OIL SHALE RESOURCES OF TASMANIA.

A. - INTRODUCTION.

Oil Shales occur chiefly in the north central and north western parts of the State.

Two quite distinct types occur viz. Tasmanite Oil Shale and the black shales of Preolenna and Barn Bluff. Of these the Tasmanite fields have by far the greatest known extent and have been the subject of a greater amount of testing.

Companies have operated in the Railton-Latrobe district since 1910 and numerous types of retorts have been tested. Complete success has not been obtained but this can be attributed to failure of capital resources as well as to unsuitability of retorts.

At the present time two companies are operating with different retorts and success is claimed for both types.

B. - THE TASMANITE OIL SHALE FIELDS.

(1) QUANTITY OF SHALE.

The first important survey of these fields was made by W.H. Twelvetrees in 1911, his report being included in Tas. Geol. Surv. Bulletin No. 11. The estimates of reserves based on geological data were

Mersey	District	7,600,000 tons.
Nook	"	800,000 "
Minnon	"	3,600,000 "

In subsequent years the shale was found in other districts such as Quamby Bluff and Oonah and a considerable amount of mining and drilling had been carried out. A survey was made by A. McIntosh Reid in 1923, and the reserves were calculated on geological data to be as follows.

	Actual Reserve. Tons.	Probable Reserve. Tons.
Latrobe-Railton	6,260,000	3,460,000
Other Areas		3,865,000
Native Plains	3,000,000	4,500,000
Kimberley		2,026,000
Merseylea		4,500,000
Quamby Brook	211,250	1,043,000
Beulah	387,400	1,490,000
Nook	260,000	3,620,000
Paramatta	22,250	2,400,000
	10,140,900	26,904 000

In addition a reconnaissance was made of the recently discovered Oonah field and an estimate of 6,000,000 tons arrived at.

(2). OIL CONTENT OF SHALE.

W. H. Twelvetrees (Bull. No. 11) from data available in 1911 adopted the figure of 40 gallons of crude oil per ton of shale as the average yield of the shale. This was based upon laboratory tests which showed 29 to 50 gallons per ton and other tests which gave 44 to 65 gallons per ton. He also stated that 35 to 36 gallons of refined oils could be obtained by distillation and fractionation.

A practical Test carried out at the Scottish works in 1910, gave the average content of the three portions of the bed as 33.67 gallons per ton. Neglecting the poorer band, the average content would have been 41 gallons. The percentage recovery was not given.

A. McIntosh Reid (Min. Res. No. 8) quotes results analyses of average samples which ranged from 11.40 to 65 gallons per ton. These included outcrop samples (which are not truly representative, mudstone bands &c.

In 1924, a test in a small Bronder retort in Melbourne gave yields of 37.5 and 39.0 gallons per ton with a percentage recovery of 85.6 and 90.0 compared with the oil content of 43.75 gallons per ton obtained by a distillation test at the Victorian Mines Department.

In 1926, in a test by the Australian Shale Oil Corporation supervised by Mr. Stanley Jones, a three days run gave 41.5 gallons per ton of crude oil and 3.65 gallons per ton of naptha collected by scrubbing with crude oil, or a total of 45.15 gallons per ton.

In 1925, samples were tested in England in the Crozier retorts. The average oil content by laboratory tests was 45.67 gallons per ton and a recovery of 42.1 gallons per ton (which equals 92.1% recovery) was made in the retorts .

The average grade would have been more definitely determined by extended treatment over a period of time when run-of-mine shale was used. The results of such long tests as have been made are not, however, available. The tests and analyses quoted above indicated an oil content of approximately 40 gallons per ton, but whether this figure will be increased or decreased by actual working conditions remains to be determined.

OIL CONTENT OF SHALE.

W. H. Twelvetrees quotes reports by Messrs. Esdaile and Black on tests in 1901 to determine what prpducts could be obtained by fractionation from the crude oil. The results of these tests are as follows (expressed in gallons per ton of average shale)

For Tasmanian Shale & Oil Syndicate 1901.	ESDAILE.	BLACK.
Petroleum Spirit	5.626	6.429
Light Burning Oil	5.754	6.355
Heavy " "	3.335	2.827
Light Lubricating Oil No. 1	1.979	3.659
" " " " 2	4.705	5.027
" " " " 3	.....	1.311
Medium " " " 1	4.552	4.873
" " " " 2	3.005	2.468
" " " " 3	3.200	2.445
Heavy Lubricating Oil " 1	2.349	
" 2	2.135	
	36.640	35.394

In 1910, W.J. Hall, Manager of Tasmanian Shale & Oil Company, considered that he would obtain from the crude oil 11% Motor Spirit, 10% Turpentine Substitute, 9% Engine Oil and 70% fuel oil.

The test in the Pumpherston Retorts in Scotland in the same year indicated that the crude oil would yield.

Naptha	1.53%
Burning Oil	10.50%
Fuel Oil	30.15%
Heavy Grease Oil	25.10%

From the test in Crozier Retort, it was estimated that each ton of shale would yield

Motor Spirit	5.73 gls.	(including 3 gls.
KEROSENE	8.64	from scrubber).
Fuel Oil	~~8.64~~ 25.20	Ref.
Pitch	5.46	

The test at the Victorian Mines Department in 1924 gave results as follows :-

	Water	10.0	per cent.
Products	0-170°C.....	15.94	" "
	170°-230°.....	12.50	" "
	230°-300°.....	14.37	" "
	Over 300°	41.25	" "
	Coke, Gas, Loss &c..	5.94	" "

It will be noted that the information as to nature and amount of the products from the crude oil is such that these factors cannot be determined. Other tests have no doubt been made, but results are not available. It appears, however, that the products which can be obtained are (in gallons per ton of 40 gallons shale).

Petrol	1 - 6
Kerosene	4 - 10
Fuel Oil	12 - 16
Asphaltum product	

There is some evidence that lubricating oils could be obtained from the crude oil, but the suggestion seems to be that they are of poor quality. However, it is by no means certain that the tests have been sufficient to demonstrate anything as to the nature and amount of these. Lubricating oils can be obtained from crude shale oils and so further testing would appear desirable.

In addition to the above, two products can be obtained from the Tasmanite Shale which are probably peculiar to it. These are :-

1. The spray oil which is stated to be excellent for spraying fruit trees &c.

2. The residue has a certain value as a manure. The effect would appear to be physical rather than chemical.

THE OCCURRENCE.

The Tasmanite Oil Shale occurs as a bed some 3 to 6 feet in thickness in the Permo-Carboniferous rocks of Tasmania. These rocks are usually horizontally bedded or dip at only low angles.

they have been faulted by vertical faults of the nature of block faults.

The bed is not uniform but generally consists of a lower and upper portion separated by a low grade band.

BRIEF HISTORY OF THE TASMANITE SHALE OIL INDUSTRY.

The first attempt to start an industry appears to have been made in 1901 when the Tasmanian Shale & Oil Syndicate had extensive tests carried out by Messrs. Esdaile & Black. The first retorts were not erected, however, until 1910 when the Tasmanian Shale & Oil Co. N.L. erected four retorts of a type patented by W.J. Hall who had had experience in New South Wales. While the retorts were being erected, laboratory tests were made in Launceston. The retorts were to treat 4 or 5 tons daily and it is stated that 20 tons of oil were produced. In the same year, the Latrobe Shale & Oil Co. was formed and although mining operations were carried out, no retorts appear to have been erected.

The operations of the Hall retort do not appear to have been successful and in 1912 a new Company (Railton-Latrobe Shale Oil Co) took over the property. A new retort was tested and said to be satisfactory and the old retorts were scrapped. By 1914 there were four vertical and two horizontal retorts with condensing and refining plant. The capacity was 250-300 gallons of crude oil per day. In 1915 it is reported that 24,000 tons of crude oil were produced from 600 tons of shale.

Interest lapsed during the war, but revived afterwards. The drilling for liquid petroleum by the Mersey Valley Oil Co. and the Adelaide Oil Exploration Co. intersected the shale bed in numerous localities and added greatly to the information in connection therewith.

The Southern Cross Motor Fuel Pty. Ltd., was formed in 1922, and began experiments with a retorting plant. These were continued with one or more types of retorts until 1928, but apparently without success. The property was then taken over by the Tasmanite Shale Oil Co. Ltd., and experiments with a Long Retort were carried out over two years. The company is still, however, experimenting.

The Tasmanian Cement Co. was formed in 1922, and in addition to cement became interested in the Oil Shale. Experiments were carried out in a retort designed by Mr. Stone, the Manager, but were not successful. In 1928 the Company was reconstructed as the Goliath Cement Co. and arrangements were made with Mineral Oils Extraction Ltd. to test the shale in the Crozier retort. At the present time it is claimed that the trials have been successful.

In 1925, the Australian Shale Oil Corporation erected Bronder retorts near Latrobe. Large scale units were erected and during 1927, 60,000 gallons of crude oil were produced. Difficulties arose and operations ceased, but arrangements were made whereby L. & N. (Tas) Ltd. an offshoot of L. & N. Brown Coal Co. Ltd. of England would test their retort. One retort was erected but operations were suspended.

The total quantity of Tasmanite oil shale mined since 1910 has been 19,671 tons. The production of crude oil is given as follows :-

Up till 1926	Several companies	22,000	gallons
" " 1928	Australia Shale Oil Corp.	65,000	"
" " 1930	Tasmanite Shale Oil Co.	7,800	"
1929	Goliath Cement Co.	2,200	"
		97 000	

C. - THE PREOLENNA & BARN BLUFF OIL SHALES.

1. BARN BLUFF.

The oil shale known as pelionite occurs on Barn Bluff. It is a black kerosene shale similar to those of New South Wales. A distillation test by W. F. Ward, Government Analyst, gave a result of 22 gallons per ton of crude oil and tar.

However, the seam has not been located in situ and so it cannot be held to have any potential value. Large blocks of it are found in the morainal material and these suggest a thickness up to 9 inches.

2. PREOLENNA.

The Preolenna coalfield contains kerosene shale and cannel coal of two grades. The exact extent of the field is not known but it has been considered that coal extends over at least 750 acres with extensions to the south-west, west and north-west. Four seams are known to occur and these range in thickness up to two feet with a total of 6.5 feet for the four seams. On these figures the reserves have been calculated as 5,000,000 tons.

The proportion of kerosene shale is relatively small as it appears to occur as lenses only in the coal seams. Laboratory tests of such material have yielded results up to 100 gallons per ton of crude oil. However, the coal contains a high proportion of volatile hydro-carbons and it is possible that it would yield a fair amount of crude oil per ton.

The field has little value as a coalfield owing to the thinness of the seams and their high content of sulphur. It is possible that the crude oil might contain products of particular value, however, and thus render the coal and shale of economic importance.

No records of distillation tests of the shale and of fractionation of the crude oil are available. Some experiments along these lines seem justified.

D. - POSSIBLE MEANS OF ASSISTING THE OIL SHALE INDUSTRY.

There are three main factors in an oil shale industry viz. mining, retorting or distillation and fractionation or refining.

1. MINING.

The Tasmanite Oil Shale occurs as a bed ranging up to 7 feet in thickness. It occurs under cover of other rocks and so underground mining methods would have to be resorted to. The bed generally consists of a lower and upper portion with a one foot band of low grade shale in the centre. It is probable that the whole of the bed would have to be mined and treated, and while this would avoid selective mining, it would lower the grade of the shale.

Taking everything into consideration it is doubtful if the shale could be delivered to the retorting plant under 10 shillings per ton. When it is realised that the total value of crude oil from 40 gallons of shale is approximately 15/-, it will be realised what a large part the mining plays in the oil shale industry.

As a preliminary to any shale mining operations the shale bed in the area in which mining is proposed should be closely bored. This would enable the position, dip, faulting &c. of the bed to be determined and the mine openings sited to advantage. Without such boring, the mine openings may be located in faulted areas and great expense would be added to the mining costs.

One method by which the oil shale industry could be assisted would therefore, be provision for close boring in areas where mining operations are contemplated.

2. RETORTING.

The oil doesnot occur in the shale as such but as a kerogenous material which requires heat (about 700°-800°F) to break it up and yield the gaseous liquid and solid hydrocarbons which when condensed form the crude oil.

The problem of retorting is to find a retort suitable for the destructive distillation of the shale and which will :-

1. Enable a large quantity of shale to be treated per unit of time.

2. Produce a maximum amount of the most valuable products which can be obtained from the crude oil.

3. Be free from operating and other defects.

It will be readily understood, therefore, that the retorting problem is a complicated one. Moreover, it is one that can only be solved by patient and continued research. The large number of retorts that have been tried and the number of companies that have failed to bring their operations to a successful issue tend to prove thes statements and bear witness to the difficult nature of the problem.

Research and investigation can and has been carried out by small pilot plants and by large scale operating plants. The latter is the most satisfactory method but naturally it is the more expensive and there is justification, therefore, for the use of pilot plants. The large scale operating plant is however, the final test as retorts and processes often fail under such conditions when they have been successful in pilot plants.

It is considered that the problem of successful retorting will be solved in either of two ways.

1. Long and patient work by strongly financed companies beginning with pilot plants and ending with operating units.

2. Research by properly organised bodies such as the Council for Scientific & Industrial Research. The main difficulty would be in obtaining small plants corresponding with the different types which are usually the subject of patents. It might be possible however, to co-operate with the companies and others testing retorts.

It is abvious that great assistance could be given to the oil shale industry in connection with the retorting problem. It is not easy to determine the best means of rendering this assistance, but it would appear that direct assistance to those operating retorts would be the most satisfactory. Such assistance could be supervised and controlled by the C.S. & I.R.

3. REFINING THE CRUDE OIL.

The refining of crude oil is an intricate process and involves large capital expenditure. When a continuous production of

crude oil was attained, it is possible that assistance could be rendered in having the crude oil treated by the Commonwealth Oil Refineries. However, the crude oil from certain shales might be such that the C. O. R. processes would have to be modified to suit it, or it might be very desirable to refine it by a special process to obtain special products from it. Separate refining processes and plants might thus be necessary, if any Government assistance was needed, it could be given along lines suggested for retorting.

4. EXPLORATION OF RECENTLY DISCOVERED FIELDS.

The recently discovered fields of Conah and Chudleigh have not been tested and little is known as to their possibilities. Short drilling campaigns following geological surveys would greatly assist in this direction.

P B McNye

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