

Operations at Bkarta were commenced in August, 1942, by the Compagnie Ferso-Libano-Syrienne, who were also interested in starting a briquetting factory at Chiah, near Beirut, the object being to utilise the large amount of fines produced in mining. During the first four months only 60 tons of lignite were extracted from Bkarta. It is impossible to state the available reserves, but they are certainly of the order of hundreds, and may well be thousands of tons.

12. TANNOURINE. (Fig 5.) (Map Reference 1660.2486.
Altitude 4710 feet : 1450 metres

Location.

The occurrence lies 2.5 miles (4 kms) east from Belaâ, across the mountains, and during the winter months it can only be reached by foot from Belaâ. The prospect itself, is situated about 0.5 mile above the village of Tannourine.

Nature of the Seam.

The bed of shales lies between the purple-red volcanics and basalts of the Jurassic. In these shales there are two beds of lignite, the upper reaching 12 inches in thickness, and the lower, some 10 inches down, reaching 6 inches in thickness.

The main seam probably maintains a thickness of 8 to 12 inches over a length of outcrop of 650 feet (200 metres) while the thinner seam varies from 3 to 6 inches over the same range. The outcrop runs approximately west-north-west to east-south-east, and adits have been driven in along the strike in a south-west direction. One adit, driven along the strike for 60 feet where the seam is at its thickest, failed to reveal any appreciable change in thickness and quality. Another adit, about 500 feet further west has followed

the seams at approximately the same thickness for 25 feet, also revealed little change.

The results of an analysis of the thicker and richer seam gave a calorific value of 6,660 B.T.U.s or 3700 Cals/kilo, with volatiles 34.8%, fixed carbon 20.8%, ash 44.4% and sulphur 7.3%.

Generally speaking, the nature, quality and situation of the occurrence, do not warrant further investigation.

III.THE MEYROUBA AREA.

In what has been classified the Meyrouba Area, there is only one deposit of coal worthy of mention, and this occurs near Meyrouba village itself. On account of its past reputation and values of analysis which the owner submitted, a careful study was made of the occurrence as it was thought that this would be a useful property to supplement the tonnage of lump lignite for export to Egypt. The area was visited on several occasions, and the following account was drawn up.

13. MEYROUBA MINE. (Map Reference 1553.2337.
Altitude 5040 feet: 1550 metres.)

Location.

The workings of Meyrouba Mine are situated on the steep western slope of the Lebanon under Mount Sannine, at an altitude of 5040 feet. They are about 3 miles (5 kms) to the north of the village of Meyrouba, which lies some 1450 feet below the mine workings, at an altitude of 3575 feet (1100 metres).

The village is 19 miles (30 kms) by road from the coastal town of Djouni. The mine is reached by a winding foot-path, and due to climatic conditions, the deposit can only be exploited between April and November.

The Nature of the Seam.

The seam is situated in volcanic tuffs of Jurassic Age. It is lenticular in outcrop with a thickness of 16 to 24 inches (40 - 60 cms), and in places over 40 inches, and is exposed at intervals over a distance of 820 feet (250 metres). It dips towards the mountain at an angle of 5 to 15 degrees. Entries have been driven down the dip, but stopped when water was encountered.

The seam varies in composition from vitreous sub-bituminous coal, to a softer variety with a dull 'greasy' colour and a conchoidal fracture, and then to a grey marl. The thickness increases towards the southern portion of the property. In the northern portion of the mine the seam is of poor quality and low calorific values and high ash content can be expected here, as has already been proved by sampling, the ash running from 40 to 70 per cent. The quality improves, however, in the central and southern sections of the mine, where better values can be expected, but with an increase in the sulphur content. There is a considerable amount of pyrite in the seam, both disseminated and in large lenticular blebs; this sulphur content increases towards the south.

As already mentioned in Section V. folding and faulting have thinned out and broken up the seam, and a large north-east fault is likely to have caused a considerable dislocation to the east. Another

dislocation is visible on the extreme southern end of the mine area, where a 200 foot downthrow is encountered.

Analysis.

The mean of three different sets of samples, when analysed, yielded the following results:-

	<u>No. 1.</u>	<u>No. 2.</u>	<u>No. 3.</u>
Moisture	3.4%	5.4%	4.0%
Volatiles... ..	49.3%	51.6%	43.7%
Fixed Carbon ...	32.2%	22.9%	24.5%
Ash	18.5%	25.5%	31.8%
Sulphur	3.8%	5.3%	5.6%
Calorific Value.	<u>11,540</u>	<u>11,000</u>	<u>10,190</u>
B.T.U.s and Cals/kilo	(6410)	(6110)	(5660)

Comments.

1. Mining:

The present system of mining is inadequate in that -

- (a) it permits no drainage of water which makes the lower workings inaccessible, and forms a thick mud with the easily decomposed footwall tuff, thus increasing the danger to the workmen in the winzes;
- (b) the support is inadequate for a comparatively bad roof;
- (c) the layout of adits, drives and winzes is unsystematic, no attention being given to the jointing or bedding planes of the seam, this increasing the danger of the unstable side walls falling in, and throwing unequal pressure on the timber sets.
- (d) no systematic form of extraction, either with pillar support or controlled subsidence of the roof is employed.

2. Development:

To open up the mine with a view to simplicity of mining, rapid extraction, the elimination of machinery, and the reduction of costs to a minimum without decreasing the efficiency appreciably, the following system of development would be applicable at Meyroube:-

Footwall adits should be driven in, on a slight up-grade of say 1% to intersect the body at depth, preferably where the body is cut off by the north-south fault already mentioned. At this point a main drive should be turned off to intersect the winzes put down on dip.

These adits should be adequately supported throughout with timber sets spaced not more than 6 feet apart, as they will be, for the greater part in volcanics. The entrances will present a certain amount of difficulty, due to running ground on the steeply-sloping hillside. This can be partly overcome by commencing with an open-cast, and where earthworks become too great an adit can be started. The entrance of the adit must be well supported with closely spaced timber sets, and the sides of the cutting must be sloped to prevent collapse.

Apart from acting as a means of drainage, these adits may also be used as haulages. The broken rock, which will easily fall down the winzes, may be collected in the main drive and taken out through the adits, thus eliminating the arduous task of carrying it up the winzes. To facilitate descent, and to prevent mixing with the soft floor, some form of chute may be installed, terminating in an improvised box for storage.

The number and location of winzes and adits will depend on the width of deposit decided to mine, but in view of the adits being in the footwall, this number should not be great.

3. Haulage:

No elaborate system of haulage can be used, and is totally unnecessary for any future output of the mine. Wheelbarrows will be adequate for this purpose, though, if available, a few side-tipping cars would greatly reduce labour.

4. Extraction:

Galleries should be driven connecting the winzes and dividing the property into small blocks about 100 feet square. The height of the working places will depend on the width of profitable coal to be mined, but should be kept as low as possible. The seam, which is usually harder than the adjacent formation, should be carried near to the roof, and a system of undercutting employed whereby the barren ground is extracted out of the footwall, after which the seam is allowed to fall - this latter operation can invariably be done with crowbars. While undercutting, the seam should be supported by small timber props with head boards.

Adequate pillars should be left for support. These pillars will eventually be recovered by a system of retreating with controlled subsidence of the roof. Breaking can usually be done by hand-pick, though in some cases where the shale is hard, hand drilling with light charges using gunpowder pellets may be necessary. Little advice can be given on this matter, and individual cases must be treated on their merits. The size and value of the mine does not warrant the use of compressed air.

As the mine will not extend to any great depth into the mountain, "natural" ventilation will be sufficient for all purposes.

5. Transport:

It is not considered advisable to construct a road from the mine to Meyrouba village, as the output would not be sufficient to justify such construction. Due to the mountainous nature of the country, a considerable amount of cutting would be necessary. The present system of transport by mule would be adequate. A path runs along the ridge down to the village, the journey by mule or donkey, carrying a load of 400 to 500 lbs (180 - 230 kgs), taking $1\frac{1}{2}$ hours.

6. Conclusion:

Depending upon the tonnage aimed at, the labour and stores available, the above comments may be modified or amplified.

The footwall adits have the disadvantage of being in barren ground, but as against this the advantages of:-

- (a) increasing the efficiency of haulage and ventilation;
- (b) decreasing labour required in haulage work;
- (c) permitting the deposit to be worked from the rear;
and
- (d) effecting good drainage of the mine.

In addition to these advantages, it must be remembered that the mine cannot be exploited from the middle of December until March; under such circumstances, the footwall adits will keep the workings better drained from the melting of snow than will the present means of entry, which allows the workings to become partly flooded during the inclement weather.

Pumps have not been advocated as a means of dealing with the water. They entail the making of drains and sumps and do not solve the problem of efficient haulage. Furthermore, spare parts and piping are difficult to obtain. Any elaborate equipment is not necessary and is probably unprocurable.

At present it is not considered advisable to extend mining operations beyond the north-south fault previously mentioned, as this would entail too much expense due to development, and a more complicated system of mining, which would no doubt be difficult for the workmen to follow, unless strictly supervised.

THE CENTRAL LEBANON.

As previously set out, the detailed accounts of the deposits of the Central Lebanon will again be subdivided as follows:-

1. The Region between Ras-el-Harf and Bzebdine comprising:-

Present Workings: A. Merjlaya Mine.

B. Arsoun.

C. Bzebdine.

Other Properties: D. Mdekhen.

E. Mar Youhanna Mine.

2. The Region around Abey.

3. Other Deposits.

1. The Region between Ras-el-Harf and Bzebdine.

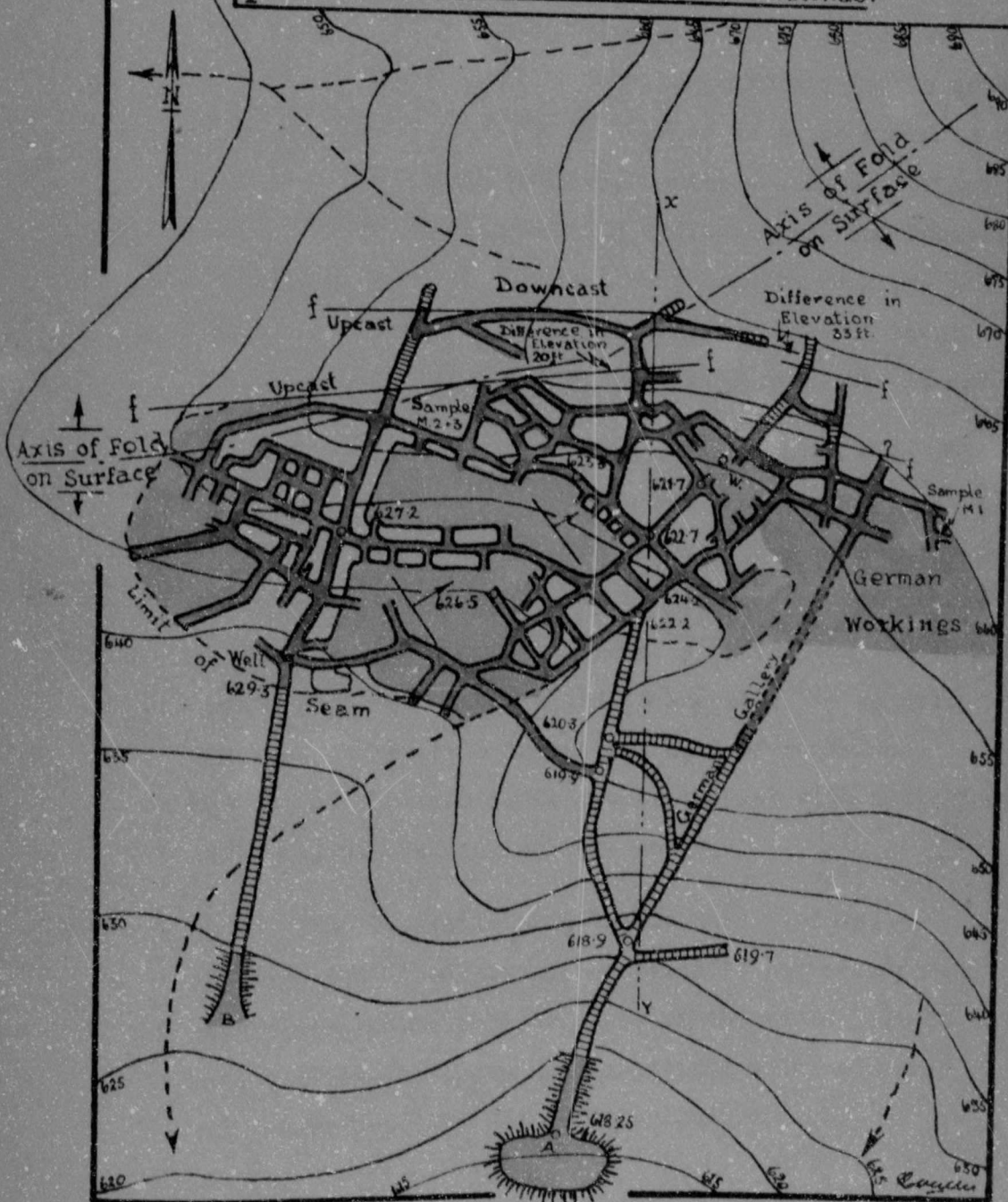
- A. Merjlaya Mine (Fig. 20)

This property is the most important of those coming under 1., and a more detailed study was made of it as it was thought likely to increase the production.

Location.

The village of Ras-el-Harf is situated 13 miles (21 kms) south-east of Beirut (Map Reference 1445.2083), at an altitude of 2600 feet (800 metres). Merjlaya Mine is situated north of the village at an altitude of about 1950 feet (600 metres), accessible only by a winding mule path, 2 miles (3 kms) in length.

The mine is at present being worked by the Societe de Briquetage des Matieres Combustibles who have leased the Exploitation Permit from the owner M. Dfouni, the



Scale 1 : 1000.



latter being also employed at the mine as supervisor. The royalties paid to M. Dfouni are 4/6d. per ton.

Nature of the Lignite Seam.

The geological description of the area has already been dealt with in Section V. The lignite seam is interbedded in the sandstones of Lower Cretaceous Age, interspersed with schists, and contains the usual intermingling of pyrites characteristic of the lignites in the Lebanon, either in compact masses or fine particles. The sandstone is of a hard variety and offers a fairly good roof and sides, probably as good as is to be found in the Lebanon. The area, however, contains a number of faults, which tend to increase mining difficulties, and renders an approximation of the available lignite reserves a speculative task. In the vicinity of some of these faults a dark, plastic clay band appears in the sandstone.

The thickness of the seam varies from 8 to 21 inches (20 - 70 cms). In the north and north-east portion of the workings, the thickness is between 16 and 24 inches (40 - 60 cms). In the central region of the mine, which is practically totally extracted, the seam splits into two bands, 6 and 10 inches (15 - 25 cms) thick separated by 8 inches (25 cms) of sandstone. The dip of the seam is from west to east with anticlinal and synclinal folding north - south.

The lignite is of a fairly hard variety, although the mined product contains 50 per cent fines, mainly due to the thinner parts of the seam. It is of good quality, having a high calorific value compared with other deposits and a low sulphur content, as

indicated by the following analysis:-

Merjlaya Lump Lignite (Unwashed)

Moisture	5% to 8%
Volatiles... ..	30% - 35%
Fixed Carbon	35% - 42%
Ash	30% - 35%
Sulphur	4% - 5%
Calorific Value	9000 - 9720 B.T.U.s
	5000 - 5400 cals/kilo

Values of more recent samples taken at the working face are recorded in the ensuing pages.

Merjlaya Lump Lignite as it is marketed to-day is suitable for domestic purposes (at present it is used in restaurants in Beirut), lime burning and small boilers. It is not suitable for large boilers as the ash fuses at 800°C and slags are formed. The fines can be utilised in manufacturing briquettes.

As already stated it is not possible to estimate the lignite reserves. It would appear, however, that lignite of reasonable thickness exists to the north and north-east of the present workings, while to the west the seams thin out.

Method of Extraction.

The usual haphazard and unsystematic method of extraction as employed throughout the Lebanon is also in evidence at Merjlaya. Although the Germans installed tracks and cars underground, the execution of a workman-like layout was deplorable. The method of mining employed was Pillar and Room, the pillars being about 16 feet (5 metres) square. These pillars were afterwards extracted, the rock being sometimes packed as support, or the area left to collapse.

Following on this, the work that has been done by recent exploiters has not been an improvement on the original methods, although since the mine was visited in December 1942, some attempt has been made to introduce a regular system of development beyond the area exploited by the Germans.

The greater part of the output obtained in recent months has been obtained from the extraction of pillars in the central zone of the mine. The fact that these pillars are nearing exhaustion has forced the company to open up new galleries. Owing to the lack of a market this work has not been intensified. Also, it is unfortunate that where this development is necessary to the north, the seam has folded over in the shape of a dome and is intermingled with small faults. Development is slow, the rate of advance being about 2 feet (60 cms) per day, all work being done by hand picks. These headings are being carried at various grades in an endeavour to pass out of the dome into flatter ground as seems indicated by surface features. In the eastern portion of the mine two roadways have been constructed through old German workings, and are now in the solid. The seam here is about 20 inches (50 cms) thick.

Transport of the lignite from the working face to the mouth of the adit is done by means of wheelbarrows. This would appear to be the only means ever possible. It would be difficult to instal tracks now owing to the winding nature and narrowness of the existing galleries. Moreover, the present output or any probably future output, does not warrant any such installation.

It was noted that attention is being paid to timbering, and generally speaking the mine is well timbered, and due regard is being paid to the safety of the workmen. No washing of the lignite has ever been attempted, the mined product being transported by mule to the main road and thence to Beirut by motor truck.

Labour.

At present there are 30 employees at the mine for an output of 4 tons per day. Additional labour is available for an increased output should a market be found. The wages paid seem to be slightly above the average of the other mines.

Transport.

The transport problem again presents difficulties and constitutes 40 per cent of the total cost per ton of lignite delivered in Beirut. Until recently the lignite was carried by mule up to the village of Ras-el-Harf, a distance of 2.3 miles (3.6 kms), and then transported by truck to Beirut. On account of one section of the road near Ras-el-Harf being difficult after rains due to mud and small landslides, another route was chosen, by-passing this uncertain portion. The lignite is now taken by mule to a depot on the road near the village of Baalchmaye, this distance being about 2.6 miles (4.5 kms). The cost of such transport is 24/9d. per ton. From Baalchmaye to Beirut, about 11.5 miles (18 kms), the cost of motor transport is 15/9d.

It was thought that it might be possible to relay a Decauville over the route used by the Germans, but an examination of this showed that the construction of such a track, the cost of material and the maintenance

would be disproportionate to any likely yield from the mine. Moreover, the operation of such a haulage would require the installation of a fairly large engine as the gradients are exceptionally steep. All things considered, the present system of transport is the best.

Costs.

The present cost of Unwashed Lignite delivered at Beirut may be stated collectively as follows: (No allowance is made for profit).

	£	s	d
A. Mining Operations... ..	2	0	6
B. Transport... ..			
1. Mule (a) In kind (Barley)...	11	3	
(b) In Cash	13	6	
2. Motor	15	9	
C. General.			
Administrative, royalties salaries, etc... ..	17	0	
<u>TOTAL COST PER TON</u>	<u>£4</u>	<u>18</u>	<u>0</u>

With assistance in the purchase of barley through military sources, and also in the matter of transport, Item "B" can be reduced by at least 8/-, thus bringing the cost per ton at Beirut to about £4.10s.0d. per ton.

Conclusion.

Provided a market is available, either civilian or military (with the exception of railways), it is possible to produce 10 tons per day of unwashed lignite of a fairly good quality at a reasonable price with little outside assistance.

Such assistance comes under the headings of:-

- (a) Technical supervision.
- (b) Transport, and
- (c) Replacement of picks, shovels, wheelbarrows, etc., through military sources.

Summary of Conditions at Merjlaya Mine.

Map Reference: 1452.2102

Altitude: 1950 feet (620 metres)

Situation: Below ~~and~~ N.N.E. of Ras-el-Harf and Bhamdoun villages. About 110 yards (100 metres) above a river bed, on the north side of Wadi Hammama.

Distance from road at Ras-El-Harf village: 2.2 miles (3.5 kms) by mule track. Lowest point on route 330 yards (351 metres) below road. Lignite is usually transported by mules along a 2.6 mile (4.5 metres) route to Baalchmame village. (Map reference 1420.2094).

Owner: M. Dfouni, who receives ^{royalty} from and is employed as supervisor by the Societe de Briquetage des Matieres Combustibles,

Labour: 30 men.

Production: 4 tons per day.

Coal: Extensive seam, dipping generally into the hill at about 8 degrees to the N.E. From 8 to 21 inches (20 - 70 cms) in width occasionally splitting into small seams with a narrow sandstone parting. Comparatively good quality lignite; little sorting required. 50 per cent fines.

Analysis. Recent samples taken at the working face gave the following:-

<u>Sample No:</u>	<u>M1.</u>	<u>M2.</u>	<u>M3.</u>
Width (ins. & cms)	29 (72)	8 (20)	4 (10)
Moisture %	6.8	6.0	8.6
Volatiles %	30.6	36.7	34.7
Fixed Carbon %	28.8	25.0	29.7
Ash%	40.6	38.3	35.6
Sulphur %	7.4	4.6	6.6
Calorific Value B.T.U.s and Cals/kilo.	<u>8030</u> (4460)	<u>8150</u> (4530)	<u>9500</u> (5280)

Comment.

The greater part of the mine area open for examination has been worked out, either by the present operations, by the Germans in World War No. 1, or prior to that. The developed tonnage in reserve at present is undesirably small.

It is indicated that un-mined extensions of the seam may exist to the north and north-east. The present operations are now proceeding to penetrate this ground. Progress in this direction has been hampered by a series of east-west faults, against which the German work seems to have ceased.

The latest development has encountered the seam (12 ins) at M5. Development in this zone should be speeded up. Further faulting may be encountered, but the particular set of faults thus far penetrated may be limited in extent, being associated with a small flexure in the formation visible on the surface (Fig. 20).

No estimate of available reserves can be made. The extent of the seam which still remains to be developed towards the north is, at the present stage, entirely a matter of speculation. The relative inaccessibility of the property creates transport difficulties.

The Germans installed an elaborate and extensive surface Decauville haulage to Bhamdoun village, but present circumstances do not warrant such a scheme. No improvements, within reason, of the present mule and truck transport system can be proposed.

B. Arsoun Workings. (Makla Ain-el-Bed) Fig. 21)

Map Reference: 1484.2134

Altitude: 2830 feet (870 metres).

Situation. On north side of wadi which is parallel to and north of Wadi Hammana. Below and west of Qornaye village. 35 miles (56 kms) from Beirut via Broummana.

Distance from Road: Main gallery opens on to end of motorable track 500 yards long, off the main road from Hammana to Arsoun village.

Labour: 9 men

Production: 1 ton per day.

Owner: Compagnie Perso-Libano-Syrienne. (Beirut).

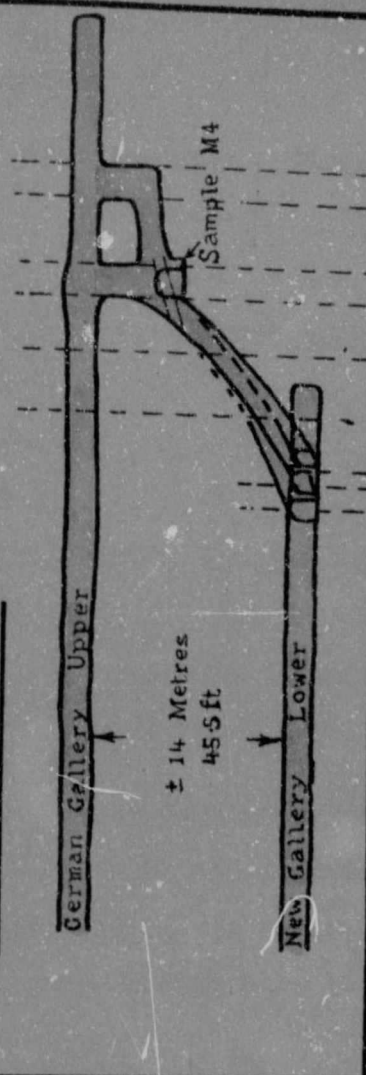
Analysis: The following are the results of samples recently taken, sample M4 being at the face, and sample A selected as one large lump from the face.

<u>Sample No:</u>	<u>M4</u>	<u>A.</u>
Width (ins & cms)	34 (84)	30 (75)
Moisture %	7.0	2.6
Volatiles %	37.9	41.0
Fixed Carbon %	32.5	39.4
Ash %	29.6	19.6
Sulphur %	6.1	8.4
Calorific Value B.T.U.s and Cals/kilo.	<u>10330</u> (5740)	<u>11700</u> (6500)

Reuter

SKETCH SECTION THROUGH

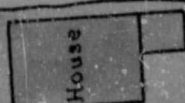
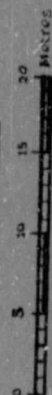
PORTION OF WORKINGS



SKETCH PLAN OF PRESENT WORKINGS

AT ARSOUN.

Scale 1 : 400



Peat

Comment.

The mine is recorded as having produced in 1834. There is extensive evidence of old work over a long outcrop distance. The present workings are restricted to the eastern end of the outcrop, where a new gallery has been driven below an old one. The lignite seam has been located in a connecting raise between these two galleries (Fig. 21). There are old workings at this point, and their extent is unknown, so that the present results are speculative. It is stated, however, by the locals, that the Germans were still developing in good coal when work was stopped at the end of World War No. 1.

The development of a reserve of suitable tonnage would render it of particular interest due to its high calorific value, width, and its proximity to the road thus dispensing with mule transport.

C. Bzebdine Workings. (Fig. 22)

<u>Map Reference:</u>	1508.2150
<u>Altitude:</u>	2760 feet (850 metres)
<u>Situation:</u>	500 yards down road to E.N.E. of Bzebdine village; immediately west of road. Bzebdine is 37.5 miles (60 kms) from Beirut via Broummana.
<u>Owners:</u>	Compagnie Perso-Libano-Syrienne
<u>Labour:</u>	6 men.
<u>Production:</u>	nil.

Comment:

Mentioned in 1836. There is evidence of old work. The deposit was worked by the Germans in conjunction with Arsoun, but the old workings have now collapsed.

Shewing positions of present galleries relative
to old German workings and wells in which Lignite
was found.

Author Coulter J

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