ABEY LIGNITE MINE - LEBANON.

PLAN OF UNDERGROUND WORKINGS.

Scale 1:5000.
On the north side of the ravine there are ten adits with their associated workings. Of these three are at present being worked, five could be re-opened, while two are so disturbed and unsafe that further extraction is not considered practicable. Similarly, on the south side of the ravine, there exist fifteen adits with their associated workings. Three are being worked at present, three could easily be re-opened, two are doubtful, and seven must be abandoned.

In the valley near Aaramoun, there are also fifteen adits of which five could probably be worked. One of these is being worked at present in a southerly direction and could be connected with the headings from the north side of the Abey ravine, a distance of 1950 feet (600 metres).

In considering the areas which will have to be abandoned, it must be remembered that this will not necessarily mean the loss of coal ahead of these abandoned areas. It is considered practicable to push ahead safe workings on one or both sides of these abandoned workings, and when sufficiently far advanced to drive off at right angles and eventually double back on to these old workings. An adequate safety pillar would have to be left between the abandoned areas and the approaching fresh workings. This will necessitate fairly frequent surveys underground. In cases where it is necessary to augment the ventilation, holes could be made at intervals into the old workings.

At present there are two methods of extraction being employed at Abey. One is an attempt at systematic Pillar and Room method, which aims at about 70% extraction; the other and more recent one aims at
total extraction. This latter method was used on the Continent many years ago, and if properly employed, should give good results.

However, the present method of aiming at total extraction can be improved upon by arranging the initial development of headings in such a manner as to divide the areas into blocks. At some advanced stage, when the area has been "blocked out", it will be possible to commence a retreating system of total extraction, in which only coal itself, with no standstone, will be extracted; this condition governing at least half the area blocked out. The remaining half would be extracted simultaneously with a minimum thickness of sandstone. The area exposed by extraction can be easily filled up with the waste sandstone from the sub-division of pillars. This method has the advantage of retreating towards the primary headings, ensuring a much greater safety for the men employed, as supporting pillars will always be in existence between the working face and the road through which they must travel with the mined product.

The lignite and the accompanying standstone is extracted entirely by hand pick. Unless pneumatic picks are available, this is the only means possible. The use of explosives, unless perhaps special gunpowder pellets, is not recommended on account of the shattering effect they would have on the already disturbed surrounding strata. The method of breaking ground must, perforce, remain the same as it has always been, viz. pick and shovel. Should a compressor be available it would only be of use in the main galleries. The holes in other faces must be drilled by hammer and short jumpers. If it were at all possible to obtain Auger Drills (unknown in those parts), they could be advantageously used in drilling the holes in the coal.
Detailed Accounts of Deposits.

It is also possible that in many parts of the mine auger drills could be used in the sandstone itself, which in some places is not a true sandstone. The only safe type of explosive to be used would be compressed gunpowder pellets. There are safer to handle, effect a saving in detonators and obviate a shattering of the ground.

Transportation of the mined product from the face to the mouth of the adits is done by boys using small wheelbarrows, each barrow having a capacity of 55 lbs. (25 kgs). Illumination underground is effected by means of small "petrol wick" canisters made at the mine. Timber is plentiful in the neighbourhood, but is expensive.

Cleaning of the Lignite.

The mined product contains about 40 per cent extractable impurities, pyrites predominating. As mentioned in Section VIII the exploiters of Abey have had the initiative to install a small washer, which although primitive, nevertheless removes a great deal of the impurities, thus reducing transport costs to Beirut.

Water Supply.

The necessary amount of water required for washing at the mine is liable to cause difficulties at times. The sources during the summer months are small, but it is possible to augment these by conserving water from the surrounding strata and from the mine workings themselves. Decantation at the washery would also assist. It is estimated that the volume of water required for washing is six times that of coal.

During the winter months, the position is definitely better, and water is plentiful.
Washing arrangements however, will be seriously affected during heavy rains, when a sudden rise of 6 feet occurs in the level of the stream in the ravine. For this reason the washing arrangements should be elevated and a pump installed. The weather itself, during winter, has little effect, beyond local inconvenience, on the outside activities of the mine, except that transport is slowed down.

**Labour.**

The labour position as regards the mines in the Lebanon has already been described under Difficulties of Exploitation, Section VI. This is particularly applicable to Abey. At present there are 60 men employed at Abey. Of this number half must be classified as unproductive labourers (e.g. blacksmith, carpenter, timberman, etc.). There is pit room underground to increase this number to 200 with a greatly increased tonnage, should a ready market be available. To-day Abey is producing 8 tons daily as compared with 22 tons some months ago.

Summarising the labour position at Abey, it may be stated that for a daily output of 10 tons, the labour strength would be 60 (half unproductive). Each additional 10 tons increase will require 40 additional men, 10 of which would be unproductive. Thus, a daily output of 40 tons "run-of-mine" coal would require 180 workmen. It would be quite possible to obtain 40 tons per day provided certain outside assistance, as will be indicated later, was given.

For increased outputs, say over 30 tons per day, it may be necessary to import labour from Beirut. This may lead to the necessity of housing and feeding them, a contingency to be avoided if possible, but, nevertheless, not to be overlooked. The possibility of working a double shift during summer months may also be considered.
Wages.

The following is an indication of the wages being paid at the end of 1942. Since then, however, wages have generally increased 15 per cent. It must be remembered that inflation was rife at this period. Taking the index figure for cost of living in 1939 as 100, in 1943 it had risen to over 500.

(a) Boys:

1/6d - 2/11d per day. Their work consists of pick carrying, wheelbarrow transport, and coal washing.

(b) Men:

1. Daily paid. 4/6d. - 8/- per day. Such work includes blacksmiths, carpenters, foremen, etc.

2. Contract. The actual miner works on a contract basis. He is paid 19/- to 22/6d. per ton of coal he extracts. He can extract 660 - 770 lbs. per day, thus earning from 5/9d. to 9/- per day.

These daily figures naturally depend upon the position and nature of the coal and hours worked.

There is no restriction on the number of hours worked by a contractor at Abey. If he so wishes he can start work before the usual shift, which lasts from 7 a.m. to 3.30 p.m. and finish after the shift. This does not mean that he wanders in and out of the mine as he pleases. Whenever any extra hours are worked, the men are always in groups, never alone. Nevertheless, proper supervision is lacking.
Material.

In order to increase the output at Abey, a certain amount of assistance would be required to enable the owners to purchase or hire through military channels, items of equipment. Such equipment would consist of tracks, mine cars, turntables, pumps, piping, steel cable, picks, shovels and miscellaneous small tools. This material is practically unobtainable in the Lebanon. The owners were perfectly willing to buy this from military controlled sources, but were not prepared to deal extensively in the Black Market even were such material available there.

Transport.

This problem has received special attention as regards Abey, and various means of improving and cheapening the cost were considered. The lignite from the mine is transported by mule up to a depot outside the village. From this depot it is conveyed to the Dora Briquetting Factory, Beirut by motor truck.

The transport by mule up the ravine entails a climb of 1300 feet (400 metres) along a winding mule path 2 miles (3 kms) in length. These mules are hired from a local contractor who charges 22/6d. per ton transported, payable half in cash and half in supply of barley. This system of hiring leaves the owners at the mercy of the contractor. Mules are also scarce as the restrictions on mechanical transport in the Lebanon has led to an increase in the demand of mules for other purposes.

Over the present track a mule can make 3 - 4 trips per day, transporting a daily total of 1430 to 1540 lbs. (650 - 700 kgs). A donkey transports 880 to 990 lbs. (400 - 450 kgs.) per day. Abey hires 8 to 10 mules for the transport of their washed coal.
The cost of motor transport from Abey to the Dora Factory, a distance of 20 miles (32 kms) is 18/- per ton, a figure which is likely to be increased.

In view of this transport difficulty it was considered advisable to transport the coal from Abey Mine down to the coastal road and railway line by a more direct route. At present no such route exists. A tour of the country in this neighbourhood and a study of the maps of the area led to the following conclusions:

There are three possible means of effecting direct transport to the coast:-

I. (a) by constructing a road from Naame Monastery up to the Mine.
   
   (b) by constructing a mule pathway from the Monastery to the Mine.

II. by constructing a road from Damour up to Baouardche and a Decauville or mule path from Baouardche down to the Mine.

Considering these:-

I. (a) Road. Naame - Abey Mine.

   The distance from the village of Naame to the mine is 4 miles (6 kms). There already exists a road from Naame up to the Monastery, Deir Mar Joras, a distance of 1 mile. This leaves 3 miles to be covered by either I.(a) or I.(b). The construction of a road over this remaining distance would take some considerable time. The gradient is not excessive, being about 3\% to 4\%, but the road would wind a great deal and five small bridges would be necessary. Moreover, such a road would require special attention during the winter months. Unless a concerted effort was made, this means of transport is not recommended.

Provided a Mule Camp can be established at Deir Mar Joras, this means has possibilities. The water position for the animals in such a camp must be considered. Also objections might be raised by the Monastery. The remaining part of the journey could then be completed by motor truck, either to the nearest railway station or into Beirut a distance of 11 miles (18 kms).

Over such a pathway a mule can transport 550 to 660 lbs. (250 - 300 kgs) per trip, making 2 trips per day. i.e. Transport of 1 ton requires 2 mules.

II. Damour - Baouardche - Abey Mine Route.

At Haret-en-Haame, just outside the north entrance to Damour, there is a track that leads off the coastal road and climbs up to the village of Baouardche. The distance is 4 miles (6 kms) and the average grade is 1 in 10. From Baouardche down to the mine the direct distance is 870 yards (800 metres) approximately, the difference in altitude being 325 feet (100 metres). The construction of a Decauville may be possible. In the event of this not being the case, the construction of a mule pathway will present no difficulties.

Over such a pathway a mule can carry 3550 lbs. (1750 kgs) per day. i.e. Transport of 10 tons requires 6 mules.

In such a case a small mule camp could be established at the village. Water for the animals presents no difficulty.

A detailed examination in the field of the above schemes by M. Duberret, Service des Mines and the writer led to certain modifications and the following conclusions:-
Detailed Accounts of Deposits.

(1) From Damour to Baouardche passing over the rise at Kheurbet-el-Piar.

(2) From Baouardche to the Mine by the slope south of the ravine.

Distances of this Route.

Through Damour (ex coastal road) ... ... 0.5 miles

From end of road in Damour over a section already laid out... ... ... 1.6 "

End of laid out section to Bacurdche over limestone. ... ... ... ... ... 2.2 "

From Bacurdche to Mine over sandy ground. ... ... ... ... ... ... 1.6 "

Total Distance from Coast Road to Mine. 5.9 miles

On approaching the Public Works Department, then under French control, they estimated that it would take 4½ months to complete the work, and made arrangements to have the route properly surveyed and plans drawn up.

Conclusion.

In conclusion it may be stated that in order to utilise the potential output of Abey Mine, the following points must be considered:

1. The lignite deposits are sufficient in quantity and of a washed calorific value suitable for briquetting, to justify an improvement of the existing conditions with an accompanying increase in output.

2. The accelerated and increased exploitation and working of the deposit necessitates immediate attention to (a) Labour, (b) Materials, and (c) Transport.

(a) Labour: This could be improved considerably if some arrangement were made whereby the mine employees received a definite ration of wheat.
(b) **Materials:** It would be necessary to install tracks and cars underground as the present system of transport is tedious and inadequate for expeditious work.

Pneumatic picks with their attendant accessories would facilitate development of the main headings and blocking out. At present the rate of advance is slow - 2 feet per day. A washing box must be built to take the place of the present washing arrangements. It should be elevated; this will necessitate the use of pumps. On account of transport costs, the run-of-mine product must be washed at the mine. Explosives are not necessary at the commencement.

(c) **Transport:** This is the heaviest item in the costs, and alternative means must be considered.

3. The total extraction of the coal seam should not take place concurrently with the blocking out of areas, i.e. on the Advancing System. On account of faults, slips and thinness of seam, total extraction should be carried out on the Retreating System.

4. The deposits can be mined in such a manner, viz. from west to east that water difficulties underground will be minimised and present only local problems.

5. A better system of supervising the advance and direction of the workings must be introduced. Accidents have occurred in the past, and areas of coal lost through lack of supervision in this respect. Drawn out plans of proposed future mining schemes should always be on hand.
9. The Briquetting Factory at Dora can utilise any increased output, and is capable of putting out 30 tons of briquettes a day, provided always there is a market.

10. The officials in charge of production are relatively familiar with the local conditions and necessary technique.

11. The Mines of the Government should be informed monthly of the various activities at the mine. Not only should a plan of the workings be submitted, but also a written report on general underground and surface matters. Such reports will form records which may prove of value in the subsequent exploitation of the lignite.
### ABEX LIGNITE MINE

#### TAMULATED ANALYSES OF SAMPLES.

<table>
<thead>
<tr>
<th>Adit No.</th>
<th>Width of Seam</th>
<th>Moisture</th>
<th>Volatile</th>
<th>Fixed Carbon</th>
<th>Ash</th>
<th>Sulphur</th>
<th>Calorific Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ins.</td>
<td>Cms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>10</td>
<td>25</td>
<td>9.0</td>
<td>33.2</td>
<td>31.4</td>
<td>35.4</td>
<td>4.2</td>
</tr>
<tr>
<td>20</td>
<td>12</td>
<td>30</td>
<td>6.8</td>
<td>23.5</td>
<td>37.8</td>
<td>38.7</td>
<td>12.5</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
<td>40</td>
<td>8.0</td>
<td>23.5</td>
<td>36.9</td>
<td>39.6</td>
<td>10.8</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
<td>40</td>
<td>12.0</td>
<td>29.0</td>
<td>46.2</td>
<td>24.8</td>
<td>10.4</td>
</tr>
<tr>
<td>14</td>
<td>8</td>
<td>20</td>
<td>10.6</td>
<td>28.5</td>
<td>32.8</td>
<td>38.7</td>
<td>7.8</td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td>10</td>
<td>12.8</td>
<td>25.7</td>
<td>43.1</td>
<td>31.2</td>
<td>12.9</td>
</tr>
<tr>
<td>21</td>
<td>10</td>
<td>25</td>
<td>10.8</td>
<td>29.5</td>
<td>37.7</td>
<td>32.8</td>
<td>8.6</td>
</tr>
<tr>
<td>21</td>
<td>8</td>
<td>20</td>
<td>10.0</td>
<td>25.5</td>
<td>42.9</td>
<td>31.6</td>
<td>4.4</td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>20</td>
<td>12.0</td>
<td>21.6</td>
<td>46.5</td>
<td>29.9</td>
<td>10.6</td>
</tr>
<tr>
<td>11</td>
<td>5</td>
<td>12</td>
<td>12.8</td>
<td>25.5</td>
<td>41.3</td>
<td>33.2</td>
<td>12.4</td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>20</td>
<td>10.4</td>
<td>27.7</td>
<td>38.1</td>
<td>34.2</td>
<td>10.5</td>
</tr>
<tr>
<td>18</td>
<td>8</td>
<td>20</td>
<td>12.8</td>
<td>28.4</td>
<td>46.3</td>
<td>25.3</td>
<td>10.1</td>
</tr>
<tr>
<td>8</td>
<td>14</td>
<td>35</td>
<td>10.0</td>
<td>25.5</td>
<td>43.5</td>
<td>31.0</td>
<td>11.6</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>25</td>
<td>12.8</td>
<td>30.6</td>
<td>45.0</td>
<td>24.4</td>
<td>5.8</td>
</tr>
<tr>
<td>13</td>
<td>10</td>
<td>25</td>
<td>13.0</td>
<td>27.3</td>
<td>41.2</td>
<td>31.5</td>
<td>10.1</td>
</tr>
<tr>
<td>3E</td>
<td>10</td>
<td>25</td>
<td>8.6</td>
<td>24.1</td>
<td>41.9</td>
<td>30.0</td>
<td>11.0</td>
</tr>
<tr>
<td>3W</td>
<td>8</td>
<td>20</td>
<td>8.0</td>
<td>29.2</td>
<td>37.4</td>
<td>33.4</td>
<td>10.7</td>
</tr>
<tr>
<td>AARA-MOUN.</td>
<td>8</td>
<td>21</td>
<td>10.0</td>
<td>33.9</td>
<td>35.8</td>
<td>30.3</td>
<td>11.1</td>
</tr>
<tr>
<td>WORKINGS</td>
<td>8</td>
<td>20</td>
<td>11.6</td>
<td>31.4</td>
<td>34.6</td>
<td>34.0</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>19</td>
<td>11.6</td>
<td>27.1</td>
<td>38.4</td>
<td>34.5</td>
<td>8.6</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>20</td>
<td>10.0</td>
<td>30.0</td>
<td>39.9</td>
<td>30.1</td>
<td>9.8</td>
</tr>
<tr>
<td>Average</td>
<td>9</td>
<td>23</td>
<td>10.6</td>
<td>27.7</td>
<td>40.0</td>
<td>32.3</td>
<td>9.2</td>
</tr>
</tbody>
</table>

The above Analyses were carried out in the Laboratories of the Societe Ciments Libanaise, at Chekka.
Detailed Accounts of Deposits.

3. Other Deposits.

1. Ain Traz Area.

Location.

The village of Ain Traz is situated about 15·5 miles (25 kms) south of Beirut and is reached by a good motor road through Aley. It lies at an altitude of 2110 feet (650 metres). A few hundred yards below this at an elevation of 1300 feet (400 metres) there exists a lignite deposit which can be reached by motor road, 2·5 miles (4 kms) in length, to within a distance 321 yards, (300 metres).

Nature of the Seam.

The deposit is similar in occurrence to that at Abey, the lignite being interbedded in the sandstone of Lower Cretaceous Age. It is possible to trace the outcrop over a distance of 70 yards. The thickness of the seam varies from 8 to 12 inches (20 - 50 cms), the average being 14 inches (35 cms). The dip is 9 degrees to the north. The lignite is not compact, it is laminated and contains a fair percentage of pyrites.

An analysis of the lignite showed:-

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width (ins. &amp; cms)</td>
<td>14 (35)</td>
</tr>
<tr>
<td>Moisture %</td>
<td>12·8</td>
</tr>
<tr>
<td>Volatiles %</td>
<td>35·6</td>
</tr>
<tr>
<td>Fixed Carbon %</td>
<td>35·0</td>
</tr>
<tr>
<td>Ash %</td>
<td>29·4</td>
</tr>
<tr>
<td>Sulphur</td>
<td>8·7</td>
</tr>
<tr>
<td>Calorific Value B.T.U.s and cals/kilo.</td>
<td>9000 (5000)</td>
</tr>
</tbody>
</table>
Detailed Accounts of Deposits.

An area of about 30 yards square has already been developed, leaving pillars 6 feet square, staggered here and there, the working height being 5 feet. The tonnage of lignite extracted is probably in the neighbourhood of 100. This was done in 1936, the lignite being used in a local silk factory at Ain Traz. On the north and south side of this worked area, the seams thins out, but it is not possible to say what lies in the solid on the east side.

Conclusion.

In view of the fact that the extent of the deposit is unknown, and that the area is practically virgin, it was suggested to the present holder of the Exploitation Permit, M. Elie Dfouni, that he commence two exploration galleries in an easterly direction, starting from inside the present mined area. It should be noted that the deposit is only 320 yards from a motorable road, and the ground is fairly level. Transport is thus rendered very easy.

2. Guadi Chanrour.

This lignite occurrence is situated 8 miles (13 kms) south of Beirut, and lies about 0.5 mile from a metalled road. (Map Reference 1355.2086). The altitude is only 780 feet (240 metres).

The outcrop is visible only over a short distance, and is 10 inches (25 cms) in thickness. It has been exploited before, presumably by the Turks, and one adit, now fallen in, was driven into the body.

Overlying the deposit as exposed, is a practically vertical mass of rock, some 25 feet high, which is very disturbed and liable to slip away at any time.
It is not possible to take safety precautions against this happening without considerable trouble and expense.

No estimate of the extent of the deposit can be formed. From a mining point of view, however, it would be dangerous to attempt any exploitation of the seam in this area owing to the overhanging rock.
The occurrences of lignite examined in this area, being grouped in a comparatively close vicinity, the general description given below is applicable to all the deposits. This general account is followed by a stereotype description of each occurrence.

**GENERAL.**

The mining methods employed are unsystematic, and owing to the thinness of the seams, mining is relatively costly. Owners are unwilling to spend money on timber, which is expensive, and consequently scarcely any timbering is done. The lignite, therefore, is only being extracted where the roof will stand unsupported. The mines have thus developed into a maze of "rabbit-warren" galleries.

The seams dip eastwards into the mountain side. Work on these properties commenced in the re-entrant angles of the ravines, and the tendency has been for the systems of galleries to develop progressively down the dip into the mountain. It is obvious, therefore, that the latest development is usually the lowest point in the mine, and natural drainage of the mine is not possible. Fortunately little water comes in from the overlying sandstones, but after rains, the labour has to be utilised in draining the workings by carrying the water out in buckets. Under existing conditions it would not be economically possible to drive special adits through country rock for drainage purposes, nor can the owners be expected to install pumps. However, if more attention was paid to following up the seams into the spurs or salients separating the different ravines, the galleries could be driven on suitable grades for adequate drainage.
Author Coulter J
Name of thesis The occurrence and exploitation of lignite in the Lebanon 1944

PUBLISHER:
University of the Witwatersrand, Johannesburg
©2013

LEGAL NOTICES:

Copyright Notice: All materials on the University of the Witwatersrand, Johannesburg Library website are protected by South African copyright law and may not be distributed, transmitted, displayed, or otherwise published in any format, without the prior written permission of the copyright owner.

Disclaimer and Terms of Use: Provided that you maintain all copyright and other notices contained therein, you may download material (one machine readable copy and one print copy per page) for your personal and/or educational non-commercial use only.

The University of the Witwatersrand, Johannesburg, is not responsible for any errors or omissions and excludes any and all liability for any errors in or omissions from the information on the Library website.