

Early History of Lebanese Lignite.

Soon after the outbreak of war in 1939, the fuel question came up for serious consideration, but due to local prejudice and the fact that there were still appreciable stocks of imported coal in the Middle East, the interest taken in Lebanese Lignite was apathetic in the extreme.

In 1941, however, the shortage of imported coal was being felt, and in an endeavour to revive national interest and encourage private enterprise, M. Louis Dubertret of the Section des Mines, published in January 1942, an article in "La Syrie", a daily newspaper, a translation of which reads:-

" Since the outbreak of war, the small industries and the railways have suffered as a result of the limitation in the imports of coal, and have devoted their attention to procuring it from other sources. To-day with the rigours of winter upon us, the shortage of fuel will be felt by every household. We would, therefore, draw attention to the valuable sources of fuel that the Lebanon possesses, and which could be utilised, namely Lignite.

" Abandoned since 1918, the lignite industry in wartime finds conditions favourable to its development. The year 1940 saw a definite tendency towards the use of lignite, and to-day a quantity of some dozens of tons is daily put to use in the smaller industries, some in its natural state and some in the form of briquettes. But in the first place, what is Lignite? In pieces it resembles coal; often there are clear indications of vegetable formation, similar to wood, and even marks of branches and leaves. This is due to the fact, that like coal, lignite

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is the product of the fermentation of vegetable matter accumulated either upon the region of their growth, as in forests, or in the depths of lakes or estuaries, where it has been brought by the flow of water.

" The existence of lignite deposits is a strange phenomenon, suggesting as it does, that the regions in which the beds were formed were, at some time distant in geological history, either the site of dense forests or the area of a lake or estuary, neighboured by wooded land. In the Lebanon and Anti-Lebanon, the necessary conditions existed during a period which fell between the two ages known to geologists as the Jurassic and the Cretaceous. Thousands of metres of sediment settled into deposits to form lignite, and these beds, situated at a great depth, were only uncovered by the movements of the massifs of the Lebanon and the Anti-Lebanon, and by the action of erosion.

" To-day, lignite outcrops are discernable throughout the mountains of the Lebanon and the Anti-Lebanon, particularly where the movements of the Jurassic and the Cretaceous have passed. In the Anti-Lebanon it is found around Mount Herman, but much less developed.

" The deposits are easily mined from the surface, since their position renders deep mining unnecessary. The lignite is in lenticular and irregular masses, the diameter of which measures tens of yards, and the thickness ranging from a few inches up to three feet. The varied formations of the beds constitute one of the difficulties of exploitation.

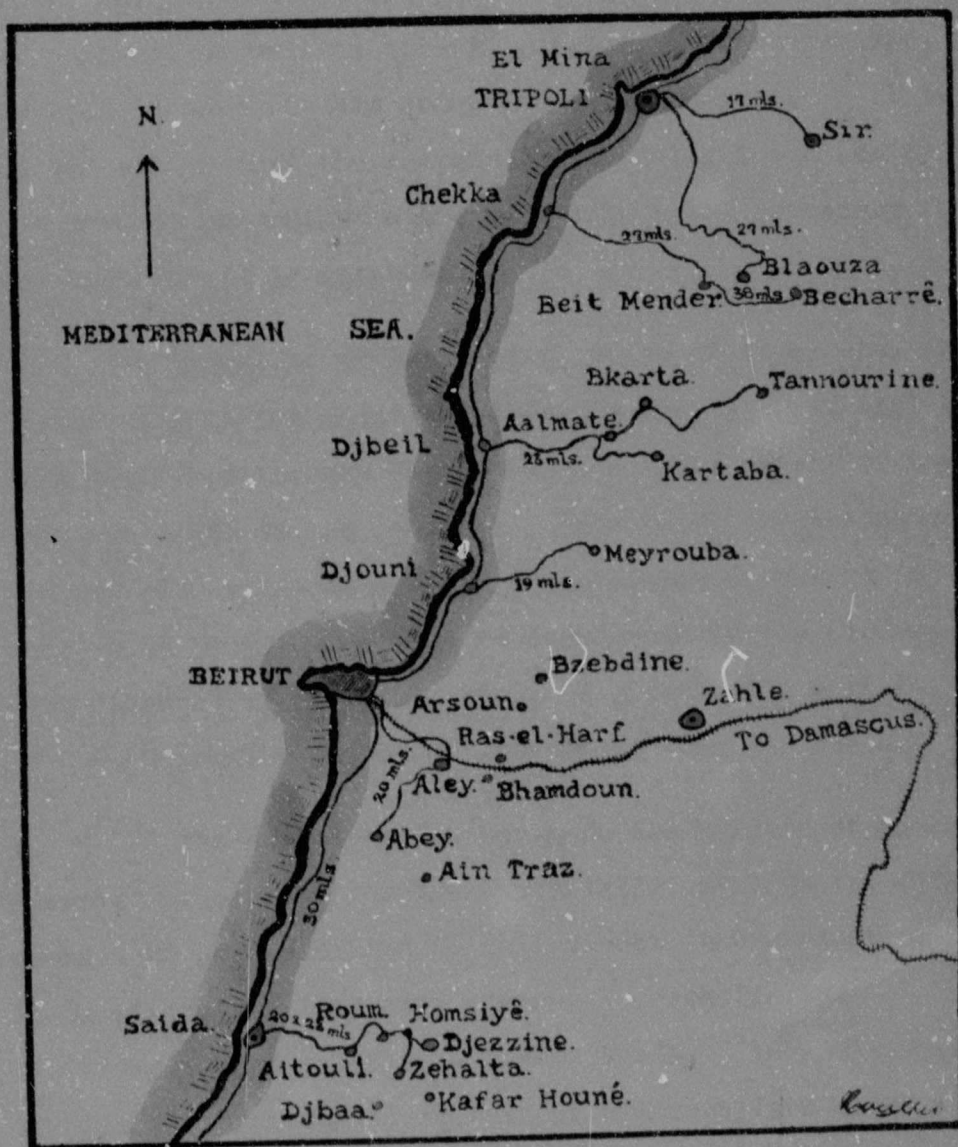
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" There are also other difficulties. The lignite is nearly always mixed with a certain proportion of useless matter: clay, sand, limestone, which not only reduce the calorific value of the fuel, but also prevent proper combustion and foul the hearth. In addition to this waste matter, there is iron pyrites, which is found in the lignite, sometimes in the form of compact masses, yellow in colour, and of a metallic character with square or pentagonal forms, sometimes diffused throughout the deposit. The oxidation of this in the course of combustion, produces suffocating sulphurous gases which attack iron, particularly grills and pipes.

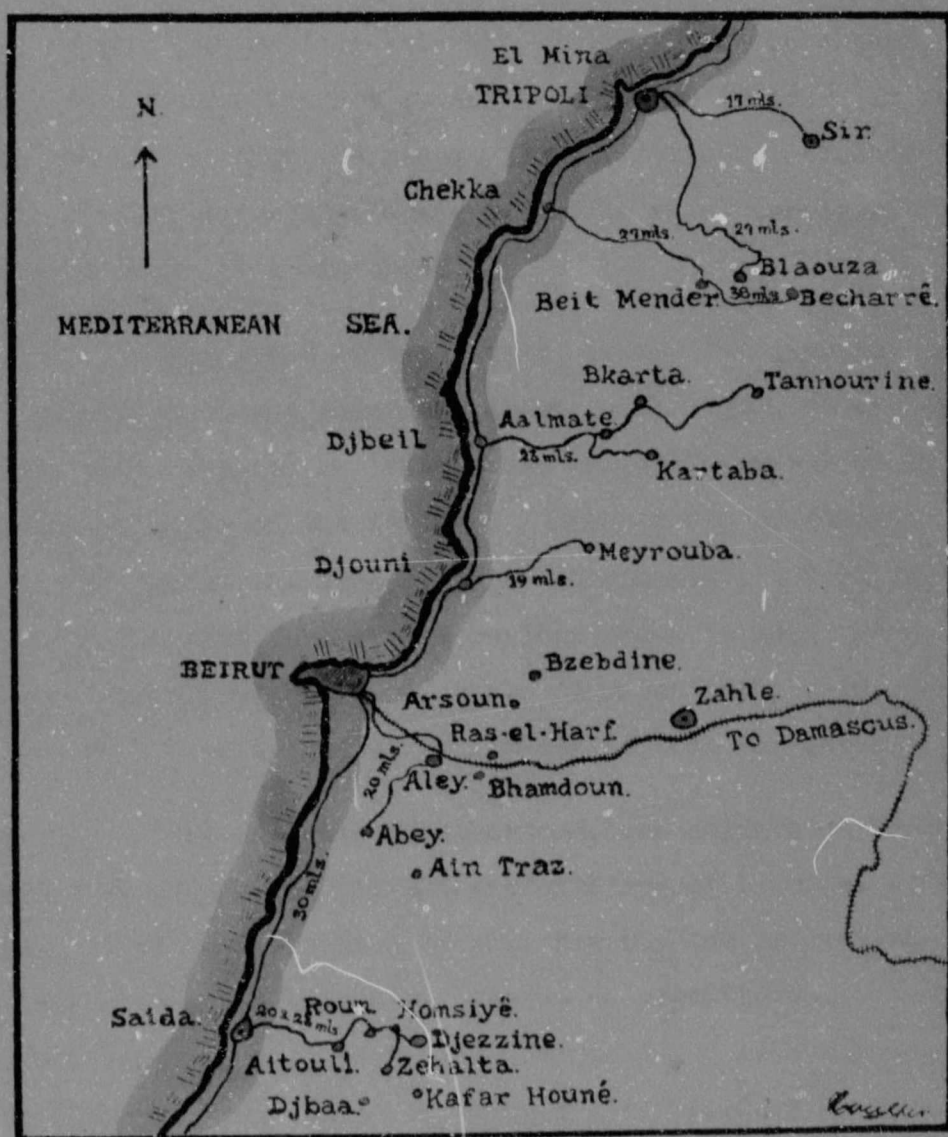
" Fortunately these impurities can be reduced, first in the course of extraction, by careful separation of the lignite from waste matter, later by hand sorting at the mine entrance. Pyrites, when present in mass, can be almost entirely eliminated. Often, however, the lignite can only be improved by washing, which necessitates crushing. The lignite thus treated is in powder form, which is difficult to use in normal fires. From this arises the need for the production of briquettes or balls, by mixing the powder with a binder, and subjecting the mixture to great pressure.

" It will be seen, therefore, that the products of the lignite mines can be delivered to the public in various forms:-

1. The raw products, containing a certain amount of waste and sulphur in varying proportions.
2. Lignite in pieces, sorted by hand, i.e. lump lignite. (Some mines supply lignite approaching coal in quality).
3. Lignite briquettes (or balls), manufactured by mixing the washed powder with bitumen.



CENTRES OF LIGNITE EXPLOITATION IN THE LEBANON.



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" Each of these products has its own particular advantages. The raw fuel suits the needs of most of the industries, while the sorted lignite or briquette is more convenient for domestic purposes.

" Chemical analysis can show the qualities of the fuel, and the content of fixed carbon, of volatile matter, of sulphur, as well as calorific value. The purchaser, however, cannot fit his orders to these analysis. It is on the seller that the responsibility falls for classifying his product according to the calorific value necessary for use to which it is intended.

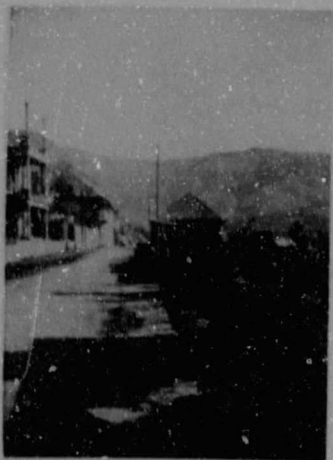
" The areas of extraction, means of transport, and distances from the coast are shown in Fig. 3. It will be seen that deposits are found over the whole extent of the mountain parts of the Lebanon. Undoubtedly exploitations are not all at the same stage of development, but it is considered that each of the regions shown in the figure, around Becharre, Meyrouba, etc., is potentially able to produce a regular output of 100 to 150 tons per month.

" The exploiters authorised, are holders of research permits, or permits for the exploitation of lignite. Some among them are permitted to sell direct, the product of their mines, and they have a group to organise the exploitation and sales on a common basis. In addition, lignite is permitted to be sold by all retailers of coal authorised by Amendment No. 1 to the annex to Regulation No. 2 in application of Arrête 213/LR, of the 5th September 1939, concerning trade in solid mineral fuels."

There is little doubt that this article revived a certain amount of interest, but the mercenary instincts of the exploiters and their associates hampered any progress. It was also unfortunate that at this period, although the holders of exploitation permits were willing to carry on small scale production and many new permits were taken out, the local authorities took little interest in the enterprise, beyond that of an academic nature, and gradually an industry, which to-day might have been on a working basis, receded into the background and was ignored.

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Buchari District.
Main Road through
Buchari Village.



Abee District.
Primitive boat
washing at Abee River.



Buchari District.
Looking down from
the hills on to the
Main Road. Buchari
in the background.



Karaka District.
Main Road through
Karaka Village.

THE ISLANDS OF THE GULF OF MEXICO

IN THE MIDDLE OF THE GULF OF MEXICO, THERE ARE SEVERAL ISLANDS, THE LARGEST OF WHICH ARE THE FLORIDA KEYS. THESE ISLANDS ARE OF VARIOUS SIZES AND SHAPES, AND ARE SEPARATED BY NARROW CHANNELS. THE ISLANDS ARE OF GREAT INTEREST TO THE MARINER, AND ARE OF GREAT IMPORTANCE TO THE COMMERCE OF THE GULF OF MEXICO. THE ISLANDS ARE OF GREAT INTEREST TO THE MARINER, AND ARE OF GREAT IMPORTANCE TO THE COMMERCE OF THE GULF OF MEXICO.

1. THE NORTHERN AREA LYING ALONG THE COAST OF FLORIDA.
2. THE CENTRAL AREA LYING ALONG THE COAST OF CUBA.
3. THE SOUTHERN AREA LYING ALONG THE COAST OF VENEZUELA.

THE SURVEY WAS A VERY SUCCESSFUL ONE, THE PURPOSE BEING TO OBTAIN A LIST OF ALL THE ISLANDS AND REEFES IN THE GULF OF MEXICO.

SECTION IV.

IN ALL CASES VISITED, FIRST IN THE NORTHERN AREA, THEN IN THE CENTRAL AREA, AND LAST IN THE SOUTHERN AREA.

PRELIMINARY INVESTIGATIONS.

A BRIEF INDICATION OF THE RESULTS VISITED IS GIVEN BELOW:

1. ABACOS, FLORIDA (See Reference 1913, 1917).
Elevation 100 feet (30 meters). Approximately 15 miles (24 km) from the coast of Florida.
2. Key West, FLORIDA (See Reference 1913, 1917).
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IV. PRELIMINARY INVESTIGATIONS.

In the middle of 1942, the War Department became definitely interested in Lebanese Lignite and preliminary investigations were carried out. Three trips were arranged, which would quickly cover the three main areas of the Lebanon where lignites are known. These areas were:-

1. The NORTHERN AREA lying inland from TRIPOLI.
2. The CENTRAL AREA lying inland from BEIRUT.
3. The SOUTHERN AREA lying inland from SAIDA.

The survey was a very cursory one, its purpose being to decide which, if any, of the occurrences were worth exploiting in the immediate future. Eight properties in all were visited, four in the NORTHERN AREA, one in the CENTRAL AREA, and three in the SOUTHERN AREA.

A brief indication of the deposits visited is here given:-

1. MEYROUBA MINE: Map Reference 1553.2337.
Elevation 5000 feet (1500 metres). Approximately 15.5 miles (25 kms) by road from the coast at Djounie.
2. Coal occurrence on the road, DJEZZINE-SAIDA. Map Reference 1325.1797. Elevation 3410 feet (1050 metres). 15.5 miles (25 kms) approximately by road from the coast at Saida (Sidon).
3. Workings between AITOULI and EL QABAA villages. Map Reference 1331.1785. Elevation 3410 feet (1050 metres). Approximately 19 miles (30 kms) from Saida.

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4. Near HAMRA ABU JDID. Map Reference 1329.1775.
Elevation 3250 feet (1000 metres). Approximately
19 miles (31 kms) from Saida.
5. BEIR MENDER. Map Reference 1675.2574.
Elevation 4060 feet (1250 metres). Approximately
16 miles (26 kms) from Chekka.
6. BECHARRE MINE. Map Reference 1766.2555.
4550 feet (1400 metres). Approximately 25 miles
(39 kms) by road from Chekka.
7. BLACUZA MINE. Map Reference 1711.2580.
Elevation 4390 feet (1350 metres). Approximately
30 miles (48 kms) by road from Chekka.
8. MAZRA BUSAB. Map Reference 1651.2558.
Elevation 3575 feet (1100 metres). Approximately
19 miles (30 kms) from the coast at Chekka.

The salient points arising out of this short preliminary survey were:-

- (a) None of the deposits appeared to be sufficiently extensive to justify development on a large scale.
- (b) Five deposits were estimated to yield about 45 tons per day - say 15,000 tons per annum.
- (c) Any past development had been unscientific, the operators being local villagers with pick and shovel.
- (d) The quality of the final product depended to a very large extent on the hand picking of the material, which was carried out by the families of the operators.

Preliminary Investigations.

- (e) Deposits with the seams inclined towards the mountains were considered unsuitable because of roads, adits and arrangements for drainage, which have to be made if development on a large scale is contemplated.
- (f) There were only two deposits, Becharré and Blaouza, which could be developed immediately, and which would not involve any large scale non-productive work. These were situated 25 and 30 miles respectively from the main road, rail and sea at Chekka, the access road being in reasonably good condition, though impassable at times in winter.

Both Becharré and Blaouza Mines were closed down at the time by order of the Section des Mines, on account of the fact that the exploiters, by their method of working, had rendered the underground workings unsafe.

It was estimated that there was at least 1,000 tons of lignite in sight, and the rate of production was put down at 15 and 10 tons per day respectively.

The deposits were the best that had been found in the preliminary survey, taking quantity and quality into account, and could be expected to increase with supervision and assistance in mechanical plant and explosives. Labour, which had already produced over 5,000 tons was still in the vicinity.

It would probably be necessary to allocate part of the output to the Chekka Cements Works, whose annual requirements were approximately 1,000 tons.

The only use to which the products of these two deposits had been put during the period of working, had been by the Chekka Cements Works for the burning of lime and gypsum for War Department purposes. The several civil briquette factories were then working with products from other deposits, so if the War Department decided to take the whole of the output of the two deposits, the normal activities of the other deposits would not be affected.

Apart from the proposed allocation to Chekka, other purposes for which the lignite could be utilised were:-

- (a) Fuel for Steam Road Rollers (under military control) in Syria and the Lebanon.
- (b) Cement production at Haifa, Palestine, from which plant the military draw the total output for their own requirements.
- (c) Fuel for War Department and civil requirements in Syria and the Lebanon.
- (d) As raw material for the manufacture of black camouflage pigments.
- (e) For lime production in Palestine for the manufacture of silicate bricks, the total output to be used for military requirements.

If after investigation and experience gained, it was found possible to increase the output of lignite, it was proposed to utilise the surplus output for:-

Preliminary Investigations.

1. Syrian and Palestine Railways.
2. Egyptian Railways.
3. Fuel for steam rollers and domestic requirements throughout the Middle East.

As a result of these and subsequent investigations, the War Department took over the Concessions in respect of the Becharré and Blacouza deposits, under certain royalty conditions to the civilian concession holders, and the commencement of lignite mining operations by the War Department took place in September 1942. The actual working of the two deposits was carried out by a Detachment of the 61st. Tunnelling Company (Mines Engineering Brigade) South African Engineers' Corps. All operations were controlled by a Lignite Board, consisting of representatives from the 9th Army, Spears Mission and Delegation Generale au Levant de la France Combattante.

Once these two mines were taken over by the military, the writer, except for two visits, had little to do with them, as his work was mainly as liaison between the British Legation, the French Delegation and civilian mine and briquetting factory owners.

<u>NAME OF PROPERTY.</u>	<u>SITUATION AND DESCRIPTION.</u>	<u>DISTANCE FROM MOTOR ROAD.</u>	<u>ROAD DEPOT TO NEAREST COASTAL ROAD.</u>	<u>WATER FACILITIES.</u>	<u>REMARKS AND ROUGH ESTIMATE OF DAILY OUTPUT.</u>
<u>BELT MENDER.</u> Altitude 4060'	<u>NORTHERN AREA.</u> A partly prospected and slightly worked outcrop.	Metalled road in the immediate vicinity. Trucks could be loaded at portal	16 miles from Chekka.	Poor. No running water in the immediate vicinity.	Gossa, material ranging from red to greenish near outcrop. Possible - 5 tons.
<u>BECHARRE.</u> Altitude 4550'	<u>NORTHERN AREA.</u> A developed & partly worked MINE which is now closed because of caving roof.	Portal is 200 yards above good motor road. Gravity loading possible	25 miles from Chekka.	Excellent. Product could be washed easily.	If opened should produce 15 tons.
<u>BLAOUZA.</u> Altitude 4390'	<u>NORTHERN AREA.</u> A developed mine that has been stopped for safety reasons.	Unmettalled track 160 yards from road Easy to make all weather.	31 miles from Chekka.	Good. There is running water in the immediate vicinity.	If opened should produce 10 tons.
<u>MAZRA BUSAB.</u> Altitude 3575'	<u>NORTHERN AREA.</u> Partly worked outcrop.	Nearest motor road is 1100 yards off, down rocky stream bed. Mule haulage.	19 miles from Chekka.	Outcrop is on the bank of a stream, but this dries in the late autumn.	If sampling shows grade to be good, 5 tons.
<u>MEYROUBA.</u> Altitude 5040'	<u>CENTRAL AREA.</u> A partly developed outcrop, but not yet opened up.	Nearest motor road is 3 miles away, Transport by mule and donkey.	19 miles from Djouni.	Poor. A spring. Ain Regni exists, may be developed for washing.	If opened up by proper means, 5 tons.
<u>AITOULI AND DJEZZINE AREA.</u> Altitude 3410'	<u>SOUTHERN AREA.</u> Four outcrops visited. Two working. All seem to be small bodies.	Distance from road vary from NIL to 500 yards of steep haulage.	All these bodies lie about 19 miles inland from Saida.	Lenses are small, and one central washing plant is the best solution. Water in the neighbourhood.	The combined output should be in the neighbourhood of 10 tons.

SUMMARY OF SALIENT POINTS OBSERVED ON PROPERTIES VISITED.

SECTION V.

THE SOURCES AND NATURE OF THE LIGNITE OCCURRENCES.

SKETCH PLAN OF COAL HORIZON BLAOUZA - BECHARRE AREA

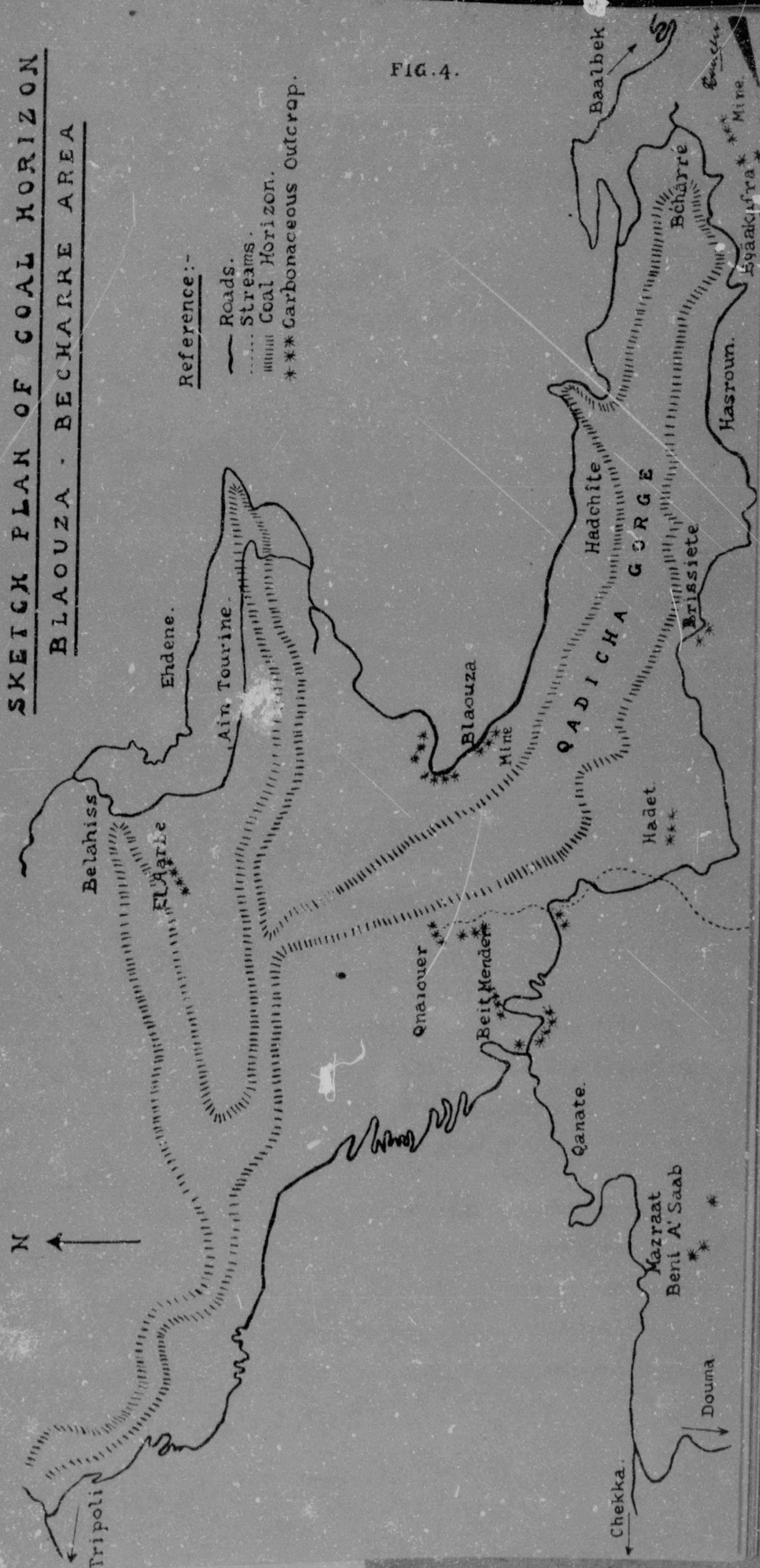


FIG. 4.

V. THE SOURCES AND NATURE OF THE LIGNITE OCCURRENCES.

I. THE NORTHERN LEBANON.

- A. The Blaouza - Becharré Area.
- B. The Kartaba Area.
- C. The Meyrouba Area.

II. THE CENTRAL LEBANON.

- A. The Region between Ras-el-Harf and Bzebdine.
- B. The Region around Abey.

III. THE SOUTHERN LEBANON.

- A. The Aitouli Area.

THE NORTHERN LEBANON.

A. BLAOUZA - BECHARRÉ AREA.

General Geology.

The lignite occurrences in this area (Fig. 4.) are numerous and of varying quantities and qualities, but those at Blaouza and Becharré were considered to be the most promising for immediate attention.

The coal beds in the Blaouza - Becharré circuit are remarkable for their close association and even interbedding with the volcanic rocks. The carboniferous shales occur near the top of the purple-red volcanics that overlie the Jurassic Limestone. At Becharré these

volcanics, alternating with black basalts, form a layer about 190 feet (60 metres) thick, but thin out towards the West-North-West. At Blaouza, no black basalts are found, and the purple-red volcanics are only 39 feet (12 metres) thick. Further west they are considerably thinner. Near Becharré the carboniferous shales average about 40 feet below the top of the volcanics; between these places they outcrop at intermediate horizons.

The shales do not occur as a continuous bed throughout the area, but as lenses in certain areas. The localities in which these shales are deposited seem to have been decided by the topography of the purple-red volcanic surface at the time. These volcanics consist mainly of ashes (but contain some lavas) which were deposited under water, but apparently by no means evenly, for it is in the troughs and basins of these that the carbonaceous shales were deposited. The chief source of origin of these volcanics appears to have been to the south-east of the area, where they are thickest. Moreover, in this part, a deposition of tuffs and ashes, which are now found to the north-west, succeeded the main carbonaceous shale depositions. The basins of depositions are an apparently invariable feature accompanying the occurrence of the lignite.

There are two other conditions that accompany coal formations in the Northern Lebanon, sufficiently often to suggest that they are not unconnected with it. One of these is an unusual degree of earth movement, resulting in acute folding and faulting. The other is volcanic activity of an intensive nature subsequent to the deposition of the shales. The relation of the coal content of a shale bed to the occurrence of one or the other, or both of these

disturbances, suggests that the heat and/or pressure accompanying them act(s) as a metamorphic agent, changing the shale into coal.

An additional factor that lends evidence to this theory, is that, in the neighbourhood, shales are found that have a higher calorific value than some of the coals found, indicating that though they have a higher carbon content, they have not been subjected to the force of the metamorphic agent for these to effect the molecular re-arrangement necessary to transform a carbonaceous shale into a coal. The association of vulcanicity and earth movement with the occurrence of coal was striking, and the establishment of such a relationship would enable one to use these geological features as pointers to coal occurrences.

If another condition was to be added to the three already given, as likely to be an indication to the presence of coal in workable quantities in a given area, it would be that some attempt to extract it should have been made there by the local inhabitants. This condition would apply throughout the Lebanon. The slopes of the surrounding country are nearly all terraced in order to prevent soil erosion. These terrace walls have to be continually repaired and rebuilt. Stone for this purpose is extracted from the ground as near as possible to the work for which it is required. The composition of the stone walls in a terraced area is a fair indication of the underlying rock formations. In the course of time the underlying bedrock will have been examined over the greater part of a terraced area. In searching for stone the local inhabitants could not fail to recognise a coal outcrop should they chance upon one.

The Sources and Nature of the Lignite Occurrences.

Coal is known to exist in certain areas, and fuel constitutes a sufficiently acute problem to ensure that no prospect that holds out a vestage of hope will be neglected. It is customary for the inhabitants of some parts to take their donkeys up considerable heights to collect a poor quality of brushwood. It is unlikely that a naturally indolent race would go to such trouble if fuel could be had near at hand for the digging.

Sub-division of the Area.

A fairly comprehensive examination of the Blaouza Becharré was made, an outline of which is here given. For this purpose the area is sub-divided into five regions:-

1. Blaouza Mine Region.
2. The Region adjacent to the Blaouza Mine Region.
3. The Region adjacent to Becharré Mine on the North West.
4. The Bqaa Kafra Region.
5. The Qnaouer Region.

The five regions are situated about 31 miles (50 kms) by road from Chekka at altitudes ranging around 4500 feet (1400 metres).

1. The Blaouza Mine Region.

This area (Map Reference 1707.2581), is situated on the steeply inclined, 25-40 degree slope on the north side of Wadi Qadicha at Blaouza. It lies on the north-west side of the Jurassic, Lower and Middle Cretaceous vault that extends from the Litani river in the south to the Homs-Tripoli gap in the north, with a S.S.W. - N.N.E. axis.

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