shale industry lends additional interest to these reports.

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<sup>1</sup>"Pet. Times", London, May 1930, p.794; March 14, 1931, etc., Jan. 24, 1931.

"U.S. Commerce Report", Dept. of Commerce, April 6, 1931.

<sup>2</sup>"Oil Shale", Bull. 210, U.S. Geol. Sur., M. J. Gavin.

"Pet. World", Oct. 1927, p.390; June 1928; Oct. 1928.

"Pet. Times", Jan. 17, 1931; May 16, 1931.

"Engineering", March 20, 1931, p.385.

In Tasmania<sup>1</sup>, the Director of Mines reports considerable activity. The Tasmanite Shale Oil Company, the Australian Shale Oil Company, and the Goliath Cement Company at Railton are all engaged in experimental work.

New Zealand. In New Zealand<sup>2</sup>, a syndicate has been formed to try and reopen the Orepuki oil shale works that were in operation about 25 years ago, and which closed down owing to removal of the bounty on shale oil.

South Africa<sup>3</sup>. In South Africa torbanites and oil shale appear to be widely distributed. The Vergelegen Shale Oil and Mineral Company is reported to be planning large scale exploitation in Natal and it is reported that a plant has been ordered from Scotland. The Transvaal Oil and Petrol Industries, Limited, has been formed in Pretoria to develop the torbanites of the Ermelo district and according to reports a pilot plant has been in operation from which crude oil has been obtained at a cost of 5 cents a gallon (including mining costs).

#### EUROPE

Esthonia. Great interest has been taken in the shale deposits of Esthonia<sup>4</sup> during the last few years, and the annual production now amounts to more than half a million tons. The state operates one mine and six others are operated by private companies, the greater part of the output being used directly as a fuel for locomotives, power plants, cement factories, etc., only about 10 per cent being retorted for the production of oil. There are at least 3 distillation plants in operation; (1) The state plant at Kohtla which uses Pintsh retorts; (2) The Esthonian Oil Shale Company plant near Pussi, where the shale is distilled in perforated waggons which pass through an internally heated tunnel; and (3) The New Consolidated Goldfields of London, Ltd., who are reported to have had 6 Davidson rotary retorts in operation at Kohtla since June 1931, refined gasoline and other products being made from the crude oil. It is reported that the government gasoline cracking plant will soon be in operation and will produce 4000 tons of gasoline a year, and that another 5000 tons a year will be produced at the plant at Pussi. As the domestic requirements amount to less

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<sup>1</sup>"Chemistry and Industry", Sept. 27, 1929, p. 940.

"Pet. World", June 1928, p. 226.

"Pet. Times", Feb. 12, 1927.

"Min. Resources No. 8", Dept. of Mines, Tasmania.

<sup>2</sup>"Pet. Times", Aug. 16, 1930.

<sup>3</sup>"Jour. Inst. Pet. Technologists", Oct. 1930.

"Pet. Times", Dec. 27, 1930, p. 1043.

"Pet. Times", July 25, 1931.

"Mining & Industrial Magazine of South Africa, July 8, 1931, p. 367.

<sup>4</sup>"Colliery Engineering", Oct. 1930.

"Pet. Times", July 19, 1930, July 18, 1931, Oct. 31, 1931.

than 7000 tons a year, a surplus will be available for export.

France. In France<sup>1</sup>, shale has been distilled since 1845 - the principal deposits being at Autun (Saone and Loire) and Bruxiere-les-Mines (Allier), both of which have been worked continuously from about 1860 till after the Great War. At present only the plant at Autun is in operation. In 1930 this plant retorted 76,000 tons of shale, with the production of about 40,000 barrels of oil. It is reported that an attempt is now being made to have the French Government provide assistance in re-starting operations at the Allier deposits.

Italy. In Italy<sup>2</sup>, deposits of oil shale have been known for some time but very little information is available regarding them. With the assistance of a government contract and a small bounty on production, steps are now being taken towards the erection of a plant at Rugasa in Sicily, capable of producing 50,000 tons of crude oil from the Sicilian deposits of asphaltic rock.

Soviet Russia. In Soviet Russia<sup>3</sup>, oil shales are widely distributed, the deposits near Leningrad and in southern Russia being the best known. The shales near Leningrad are used as raw materials for gas manufacture and also directly as a fuel, but information is very meagre regarding any developments in other parts of the Soviet Russia Republic. Near Shegloosk, Siberia, an experimental retorting plant has been erected to treat the local shales. This is reported to be the first shale plant to be built in Siberia.

Spain. In Spain<sup>4</sup>, a plant has been in operation for the last ten years at Puertallano near Madrid, which produces about 3500 gallons of oil per day from which gasoline, kerosene and the usual refined products are obtained.

Sweden. Sweden<sup>5</sup>, has abundant deposits of bituminous shales which due to its richness in potash and alumina have been used from the seventeenth to the end of the nineteenth century as raw material for the preparation of alum.

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<sup>1</sup> "Industrial Chemist", 1926, pp.391 & 445.

"Chemie & Industrie", Special No. May 1923, pp.398-410.

"Pet. Times", May 16, 1931, p.718.

<sup>2</sup> "Pet World", May 1931, p.152.

<sup>3</sup> "Shale Oil", R.H.McKee (Chem. Cat. Co., N.Y.)

"Pet World", Aug. 1931, p.263.

<sup>4</sup> "Eng. & Min. Jour. Press, Vol. 115 (1923) pp.326-7.

<sup>5</sup> "Pet. World", Dec. 1929, p.459.

"Pet. Times", March 1, 1930.

"Pet. Times", May 23, 1931, p.741.

For the last 50 years the bituminous content of these shales has attracted a certain amount of attention as potential raw material for the production of oil and during the last few years a number of small experimental plants for the recovery of the oil have been erected. At the present time, according to press reports, there is a 50-ton per day plant at Kinnekull which can produce oil at a lower cost than that of imported oil. This plant is situated in southwestern Sweden on the shores of Lake Vanerin, and it is reported that the Swedish Government contemplates taking over its operation as the Government Committee appointed to investigate the Swedish shale oil industry recommended that the Government purchase the plant as its maintenance is considered of vital importance to the Swedish navy.

#### ASIA.

Manchuria. The oil shale deposits at Fushun<sup>1</sup>, near Mukden have aroused great interest in Japan, where the desire to find a native source of oil is very keen. Owing to the fact that they overlie a large open-cut coal mine which is being worked by the Southern Manchurian Railway, mining costs are considerably reduced. Although they are of very low grade, yielding only about 13 gallons per ton, such large quantities have to be removed that the Japanese Government have decided to retort them for their oil content. A plant has been erected consisting of eighty 50-ton retorts in two sections, each section containing a double row of 20 retorts, side by side, the distillation being effected by a combination of low temperature carbonization and total gasification. It is estimated that this plant will produce 69,000 tons of crude oil and 18,000 tons of ammonium sulphate annually. The oil is exported to Japan and refined there, a large amount being required for the Japanese navy and the ammonium sulphate can be disposed of either in Japan or southern China. Although starting early in 1930, the plant was not in full operation till near the end of the year, consequently figures regarding output and costs are not yet available, but if they prove satisfactory, the plant will in all probability be considerably extended, as it can handle only about a quarter of the shale that is removed in mining the annual coal output of 3 million tons.

#### UNITED STATES

In the United States, where much interest was aroused in oil shale developments just after the war, the most important recent development has been the operation of the Bureau of Mines experimental oil shale plant, which includes both the retorting equipment near Rulison, Colorado, and the small-scale refinery and research laboratories at the University of Colorado at Boulder, Colorado. The plant at Rulison was in operation

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<sup>1</sup> "Fuel in Science and Practice", March 1929, p.133.

"Pet. World", Feb. 1930, p.58.

"Pet. Times", Oct. 1, 1927.

"Pet. Times", Sept. 13, 1930.



from September, 1926 to July, 1927, and from May, 1928 to June 1929, during which time about 5,000 tons of shale were retorted with the production of about 100,000 gallons of crude oil. The retorting plant at Rulison includes two retorts (a pumphorston and one of American design known as the N-T-U) boiler house gas producer, turbogenerator set, machine shops, etc., office and laboratory building as well as a certain amount of living accommodation. The shale for the retorts was obtained from an escarpment about one mile distant and 2,800 feet above the plant site, and transported to the retorts by aerial tramway. The Pumphorston retort is well known and does not require description here, but the N-T-U is a comparatively new design, the main feature of which is distillation by direct combustion of part of the charge, regulated by admission of air and return gases. The work done at the plant at Rulison has demonstrated that shale oil can be produced with reasonable satisfaction from American shales by retorts of types available for large scale operation. As a result of the work done at the refinery and laboratory at Boulder, methods have been found for refining shale oil and obtaining a gasoline with low sulphur content and good anti-knock properties without undue refining losses. A very full description of the work carried on by the United States Bureau of Mines at their experimental plant in Colorado is given by M. J. Gavin in Bulletin 315 of the Bureau of Mines.

In northwestern Colorado, there may be seen the remains of a large number of oil shale plants which either through poor design or insufficient capital never went beyond the experimental stage, a typical one being the plant of the Washington Shale Oil Company on Conn Creek near Debeque. This company used an inclined retort in which the shale was distilled by cascading over heated baffles, the oil vapours leaving by means of off-takes provided at the side of the retort.

The only other large scale developments which took place in the United States were in Nevada and California. In Nevada<sup>1</sup>, Mr. Catlin built a plant near the town of Elko; the main features being two retorts with a capacity of 100 tons per day, which operated on the same principle as the N-T-U, namely, internal combustion, but were continuous in operation instead of intermittent. This plant operated for two or three years, and is reported to have produced more than a million gallons of crude oil and marketed a wide range of refined products.

In California<sup>2</sup>, the N-T-U Company erected and operated a plant near Casmalia consisting of four 40-ton retorts and which was in operation for about four years from 1923 to 1927, and during 1926 and 1927 produced about 160 barrels of shale oil per day. Both of the above plants ceased operations owing to the low price of crude oil caused by the excess production in the United States during the last few years.

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<sup>1</sup>The Gas Engineer, May, 1927, pp.112-3.

Railroad Redbook, Vol. 42, pp. 7-9, (1925).

Chemical & Metallurgical Engineering, Vol. 31, No. 20, p.770, (1924).

<sup>2</sup>Jour. Inst. of Pet. Tech., August, 1926, p.371.

Pet. Times, April 16, 1927.

SUMMARY.

During recent years, over three-quarters of the world's production of shale oil has been from Scotland. In other parts of the British Empire the production has been and still is negligible. The most promising deposits appear to be in Australia, but here, as elsewhere, low prices of petroleum products and high labour costs seem to stand in the way of successful exploitation. In Canada, as long as adequate supplies of cheap petroleum can be imported from the United States and abroad, there is no justifiable incentive to start development of oil shale deposits.

On the continent, the greatest advance seems to have been made in Esthonia, where the rapidly growing production may soon equal that of Scotland. In Esthonia, by far the largest part of the shale mined is burned directly as fuel. France and Spain seem capable of maintaining their production of 50 to 70 thousand tons of shale per year. Italy may substantially increase her annual production of 10,000 tons if developments in Sicily materialize, and as for Russia, it is very difficult to forecast future production.

Manchuria is by far the largest potential producer and if present operations are successful, the future output may possibly rise to five million tons of shale per annum, especially in view of the Japanese policy with regard to the fuel oil supplies for their navy.

In the United States, where interest was aroused in oil shales after the war, when a shortage of petroleum was feared, a great deal of development work was carried out. This has all ceased due to the unexpectedly large production of the recently discovered oil fields.

Generally speaking, at the present time, oil shales as a source of oil are somewhat under a cloud due to the over-production of crude petroleum, but they are to be considered a valuable reserve that may be drawn upon when economic conditions warrant their development.