UNITED NATIONS
ECONOMIC
AND
SOCIAL COUNCIL

Distr.
RESTRICTED

E/CN.14/INR/161
10 March 1969

Original: ENGLISH

ECONOMIC COMMISSION FOR AFRICA

NON-FERROUS METAL ORES MINING IN THE NORTH AFRICAN SUB-REGION

DEVELOPMENT STUDY : 1965-1980

(With annexes on coal mining and iron ore)

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M69-1386

CHAPTER I

INTRODUCTION

This report is one of the sectoral studies necessary for preparing a complete study on industrialization and economic co-operation for the North African sub-region.

Its aim is to gather the most important information on the actual situation of non-ferrous metal ore mining in this sub-region and to project the most desirable development of the industry until 1980.

The mining industry has a special feature that distinguishes it from other industries. It needs geological reserves of minerals in such amounts, qualities and conditions that they can be extracted economically. The knowledge of these factors is an essential preliminary to a mining study. Geological research, often very expensive, is necessary. A mine is usually a big industrial enterprise which needs a large investment for its establishment and takes several years before it reaches full capacity. One needs detailed geological, technical and economic studies before one can decide on such an investment. Of course, similar studies are also necessary in other industries, but the degree of uncertainty there is much lower than in mining. One must have this in mind when preparing a mining study. In the present case an additional difficulty was the lack of very important information especially concerning reserves, new projects and costs of production. Some governments consider these confidential and do not wish to make them available. Alternative information must then be obtained by analogy and estimation.

CHAPTER II

INDUSTRY DESCRIPTION

The following non-ferrous metal ores are mined in the countries of the North African sub-region:

Manganese	-	Morocco and United Arab Republic
Zinc and lead	-	Morocco, Algeria, Tunisia
Copper	-	Morocco, and small amounts in Algeria
Cobalt	-	Morocco
Antimony	-	Morocco
Chrome	-	Sudan
Tin	-	In very small amounts in Morocco and Mercury in Tunisia.

The following table gives the amount of production in tons of concentrates in 1964.

Table 1 : Production in tons of concentrates in 1964

Mineral	Country						
	Morocco	Algeria	Tunisia	U.A.R.	Libya	Sudan	Total
Manganese ore	341,078	-	-	182,497	-	1,200	524,775
Lead ore	103,944	13,601	13,400	-	-	-	125,545
Zinc ore	80,974	64,274	6,000	-	-	-	151,248
Antimony ore	3,282	-	-	-	-	-	3,282
Copper ore	6,504	3,900	-	-	-	-	10,404
Cobalt ore	15,253	-	-	-	-	-	15,253
Tin ore	20	-	-	-	-	-	20
Chrome ore	-	-	-	-	-	30,000	30,000

One can see from this table that the main mining activities are in Morocco. Its production is also the most diversified. In the second place is United Arab Republic with its manganese ore production; at third place Algeria with its zinc and lead ores production. Sudan and Tunisia produce small amounts of ores and Libya has no production at all.

The mines are usually very small. The smallest ones are joined in co-operatives and use very simple production methods. Some of them producing manganese, lead and zinc are of medium size.

The ores occur mainly in veins and lenses. They are reached from the surface in pits or horizontal galleries (adits) when the deposits, as often occurs, lie in mountains. The ores are separated from the original rock using drilling engines and explosives. The crushed ores are roughly separated from the sterile rocks by workers and loaded separately in trucks. They may be also transported on conveyor belts.

The ores, after being transported to the surface, have to be enriched by using more or less sophisticated mechanical and physico-chemical methods. Generally speaking, the ores have to be classified according to size and crushed and washed with water in special machines. These processes may be repeated several times. In this way the ores can be separated from useless rock. They are known then as concentrates and may be transported and sold as the main raw materials for the metallurgical industry. The above operations are done in washing plants which can treat ores from several small mines. It is also possible to separate there minerals from mixed deposits, for instance, lead ore from zinc ore.

Almost all concentrates of North African countries are exported by sea outside Africa. Only in Morocco and Tunisia are there foundries which produce lead as metal.

World market situation

The world production of all non-ferrous metal minerals produced in North Africa increased during the period of 1960-1965 with the single exception of cobalt.

The rate of increase was highest for manganese (31 per cent) and zinc (28 per cent) medium for copper (19.5 per cent) and antimony (18.1 per cent) and lowest for chrome (14 per cent) and lead (12.3 per cent). The production of cobalt ore decreased (-6.2 per cent).

Tables numbered 2 to 8 give the production, imports and exports of the largest producing and importing countries in 1960, 1964 and 1965, for manganese, lead, zinc, copper, antimony, cobalt and chrome.

1. Manganese ore (Table 2)

World production of manganese ore increased rapidly from 13.9 million tons in 1960 to 18.2 million tons in 1965, that is by 31 per cent.

Manganese is consumed mostly in steel making but is used also in non-ferrous alloys and in chemicals.

The main producing countries are: U.S.S.R., India, China, South Africa and Brazil. In the North African region it is produced in Morocco and in the United Arab Republic.

The share of these countries in world production was 5.4 per cent in 1960 and 3 per cent in 1965; production falling during this period from 747,000 tons to 549,000 tons. All producing countries except China and Japan export ores to the developed countries. The U.S.S.R. exports 13-16 per cent of its production. The main importers are: U.S.A., Japan, France, West Germany, Norway and Great Britain.

Table 2 : Manganese ore - world production and trade

Region	Production in 1,000 long tons			Exports in 1,000 long tons		
	1960	1964	1965	1960	1964	1965
World	13,900	16,200	18,200			
U.S.S.R.	5,785	6,984	7,700	958	963	1,004
India	1,180	1,283	1,480	1,025	1,011	631
Mainland China (estimate)	1,180	980	980	.....no information.....		
South Africa	1,175	1,445	1,747	867	871	993
Brazil	983	1,330	1,374	853	820	1,051
Ghana	545	455	592	547	498	565
Congo	376	305	372	300	325	400
Japan	319	280	302	1	-	-
Morocco	475	336	370	381	281	316
U.A.R.	272	323	179	206	180	160
U.S.A. (shipments)	153	209	-	5	13	13
Trends of world production	100.0	116.8	131.0			
		Imports				
U.S.A.	2,033	2,700	3,442			
France	765	779	841			
Great Britain	529	524	495			
Germany (Federal Republic)	351	680	626			
Poland	328	374	343			
Norway	303	354	502			
Japan	238	550	1,048			
Belgium-Luxembourg	219	267	304			
Czechoslovakia	179	314	329			
Italy	137	104	105			

Source: Statistical Summary of the Mineral Industry.
World Production Exports and Imports 1960-1965,
Institute of Geological Sciences, Overseas Division, London.

Table 3 : Lead ore - world production and trade

Region	Production in 1,000 long tons (metal content)			Exports in 1,000 long tons		
	1960	1964	1965	1960	1964	1965
World	2,400	2,500	2,700			
U.S.S.R. (estimate)	340	400	410	-	-	-
Australia	308	375	355	60	96	74
U.S.A.	220	255	269	1	-	-
Mexico	188	172	167	3	3	-
Canada	184	182	256	46	72	96
Peru	130	148	145	57	64	65
Morocco	93	70	76	144	94	141(ore)
Bulgaria	82	90	100			
Mainland China (estimate)	80	100	100	..... no information		
Spain	72	57	57	2	-	-
South West Africa	64	95	86	61	35	36
Trends of world production	100.0	104.1	112.3			
		Imports				
Germany (Fed. Rep)	152	107	137			
Belgium-Luxembourg	137	100	194			
U.S.A. (Pb content)	123	114	115			
France	99	142	128			
Japan	41	51	66			
Great Britain (Pb content)	22	29	21			

Source: Statistical Summary of the Mineral Industry.
World Production, Exports and Imports, 1960-1965,
Institute of Geological Sciences, Overseas Division, London.

Table 4 : Zinc ore - world production and trade

Region	Production in 1,000 long tons (metal content)			Exports in 1,000 long tons ores		
	1960	1964	1965	1960	1964	1965
World	3,200	3,900	4,100			
U.S.A.	389	513	546	-	-	-
Canada	363	611	734	152	360	435 (in content)
U.S.S.R. (estimate)	340	450	470	48	-	-
Australia	317	345	348	137	132	110 (in content)
Mexico	258	232	221	376	270	304
Peru	175	233	255	131	200	209 (in content)
Japan	154	213	217	-	-	-
Poland	142	148	150	-	-	-
Italy	129	102	108	59	48	29
Congo	107	104	117	96	85	85
Morocco	48	42	50	70	63	97
Algeria	39	38	37	65	52	67
Spain	85	87	38	74	24	6
Sweden	73	76	78	137	146	146
Trends of world production	100.0	122.0	128.1			
		Imports				
Belgium-Luxembourg	540	442	502			
U.S.A.	342	278	364 (in content)			
France	286	362	327			
Great Britain	189	304	229			
Germany (Federal Republic)	158	144	119			
Poland	110	165	144			
Japan	108	284	374			
Norway	84	77	102			

Source: As before.

Table 5 : Copper ore - world production and trade

Region	Production in 1,000 long tons (metal content)			Exports in 1,000 long tons (ores)		
	1960	1964	1965	1960	1964	1965
World	4,100	4,700	4,900			
U.S.A.	964	1,113	1,207	10	1	5(in content)
Zambia	567	622	685	-	-	-
Chile	528	624	570	41	35	28
U.S.S.R. (estimate)	500	675	700	-	-	-
Canada	392	435	462	43	93	78(in content)
Congo	298	273	284	-	-	-
Peru	179	172	175	20	23	23(in content)
Australia	109	104	91	36	19	13(in content)
Japan	88	104	105	-	-	-
Mexico	59	52	68	21	7	n.a.
China	40	75	75	..... no information		
South Africa	45	59	60	-	3	4(in content)
Philippines	43	60	61	172	244	255
Trends of world population	100.0	114.7	119.5			
		Imports				
Germany (Federal Republic)	146	149	144			
Japan	64	601	609			
U.S.A.	22	39	11(in content)			
Norway	61	50	60 Copper and			
Sweden	33	76	84 nickel matte			
Spain	21	20	23			
Poland	5	19	n.a.			
Belgium-Luxembourg	9	2	2			

Source: As before.

Table 6 : Antimony ore - world production and trade

Region	Production in 1,000 long tons (metal content)			Exports in 1,000 long tons		
	1960	1964	1965	1960	1964	1965
World	52.0	62.0	61.0			
Mainland China (estimate)	15.0	15.0	15.0	..... no information		
South Africa	12.1	12.7	12.3	20.5	21.7	18.7 ore
U.S.S.R. (estimate)	6.0	7.0	7.0	-	-	-
Bolivia	5.2	9.5	8.6	5.2	9.5	8.6(Sb content)
Mexico	4.2	4.7	4.4	9.1	11.9	11.2 ore and concentrates
Yugoslavia	2.4	2.7	2.7	-	-	-
Czechoslovakia (estimate)	1.6	2.0	2.0	-	-	-
Peru	0.8	0.7	0.5	0.9	1.0	n.a.(Sb content)
Algeria	0.8	-	-	3.5	-	n.a. ore
Morocco	0.5	1.5	2.2	0.5	1.8	3.0 ore
Trends of world production	100.0	119.0	118.1			
	Imports in 1,000 long tons					
Great Britain	15.6	14.0	n.a.			
France	6.1	2.6	1.7			
U.S.A.	5.8	9.5	9.3(Sb content)			
Japan	5.3	6.4	4.5			
Germany (Federal Republic)	2.0	2.6	2.7			
India	1.2	1.3	1.7			
Italy	1.0	n.a.	n.a.			

Source: As before.

Table 7 : Cobalt ore - world production and trade

Region	Production in 1,000 long tons (metal content)			Exports in 1,000 long tons		
	1960	1964	1965	1960	1964	1965
World	16.0	14.0	15.0			
Congo	8.1	7.6	8.3	-	-	-
Zambia	1.9	1.4	1.5	-	-	-
Canada	1.6	1.4	1.7	-	-	-
Morocco	1.3	1.7	1.6	12.0	28.6	6.2 ore
Trends of world production	100.0	87.5	93.8	-	-	-
		Imports ores				
France	6.7	10.2	11.5			
U.S.A.	2.9	-	n.a.			

Source: As before.

Remark: Morocco only exports cobalt ore. All other producing countries export cobalt as metal.

Table 8 : Chrome ore - world production and trade

Region	Production in 1,000 long tons				Cr_2O_3 contents in 1,000 long tons		
	1960	1964	1965		1960	1964	1965
		Ore					
World	4,300	4,200	4,900				
U.S.S.R. (estimate)	902	1,300	1,400		n.a.	n.a.	n.a.
South Africa	760	836	927		340	380	420
Philippines	723	461	546		248	157	185
Rhodesia	597	441	625		286	211	300
Turkey	472	406	558		221	190	270
Albania	281	302	310		n.a.	n.a.	n.a.
Yugoslavia	99	87	79		n.a.	n.a.	n.a.
India	105	34	59		50	16	28
Iran	67	120	150		32	58	72
Japan	66	43	41		23	15	14
USA (partially)	95	-	-		37	-	-
Trends of world production	100.0	97.9	114.0				
		Exports				Imports	
Philippine Republic	783	578	537	USA	1,238	1,275	1,206
South Africa	744	628	690	Germany (F.R.)	356	233	301
Rhodesia	483	448	625	Great Britain	292	222	202
U.S.S R	420	652	736	Japan	275	390	355
Turkey	380	339	418	France	186	190	221
Albania	245	n.a.	293	Sweden	139	150	139
New Caledonia	49	6	-	Poland	99	115	n.a.
India	30	30	25	Norway	92	108	75
Yugoslavia	20	24	13	Italy	70	78	99
Iran	37	123	157	Austria	59	49	41

New production or projects are as follows:

In Australia, shipments started from Groote Eylands operations in the Gulf of Carpentaria, Northern territory in 1966. The capacity of the crushing plant will be 400,000 tons yearly, although production will probably be 200,000 tons yearly in the first stage.

In Ivory Coast the reserves of the Grande Lahon mine have risen by 200,000 tons. In Chile, a drilling programme has been commenced to evaluate the Corral Quemado manganese deposits in Coquimbo Province.

In Mexico, the Export-Import Bank has authorized a US$5 million loan to a Mexican firm to develop its manganese properties at Malango in Hidalgo State. New facilities are scheduled to be in operation by 1968.

2. Lead ore

World production of lead ore rose from 2.4 million tons in 1960 to 2.7 million tons in 1965 in metal content (Table 3). The main producing countries are: U.S.S.R., Australia, U.S.A., Mexico and Canada. Morocco, with 76,000 tons of metal in 1965 belongs to the medium-size producers. Its share in world production is about 3 per cent.

Almost all countries produce lead from the ores and export metal but few export ore. The main exporters of ore are: Morocco, Canada, Peru and Australia. Canada and Peru export 40 per cent of produced ore, Australia 20 per cent, Morocco 70 per cent. The main importers are: Belgium, Luxembourg, Germany (Fed. Rep.), France and U.S.A. It is expected that mine output will rise by 9 per cent in 1967 in comparison with 1966.

3. Zinc ore

World production of zinc ore rose from 3.2 million tons in 1960 to 4.1 million tons in 1965 in metal content (Table 4).

The main producing countries are: U.S.A., Canada, U.S.S.R., Australia, Mexico, Peru and Japan. The share of Morocco, Algeria and Tunisia in world production was about 2 per cent in 1965.

The main exporters are: Canada, Mexico, Peru and Australia. Morocco, Algeria and Tunisia export their whole production. The importing countries are the same as for lead.

During 1966 mine output increased by 6 per cent over 1965. The increase came mainly from Canada where three new mines began to produce and from Japan, Australia, Spain and Ireland. It is expected that the increase in 1967 will be about 11 per cent, that is 450,000 tons, mainly from Canada.

4. Copper

World production of copper ore rose from 4.1 million tons in 1960 to 4.9 million tons in 1965 in metal content (Table 5). The main producers are: U.S.A., Zambia, Chile, U.S.S.R. and Canada. The copper ore production of Morocco and Algeria is insignificant on a world scale (about 0.6 per cent).

Almost all producers of copper ore transform it into metal and export it in this form; only the Philippines, which produces about 60,000 tons of metal content ore exports it as such.

Canada, which is the biggest exporter of ore, exports 20 per cent of its output. The biggest importing countries are: Japan, Germany (Fed. Rep.), Sweden and Norway.

Mine output in 1966 was only 1 per cent higher than in 1965. The future development is uncertain depending to some extent on the situation in Vietnam; which could make a difference to the military needs of the U.S.A. (about 350-400,000 tons yearly).

(Source: Engineering and Mining Journal, February 1967, Article: "Copper", page 122). The future production of the Congo is also not clear. Nevertheless, the copper industry has invested heavily in finding and developing new mines so that a large increase of capacity in coming years is possible.

5. Antimony

World production of antimony ores is very small in comparison with that of the above metals, but it has also shown a tendency to increase, rising from 52,000 tons in 1960 to 61,000 tons in 1965, that is by 18 per cent.

The main producing countries are: China (mainland), South Africa, U.S.S.R., Bolivia and Mexico. Morocco's share is about 3 per cent. The main exporters are: South Africa, Bolivia and Mexico.

6. Cobalt

World cobalt ore production is even smaller than that of antimony. It was 16,000 tons in 1960 and dropped to 15,000 tons in 1965.

The main producers are: Congo (55 per cent), Zambia, Canada and Morocco. Morocco's share is about 10 per cent. Morocco exports only cobalt ore. All other countries export cobalt as metal. The ore is exported mainly to France. The demand will probably be high in the near future.

7. Chrome

The world chrome ore production increased from 4.3 million tons in 1960 to 4.9 million tons in 1965, that is by 14 per cent. The main producers are: U.S.S.R., South Africa, the Philippines, Rhodesia, Turkey and Albania.

The main exporters are: U.S.S.R., South Africa, Rhodesia, The Philippines, Turkey and Albania. Ore is imported by U.S.A., Germany (Federal Republic), Japan, Great Britain and France.

The only producer of chrome ore in North African region is Sudan, whose ore deposits have very difficult transport conditions.

Prices

The world annual average market prices of metals are taken from the Engineering and Mining Journal, February 1967. Table 9 gives the prices since 1930 until 1960 for every fifth year and since 1960 until 1965 for each year. There are prices for lead, zinc and copper. Table 10 gives the trends of these prices, taking as the basic years 1950 and 1960. One can see from these tables that the prices rose sharply for all these metals. In the period 1960-1965 the increase was:

lead	-	26.7 per cent
zinc	-	12.0 per cent
copper (inside USA)	-	16.0 per cent
copper (outside USA)	-	65.8 per cent

One can generally say that this tendency will continue, although there may be years when the prices will decrease in comparison with previous years. In particular, the prices of copper and antimony are very unstable.

Table 9 : World annual average metal market prices

(in US cents/lb.)

Metal	1930	1935	1940	1945	1950	1955	1960	1961	1962	1963	1964	1965	1966
Lead common N.Y.	5,517	4,065	5,174	6,500	13,296	15,138	11,948	10,871	9,631	11,137	13,596	16,000	15,115
Zinc PW E. St. Louis	4,556	4,328	6,335	8,250	13,866	12,299	12,446	11,542	11,625	11,997	13,568	14,500	14,500
Copper USA domestic refinery prices	12,982	8,644	11,296	11,775	21,235	37,491	32,053	29,921	30,600	30,600	31,960	35,017	36,170
Copper[a]	-	7,538	10,770	11,700	21,549	39,115	29,844	27,919	28,514	28,413	30,985	35,604	49,512

Source: Engineering and Mining Journal, February 1967, page 97.

[a] Outside USA refinery prices.

Table 10 : Trends in world metal prices

Metal	1950	1955	1960	1961	1962	1963	1964	1965	1966
Lead common N.Y.	100.0	113.9	89.8	81.5	72.4	83.7	104.1	120.0	113.8
Lead common			100.0	91.0	80.5	93.4	113.9	134.0	126.7
Zinc PW E. St. Louis	100.0	88.6	93.4	83.2	83.9	86.5	97.7	104.9	104.9
			100.0	89.3	89.8	92.6	104.8	112.0	112.0
Copper USA Domestic refinery	100.0	174.8	149.0	139.1	142.6	142.6	153.2	163.0	167.2
			100.0	93.4	95.6	95.6	99.8	109.3	116.0
Copper outside USA refinery	100.0	181.8	139.0	129.8	132.5	132.0	144.0	165.5	230.0
			100.0	93.4	95.4	95.1	103.6	119.1	165.8

CHAPTER III

MOROCCO

General situation

The non-ferrous metal ores mines are very dispersed in the country but they are mainly connected with the mountains of the Middle, High and Anti-Atlas. Transport conditions are difficult because the concentrate must be transported by road to the ports or by road and rail, and the distance by road transport for some mines is between 200-370 kilometres.

Manganese

There are two mines: Imini in the western part of the High Atlas and Bou Arfa in the High Plateau region near the eastern border with Algeria.

Lead and zinc

These minerals are produced in the same mines. There are four larger mines: Touissit and Zellidja near Ouida by the eastern border, Aouli-Mibladen in the valley of Moulouya between Middle and High Atlas, and Aouam in Central Morocco. Small mines in the southern province of Tafilalet and in High Guir are exploited as co-operatives.

Cobalt

The only working mine is Bou Azzar in the south of the High Atlas.

Copper

There are two more important mines: Bou Skour in the south of the High Atlas and Djibel Klakh in High Plateau Region near Bou Arfa.

Antimony

Antimony is produced in very small mines in the region of Middle Atlas. The price of antimony is very unstable. Production costs are high and the mines can only make a profit during periods of high prices.

Tin

There is one small deposit at El Karit near Oulmes situated north-west of the Middle Atlas. The ore is smelted locally.

Geological reserves and researches

The geological reserves of ores on 31 December 1966 in tons of minerals (concentrates) are given in Table 11.

Table 11 : Geological reserves of minerals on 31 December 1966

(in tons)

Minerals	Certain	Probable	Possible
Manganese	1,600,000	250,000	170,000
Lead	239,000	425,000	-
Zinc	121,000	260,000	-
Cobalt	33,000	2,500	2,800
Copper	17,000	21,200	11,900
Antimony	-	-	-
Tin	-	-	-

Source: Ministry of Industry of the Kingdom of Morocco.

The reserves distributed by mines are given in years of production as follows:

Manganese	Years of production
Imini	10
Bou Arfa	3

Research at Imini has not given good results, but at Bou Arfa the outlook for research is good though the quality of the mineral is poor. This makes it difficult to sell.

Lead and zinc

Mine	Years
Touissit	15 - 20
Bou Beker	3 - 5
Aouli - Mibladen	5 - 10
Aouan	10
Tafilalet region	5 - 8
High Guir	5 - 8

Cobalt

Bou Azzar	2 - 3
Arbat	2 - 3

Copper

Bou Skour	5 - 8
Djebel Klakh	5 - 8

Antimony and tin

Reserves are not known.

Deposits hitherto unworked

Central Morocco (provinces Kenitra, Meknes and Ksar Es-Souk).

The geological researches carried out by the Bureau des Recherches et Participations Minières has brought to light an important deposit of lead, zinc, pyrite, and valuable metals in the Ougnat Massive. The quantities of ores are not known yet.

An important deposit of lead ore has been found on the northern slopes of the High Atlas (Mibelt and High Moulouya), known as "Moulouya lead". The reserves of rough lead ore are 10 million tons with a lead content of 3 per cent. Studies are now being made to examine the rentability of the exploitation.

Another deposit of lead and zinc ores of a stratum type are found in the region of Missour - Bou Selham - Merija that is situated to the north of the High Atlas.

Research in copper in the region of Anti-Atlas has been initiated by signing contracts with Yugoslav and American companies. The deposit of Allous in the south of the Souss Valley will be investigated.

Geological research and activities

Activities in the domain of geology have been described in the Three-year Plan 1965-1967:

Overall activity

Printing of geological maps

Several maps of scale 1/50,000, 1/100,000 and 1/200,000 have to be printed in order to complete the series of medium-scale maps.

Special maps like geo-technical maps, metallogenic maps, maps of mineral deposits and general gravimetric maps are also projected.

Aerial photographs will be prepared specially in the Quarzazate, Tafilalet, Al Hoceima and Nador regions.

Funds for these purposes are as follows:

Geological maps 1/50,000, 1/100,000 and 1/200,000	1,810,000 DH
1/500,000 maps of Tarfaya	50,000 DH
Special maps	480,000 DH
Geophysical maps	60,000 DH
Aerial photographs	250,000 DH
	2,650,000 DH

Publications

Various publications have to be prepared. Memoranda on mineral deposits in the region of Oujhda, the High Atlas, the Anti-Atlas and the Djebilet are among them.

Funds for this purpose are:

Proposed undertakings	660,000 DH
Mines and geology	170,000 DH
Total	780,000 DH

Study of sedimentary basins

During the last few years a Sedimentary Basin Research Office has been formed. It deals with: The High Plateaux, the Guercif basin and the Moulouya, Bahira and Tadella.

Prospecting in the Quarzazate basin, the Souss, the Gareb, provinces of Nador, Al Hoceima and the Triffla Plain is covered by the Three-year Plan.

Funds for this purpose are: 2,800,000 DH

Geophysics

General activity will deal with the preparation of gravimetric maps and testing of methods. Some zones with anomalies will be specially investigated to assist mining work in the Central Sebilet, the Rehamma area, Central Morocco, etc.

Funds for these purposes are:

General geophysics	210,000 DH
Geophysics applied to mining work	500,000 DH
Total	710,000 DH

Prospecting of mineral deposits

The funds for prospecting are as follows:

Berylliometer prospecting	60,000 DH
Alluvial prospecting	60,000 DH
Mining soundings	580,000 DH
Shafts and trenches	150,000 DH
	850,000 DH

Laboratory work

Spectrography	50,000 DH
Chemistry and mineralogy	150,000 DH
Chemical laboratory	50,000 DH
Total	250,000 DH

Consolidation of the installation Supplementary test with lead	200,000 DH

New constructions

Solid construction of the geochronological laboratory	160,000 DH

Geochemical prospection

This is a new type of prospecting in Morocco that has to be developed. Funds for detailed geo-chemistry are	700,000 DH
The total funds for all types of geological activities described above are	8,600,000 DH

These funds do not include the funds for petroleum research and detailed geological research on specific projects such as, lead - Moulouya, Bou Madine, Irherm and El Hammam. These funds will be found by investments.

Research on minerals

These researches are concentrated on:

lead - zinc - silver
copper
potassium

Lead - zinc - silver

Formations to be searched over are: limestone backbone of the Riff (Tetouan Province), Beni Maden deposits; Ante-Riff miocene (Fez); Immouzer de Marmoucha, Foum Jerar deposits (Tafilalet)
Various indications in the High Atlas.
Silver deposits at Zgounder/Quarzazate
Various indications in the Djebilet and the High Atlas (Marrakesh).

Copper

The indications for copper are in:

Tafilalet (Anti-Atlas)
Quarzazate (Anti-Atlas)(Sirous massive)
Marrakesh (Djebilet)
Agadir (Anti-Atlas)

Miscellaneous

Following researches are in view:

Antimony in Meknes province
Manganese in Ouida province
Manganese in Quarzazate province

Precious metals, beryllium and other in Quarzazate province.

Financial plan for researches in 1965-1967 is:

Lead, zinc, silver	4.4 million DH
Copper, Anti-Atlas	2.9 million DH
Copper, Djebilet	1.0 million DH
Miscellaneous	1.7 million DH
Potassium	10.5 million DH
Total	20.5 million DH

Financed by the Bureau des Recherches et Participations Minières - 9.9 million DH.

Gross output in quantities and values (production)

Tables 12 and 13 give the quantities and values of ore production from 1960 to 1965. The quantities in tons are concentrates.

Table 12 : Production of ores in Morocco

Ores	Tons of concentrate						
	1960	1961	1962	1963	1964	1965	1961-65
Manganese chemical	93,901	114,450	100,599	68,897	74,678	54,452	413,076
Manganese metallurgical	389,183	456,634	368,758	266,051	266,400	321,429	1,679,272
Lead	135,124	128,004	131,284	106,073	103,944	113,260	582,565
Zinc	82,268	67,655	58,354	58,618	80,974	95,015	360,616
Antimony	719	819	866	1,742	3,282	4,586	11,295
Copper	5,020	5,623	7,696	6,119	6,504	6,278	32,220
Cobalt	12,712	12,899	14,364	13,707	15,253	16,654	72,877
Tin	15	19	16	13	20	23	91

Source: Yearly Statistics of Morocco.

Table 13 : Production values of ores in Morocco

In DH

Ores	1960	1961	1964	1965
Manganese chemical	37,600,000	45,780,000	-	12,710,329
Manganese metallurgical	58,350,000	68,495,000	-	18,399,877
Lead	67,500,000	64,002,000)	134,950,000	96,961,564
Zinc	27,060,000	22,326,000)		30,875,910
Antimony	430,000	491,000		4,015,044
Copper	3,012,000	3,374,000		6,820,301
Cobalt	10,400,000	10,319,000		10,820,585
Tin	100,000	167,000		70,976
Total	204,452,000	214,954,000	203,490,000	180,674,586

Sources: Yearly Statistics of Morocco, 1961.
L'Industrie et les Mines en 1964, Ministère du Développement et du Plan.
Information from the Ministry of Industry and Mining.

The values of production are calculated when the concentrates leave the mine.

The production of bigger mines and co-operatives in 1965 was as follows:

Manganese

Imini	241,000 tons
Bou Arfa	108,500 tons
Co-op. Quarzazate	6,000 tons

Lead and zinc	Lead	Zinc	Lead and zinc
Zellidja			18,700 tons
Touissit			15,000 tons
Aouli	18,500 tons		
Mibladen	18,300 tons		
Aouam	17,300 tons	1,600 tons	
Beni Tadjit	5,000 tons	5,000 tons	
Dait	2,500 tons		
Co-op. Tafilalet	7,500 tons		
Ait Labbes		2,300 tons	
Various	6,000 tons	1,800 tons	

Cobalt

Bou Azzar	16,500 tons

Copper

Djebel Klakh	1,100 tons
Bou Skour	3,500 tons

Antimony

Beni Mezala	915 tons

One can see from the production quantities that since 1960 the production of manganese ores, both chemical and metallurgical, and of lead ore has diminished, and that of other ores increased. The biggest increase is in antimony and cobalt ores.

The total value of production dropped from 204,452,000 DH in 1960 to 180,879,000 DH in 1965.

Exports, imports and domestic demand

The total production of ores, with the exception of lead and tin, is exported. Table 14 gives the quantities and Table 15 the values f.o.b. of the exported ores.

Table 14 : Exports of ores from Morocco

Ores	Tons of concentrates						
	1960	1961	1962	1963	1964	1965	1966
Manganese dioxide	104,790	120,334	117,800	59,198	142,222	144,671	174,756
Manganese metal-lurgical	282,472	329,821	316,210	290,459	191,612	176,267	159,999
Lead	116,188	98,342	93,451	137,583	95,785	145,205	88,896
Zinc	70,627	75,291	63,327	66,233	64,369	98,148	90,326
Antimony	555	1,147	1,013	1,349	1,868	3,027	2,739
Copper	4,814	4,427	5,458	6,620	4,579	5,782	7,418
Cobalt	12,220	5,327	2,429	7,100	29,106	6,249	18,613

Source: 1960-1965 - Statistiques du mouvement commercial et maritime du Maroc.
1966 - Statistique interne du Ministère du commerce, de l'industrie et des mines.

Table 15 : Exports of ores from Morocco

Ores	Values fob in 1,000 DH						
	1960[a]	1961	1962	1963	1964	1965	1966
Manganese dioxide	2,977,398	36,039	33,709	18,351	27,174	23,941	38,677
Manganese metal-lurgical	5,158,017	53,792	43,506	38,280	24,392	27,117	16,453
Lead	5,544,803	45,700	38,762	59,150	63,999	126,079	71,392
Zinc	1,420,122	14,670	13,010	15,398	19,819	32,786	31,231
Antimony	34,904	705	645	797	1,808	3,313	2,644
Copper	296,680	2,973	3,858	4,937	4,580	7,396	9,996
Cobalt	732,593	3,343	1,288	4,635	12,841	3,930	14,210
Total	16,164,517	157,222	134,778	141,548	157,613	224,562	184,603

Source: Same as for Table 5.
a/The values for 1960 are in 1,000 francs.

One can see from the above tables that the amounts of exported ores and their values have increased since 1960 with the exception of metallurgical manganese which has dropped since 1964.

Imports

The quantities and values of imported ores are given in Tables 16 and 17.

Table 16 : Imports of ores into Morocco

Ores	Tons					
	1960	1961	1962	1963	1964	1965
Manganese dioxide	10	30	50	161	100	114
Aluminium	2,475	-	1,236	2,553	921	2,502
Lead	-	-	-	-	-	121,378
Various metallic minerals	236,056	253,840	156,121	333,915	264,678	295,697

Source: Same as for Table 5.

Table 17 : Imports of ores into Morocco

Ores	Values in 1,000 DH					
	1960 a/	1961	1962	1963	1964	1965
Manganese dioxide	2,306	30	50	161	160	116
Aluminium	13,602	-	675	146	53	171
Lead	-	-	-	-	-	1,273
Various metallic minerals	236,056	2,538	1,561	3,339	2,647	2,957
Total	251,964	2,568	2,286	3,646	2,800	4,517

Source: Same as for Table 5.
a/ Values for 1960 are in 1,000 francs.

The imported quantities of manganese dioxide and aluminium ore are very small. The items "various metallic minerals" and lead ore are not concentrates but rough ores which can be seen from the average value, i.e., 10 DH per ton. They have probably been sent from Algeria to the concentration plants in Morocco.

Domestic demand

The lead foundry of Oued-el Heimer takes 20-30,000 tons of local concentrates yearly. It processed 32,700 tons of these concentrates in 1966. The whole tin concentrate is smelted locally.

All other concentrates are exported.

The value of the net demand is calculated from the equation:

$D = P + I - E$
D = Net demand
P = Production
I = Import
E = Export

The net demand so calculated includes also differences in stocks which may be important for minerals.

Its value is:

1964 + 50,000,000 DH
1965 - 10,831,000 DH

The minus value in 1965 is caused by exports being greater than production, i.e., the ores produced in former years were exported in 1965.

Table 18 : Employment in Morocco

	1960				1964				1965				1966			
	Managers and senior technicians	Junior technicians and skilled workers	Workers	Total	Managers and senior technicians	Junior technicians and skilled workers	Workers	Total	Managers and senior technicians	Junior technicians and skilled workers	Workers	Total	Managers and senior technicians	Junior technicians and skilled workers	Workers	Total
Manganese	17	136	2555	2708	19	140	2026	2185	21	137	1965	2123	22	137	1921	2080
Lead, zinc	77	628	3807	4512	100	541	2991	3632	111	576	3117	3804	112	561	3157	3830
Cobalt	11	50	675	736	7	46	523	576	10	51	517	578	9	52	526	587
Copper	1	13	204	218	2	14	276	292	2	18	286	306	4	19	199	322
Small mines	-	180	2820	3000	-	180	2820	3000	-	180	2820	3000	-	180	2820	3000
Total	106	1007	10061	11174	128	921	8636	9685	144	962	8705	9811	147	949	8723	9819

Employment

The employment data for the years 1960, 1964, 1965 and 1966 are given in Table 18.

Employment may be divided into three groups:

1. Management, senior technicians and engineers.
2. Junior technicians, supervisors and skilled workers
3. Semi-skilled and unskilled workers.

The data for small mines are approximate.

One can see from these data that employment at almost all mines has fallen owing to smaller production and higher efficiency.

Transport costs

The concentrates are transported from mines to the ports or to the plants by roads and then by railroads. Very few mines have direct rail connexions and therefore, transport costs are important. Table 19 gives the distances and transport costs for the larger mines.

Table 19 : Transport costs

Mineral and mine	Distance by road km	Distance by railway km	Transport costs DH/ton
Manganese			
Imini	170	267	65.00
Bou Arfa	–	270	7.83
Lead, zinc			
Zellidja	21	127	20.12
Touissit	18	127	20.00
Aouli	345	–	42.01
Mibladen	334	–	40.45
Djebel Aouam	235	–	21.66
Copper			
Bou Skour	285	267	100.94
Djebel Klakh	–	270	39.40
Cobalt			
Bou Azer	232	–	73.65
Antimony			
Beni Mesada	6	–	4.00
Mejma Salihine	230	–	42.00
M'Guedh	370	–	90.00

One can see from this table that the following mines have the highest transport costs:

The copper mine Bou Skour	100.94 DH
The antimony mine M'Guedh	90.00
The cobalt mine Bou Azer	73.65
The manganese mine Imini	65.00

When one compares these costs with the value of the concentrates the share of these costs is as follows:

Imini	34%	Bou Skour	10%
Bou Azer	13%	M'Guedh	9%

Thus the highest transport charges are for Imini.

Investment

Investment from 1960 to 1966 is shown in Table 20.

Table 20 : Investment in 1,000 DH

Minerals	1960	1961	1962	1963	1964	1965	1966	1961-65
Manganese	4,520	5,250	11,150	3,890	4,030	4,640	4,040	28,960
Lead and zinc	16,530	15,370	11,880	6,650	13,500	12,840	12,500	60,240
Antimony	300	200	200	350	300	930	850	1,980
Copper	1,540	3,210	2,080	1,020	1,200	1,240	1,500	8,750
Cobalt	1,220	860	940	650	2,100	1,000	1,160	5,550
Total	24,110	24,890	26,250	12,560	21,130	20,650	20,050	105,480

The division of investment into groups was only possible for 5-6 mines for the years 1964-1966. The results are shown in Table 21.

Table 21 : Investment groups shares

Groups	1964	1965	1966	Average
Buildings	8.4%	11.1%	14.1%	11.1
Materials	25.8%	23.3%	28.5%	25.8
Equipment	65.8%	65.6%	57.4%	63.1
Total	100.0%	100.0%	100.0%	100.0

Investment in these mines represents 38-40% of the total investment. Investment in 1967 in the larger mines is estimated from the Three-year Plan at 19,700,000 DH. One can assume that in 1967 this investment will be 20-21 million DH.

The average value of investment per ton of concentrates during the period 1961-1965 was as follows:

Table 22 : Investment values per ton of concentrates

	Production Quantities 1961-1965 (tons)	Investment 1,000 DH	Investment per ton in DH
Manganese	2,092,348	28,960	13.84
Lead, zinc	943,181	60,240	63.86
Antimony	11,295	1,980	175.29
Copper	32,220	8,750	271.57
Cobalt	72,877	5,550	76.15

This index has an auxiliary value only because at least two indexes are necessary to estimate future investment, namely, investment needed to maintain production in existing mines and investment needed to increase production.

Production

Table 23 gives the expected future production in three variants.

Auxiliary tables give the corresponding reserves and investment required.

Manganese

The Imini mine has reserves for about 10 years of production, and the other one for only three years. It will be necessary to stop production in 1975 unless new reserves are found. It is expected that new reserves of from 4 to 7.5 million tons will be found which will produce 200-400,000 tons per annum.

Lead and zinc

The existing mines will reduce their production from 113,000 tons of lead concentrate and 95,000 tons of zinc concentrate in 1965 to 80-90,000 tons of lead and 60-65,000 tons of zinc concentrates in 1980. There are new deposits at Moulouya and Bou Madine. The detailed projects foresee a yearly production of 25,000 tons of lead concentrates from Moulouya and 3.6-4,000 tons of lead concentrate and 19,000 tons of zinc

concentrate from Bou Madine. It is expected to find deposits that will enable 16-39,000 tons of lead concentrate and 11-21,000 tons of zinc concentrate to be produced in 1980. The new reserves needed are 2-3 million tons of lead concentrate and 1.7-2 million tons of zinc concentrate to be found by 1980.

The total production in 1980 may be 125-160,000 tons of lead concentrate and 85-100,000 tons of zinc concentrate the higher quantities being probable.

Antimony

The production of this ore is very capricious because prices fluctuate. It is produced in small mines, and the reserves are unknown.

It is expected that an average yearly production of 2,000 tons of concentrates may be reached.

Copper

The existing two mines have reserves for 5-8 years of production. But there are various other indications of copper mentioned above. It is expected that a future production of 6.3-10,000 tons will be reached but it is necessary to find new reserves of 125-170,000 tons of concentrates for this purpose and to establish new mines at the site of deposits.

Cobalt

There is one mine for this mineral with reserves for 2-3 years only. If new deposits are not found, production will have to stop. It is expected that production will either cease or attain only a maximum of 18,000 tons in 1980.

The closing down of the mine is more probable.

Investment

The investment needed can be estimated from information on existing projects and indexes, one for keeping the production on the same level and another for production increases. The values of these indexes are taken from the investment quantities of the period 1960-1965. It must be recognized that these values have an approximate significance only.

Details of these estimates are given in auxiliary tables.

Manganese

Index for maintaining production 14 DH/t-n.

Table 23 : Projections of production of ores in Morocco in 1,000 tons[a]

	1964	1965	1970 Minimum	1975 Minimum	1980 Minimum	1970 Maximum	1975 Maximum	1980 Maximum	1970 Middle	1975 Middle	1980 Middle
Manganese	341	376	350	300	250	375	400	400	350	300	250
Lead	104	113	119	120	125	130	145	160	130	145	160
Zinc	81	95	95	75	85	105	85	100	105	85	100
Antimony	3.3	4.6	2	2	2	2	2	2	2	2	2
Copper	6.5	6.3	6.3	6.3	6.3	7	7	10	7	7	10
Cobalt	15.3	16.7	15	10	-	18	18	18	15	10	-
Tin	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Production values in 1,000 dirhams											
Manganese		31110	28945	24810	20675	31012	33080	33080	28945	24810	20675
Lead		96962	102114	102972	107262	111553	124424	137269	111553	124424	137264
Zinc		30876	30876	24375	27625	34125	27625	32500	34125	27625	32500
Antimony		4015	1746	1746	1746	1746	1746	1746	1746	1746	1746
Copper		6820	6820	6820	6820	7601	7601	10859	7601	7601	10859
Cobalt		10821	9748	6499	-	11698	11698	11698	9748	6499	-
Tin		71	71	71	71	71	71	71	71	71	71
Total	203440	180675	180320	167293	164199	197806	206245	227223	193789	192776	203120

a/ Future values at internal values of 1965.

Table 24 : Investment in Morocco

(in 1,000 dirhams)

Minerals	1961-65	1966-70	1971-75	1976-80	1966-80	1961-65	1966-70	1971-75	1976-80	1966-80
	Variant minimum					Variant maximum				
Manganese	28960	24500	24800	19200	68500	28960	25900	37300	41000	104200
Lead and zinc	60240	98700	65000	65300	229000	60240	112050	102000	106000	320050
Antimony	1980	1750	1750	1750	5250	1980	1750	1750	1750	5250
Copper	8750	8550	8550	8550	25650	8750	9210	19480	21520	50210
Cobalt	5550	4550	4550	2300	11400	5550	5500	37000	5300	47800
Reserve			10000	20000	30000				40000	40000
Geological research	-	3500	5000	7000	15000	-	3500	6000	8000	17500
Total	105480	141550	119650	125100	385300	105480	157910	203530	223570	585010
Index	100.00	134.19	113.43	117.65		100.00	149.71	192.96	211.95	

Minerals	1966-70	1971-75	1976-80	1966-80
	Middle variant			
Manganese	24500	24800	19200	68500
Lead and zinc	112050	102000	106000	320050
Antimony	1750	1750	1750	5250
Copper	9210	19480	21520	50210
Cobalt	4550	4550	2300	11400
Reserve	-	10000	20000	30000
Geological research	3500	5000	8000	17500
Total	155560	168580	178770	502910
Index				

The investment needed, without the establishment of a new mine, are therefore 19-25 million DH for five-year periods for the lower variant and 26-28 million DH for the higher variant.

The cost of establishing a new mine with a capacity of 100-150,000 tons is estimated at 20-30 million DH.

It may be assumed for the higher variant that such a mine will be built during the period 1970-1980.

Lead and zinc

Index for maintaining production 64 DH/ton.

Cost of construction of Moulouya mine	32,800,000 DH
Cost of construction of Bou Madine mine	31,500,000 DH
Cost of construction of a new mine with a capacity of 25,000 tons of concentrates	26,650,000 DH

From these assumptions it can be seen that the investment needed is 229 million DH for the lower variant and 320 million DH for the higher one during the whole period 1966-1980. The construction of the Moulouya mine and the beginning of construction work at the Bou Madine mine during the 1966-1970 period cause investment in these years to be higher than in later periods.

Antimony

Maintaining index 175 DH/ton.

Investment needed - 1,750,000 DH during five years.

Copper

Maintaining index 271 DH/ton

New mine of 3-5,000 tons capacity - 10,000,000 DH.

Investment needed: 25,650-50,200,000 DH

The construction of two mines is assumed for the higher variant.

Cobalt

Maintaining index 76 DH/ton.

The construction of a new mine with a capacity of 15-20,000 tons may cost 20-30 million DH.

Investment needed: 11.4-47.8 million DH.

Lower variant is taken as more probable.

A reserve of 30-40 million DH is provided in case research is so favourable that the construction of other new mines appears profitable.

Geological researches

15.5-17.5 million DH are provided for this purpose.

The total amount of investment is estimated at:

385.3 million DH for the lower variant
585.0 million DH for the higher variant, and
503.0 million DH for the middle variant.

The proportion of investment to the value of production for these three variants for the whole period 1966-1980 is as follows:

Value of production (in million DH)

Period	Low variant	Middle variant	High variant
1966-70	902.5	936.2	946.2
1971-75	869.0	966.4	1,010.1
1976-80	828.7	989.7	1,083.7
1966-80	2,600.2	2,892.3	3,040.0

The proportion of investment to the value of production is:

Low variant $\frac{385.3}{2,600.2} \times 100 = 14.82\%$

Middle variant $\frac{503.0}{2,892.3} \times 100 = 17.39\%$

High variant $\frac{585.0}{3,040.0} \times 100 = 19.24\%$

The lowest one, as was to be expected, is for the low variant and the highest for the high variant but the highest variant has the possibility of production increases in the more distant future.

All these proportions are at a reasonable level. One must not forget that the value of production is loco mine; at f.o.b. values the proportions will be lower.

Final statement

The main data is gathered in Tables 26 and 27. The value of the gross output will not change very much during the period 1964-1980, and neither will the value added and employment. Future domestic demand

Table 25 : Non-ferrous metal mineral mines
Country: Morocco
Input structure of industry ISIC No. 1
Year 1964

(In '000 £E.)

		Absolute values		Input coefficients	
		Total	of which imported		2 as % of
		1	2	3	4
0	Agriculture, etc.	-		-	
1	Mining and quarrying	-		-	
20	Food manufacturing industry	-		-	
21	Beverages manufacturing industry	-		-	
22	Tobacco industry	-		-	
23	Textile industry	40		0.0002	
24	Footwear, wearing apparel	140		0.0007	
25	Wood industry	2,820		0.0139	
26	Furniture and fixtures	-		-	
27	Pulp and paper industry	570		0.0028	
28	Printing and publishing industry	-		-	
29	Leather industry	60		0.0003	
30	Rubber industry	790		0.0039	
31	Chemical industry	13,230		0.0650	
32	Petrol and coal industry	7,430		0.0365	
33	Non-metallic mineral products	1,260		0.0062	
34	Basic metal industry	1,900		0.0093	
35	Metal products	17,170		0.0844	
36/37	Machinery				
38	Transport equipment	1,590		0.078	
39	Miscellaneous industry	-		-	
4	Construction	-		-	
5	Electricity, gas, water	5,560		0.0273	
61	Wholesale and retail trade	-		-	
62/63	Banking, insurance	-		-	
64	Real estate	130		0.0006	
7	Transport and communications	9,900		0.0487	
8/9	All other services	2,590		0.0127	
	Total intermediate inputs	65,180		0.3204	
	Salaries and wages	63,790		0.3125	
	Rest	74,470		0.3661	
	Total gross output	203,440		1.0000	

Table 26 : Export values on 1965 counted by costs loco mine in Morocco

(in '000 dirhams)

	Value of 1,000 tons	1965		1964		1961		
		Tons	Values	Tons	Values	Tons	Value of 1,000 tons	Values
Manganese	82.7	320,938	26,542	333,834	27,608	450,155	200.1	90,031
Lead	858.1	145,205	124,600	95,785	82,193	98,342	500.0	49,171
Zinc	325.0	98,148	31,898	64,364	20,920	75,291	329.9	24,846
Antimony	872.8	3,027	2,642	1,868	1,630	1,147	599.5	6,882
Copper	1,085.9	5,782	6,279	4,579	4,972	4,427	600.0	2,656
Cobalt	649.9	6,249	4,061	29,106	18,916	5,327	799.0	4,256
Tin	3,550.0	-	-	-				
Total			196,022		156,239			177,842

Table 27 : Middle variant - production, demand, employment and investment 1960-1980

Country: Morocco
Industry: ISIC No. 1
SITC No.

	Units	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971-75	1975	1976-80	1980
1. Capacity																
2. Gross output																
a. value	1000DH		214954			203440	180674					193800		192800		203100
b. quantity	'000 t.															522
3. Value added	1000DH					138260	122775					131706		131024		138024
4. Exports																
a. value[a]	1000DH		177842			156239	196022						(net)	37536		29215
b. quantity																227
5. Imports																
a. value	1000DH		2568			2800	4517									
b. quantity																
6. Domestic demand (=2+5-4)																
a. value	1000DH		39680			50001	10831									
b. quantity																
7. Employment, total of which			11174			9685	9811					9700		9500		9500
- senior technicians			106			128	144					130		130		130
- junior technicians & skilled workers			980			921	962					930		920		920
- workers			10008			8636	8705					8640		8450		8450
8. Fixed capital formation	1000DH				105,480						155,560		168,580		178,770	

a/ By prices loco mine.

Future domestic demand and exports based on the study on metallurgy are as follows:

		1975	1980
Manganese ore:	for ferro-manganese '000 tons	100	100
	for export '000 tons	200	150
middle estimate	'000 DH	16,540	11,030
Lead ore:	for foundry '000 tons	85	95
	for export '000 tons	60	65
middle variant	'000 DH	5,150	5,580

Zinc ore: All for foundry plus, if necessary, import from Algeria

Antimony ore: Copper, cobalt: all for export.

Production estimation

Lead and zinc

('000 tons)

Year	Unit	Lead Minimum	Lead Maximum	Zinc Minimum	Zinc Maximum
1965	Total	113	113	95	95
1970	Ex mine	113	123	95	105
Moulouya	25%	6	7	–	–
Total 1970		119	130	95	105
1975					
existing mines		98.7	106.6	65	71
Moulouya		18.6	24.8	–	–
Bou Madine		2.7	3.6	10	14
Total		120	145	75	85
1980					
existing mines		80	92	60	65
Moulouya		25	25	–	–
Bou Madine		3.6	4	14	14
New mines		16.4	39	11	21
		125	160	85	100

New mines have to be constructed from 1971-1975.

Auxiliary materials

Investment estimates

1. Manganese

Index for maintaining production at 14 DH/ton

	Low variant	High variant
	('000 DH)	
1966 - 1970		
1,750,000 x 14	24,500	
1,850,000 x 14		25,900
no new mine is erected		
1971 - 1975		
1,770,000 x 14	24,800	
1,950,000 x 14		27,300
erection of a new mine		10,000
Sub-total		37,300
1976 - 1980		
1,370,000 x 14	19,200	
2,000,000 x 14		28,000
erection of a new mine		13,000
Sub-total		41,000
Total	68,500	104,200

2. Lead and zinc

Index for maintaining production at 64 DH/ton

1966 - 1970		
(470 + 380 + 180) 1,000 x 64 =	65,900	
(500 + 410 + 180) 1,000 x 64 =		69,750
Moulouya mine	32,800	32,800
Bou Madine mine	-	9,500
Sub-total	98,700	112,050
1971 - 1975		
(600 + 415) 1,000 x 64	65,000	
(700 + 465) 1,000 x 64		74,550
Bou Madine mine		22,000
New mine (beginning)		5,450
Sub-total	65,000	102,000
1976 - 1980		
1,020,000 x 64	65,300	
1,240,000 x 64		79,350
New mine continuing		26,650
Sub-total	65,300	106,000
Total	229,000	320,050

Auxiliary materials

Investment estimates

3. Antimony

Maintaining index 175 DH/ton
Investments
100,000 x 175 = 1,750,000 DH for 5 years without change.

4. Copper

Maintaining index 271 DH/ton
Investments

	low variant	high variant
	(in 1,000 DH)	
1966-1970		
6,300 x 5 x 271	8,550	
34,000x271		9,210
1971-1975		
31,500 x 271	8,550	
35,000 x 271		9,480
New mine		10,000
Sub-total	8,550	19,480
1976-1980		
31,500 x 271	8,550	
42,500 x 271		11,520
New mine		10,000
Sub-total	8,550	21,520
Total	25,650	50,210

5. Cobalt

Maintaining index 76 DH/ton
Investments

	low variant	high variant
	(in 1,000 DH)	
1966-1970		
60,000 x 76	4,550	
72,000 x 76		5,500
Sub-total	4,550	5,500
1971-1975		
60,000 x 76	4,550	
90,000 x 76		6,850
New mine		30,000
Sub-total	4,550	36,850
1976-1980		
30,500 x 76	2,300	
70,000 x 76		5,300
Sub-total	2,300	5,300
Total	11,400	47,650

6. Tin (Investments are not known)

CHAPTER IV

ALGERIA

General situation

There are five mines of non-ferrous metal ores in operation and two under construction. All five produce lead and zinc concentrates and one of them, Ain Barbar, produces mainly copper concentrates.

They are situated in three provinces: Alger, Constantine and Oran, Ouar Senis is in the Alger region, Sidi Kamber and Ain Barbar in the Constantine region and El Abed and Oued Zounder in the Oran region near the Moroccan frontier. Three mines, Kheret Youssef and Djebel Gustar for lead and zinc and Mamman N'Bails for antimony, situated in the Constantine region are in erection. The product is transported to ports by the following means:

Mine	Means of transport	Port
Ouar Senis	trucks	Tenes
Sich Kamber	trucks	Skikdou
Ain Barbar	trucks	Annoubou
El Abed	railroad	Ghazaouet
Oued Zounder	railroad	Ghazaouet

Geological reserves and research

It was possible to get information on geological reserves of existing mines only. They are given in the following table:

Mine	Reserves in tons of mineral		
	Certain	Probable	Possible
Sidi Kamber	55,750	72,000	-
Ain Barbar	25,000	67,000	500,000
Ouarsenis	325,000		
El Abed and Oued Zounder	4,000,000	1,500,000	
Total	4,080,750	1,639,000	500,000
	325,000		

These reserves are not divided into metals. They are valid till the end of 1965.

The reserves of the mines under construction and in projection can be estimated from the figures of the capacities supposing that reserves will enable production of each mine to continue for ten years.

The reserves estimated are as follows:

Mine	(in tons) Lead	Zinc	(in tons)
	Concentrate		
Djebel Gustar	11,000	142,000	
Kheret Youssef	36,000	334,000	
Boudoukha	20,000	56,000	
Oued Mesadjet	24,000	51,000	
Djebel Ichmoul	60,000	-	
Guerrouma	22,000	75,000	
Guergour	-	78,000	
Total	173,000	736,000	

One must stress that these figures are pure estimations only because more detailed information is not available. This has been promised by the Société Nationale de Recherches et d'Exploitation Minière en Algerie, but has not been sent yet.

The data on geological resources in Algeria are also not known.

Gross output in quantities and values (production)

Tables 28 and 29 give the quantities and values of production of ores from 1960 to 1965.

Table 28 : Production of ores in Algeria

Ores	Tons of concentrates 1960	1961	1962	1963	1964	1965	1961-65
Lead	14,821	13,072	12,917	11,763	13,601	14,922	66,275
Zinc blend	65,110	70,907	69,587	55,863	58,887	57,144	312,388
Zinc calamine	68	-	470	1,660	5,387	6,773	14,290
Zinc total	65,178	70,907	70,057	57,523	64,274	63,917	326,678
Copper	435	2,184	2,900	3,745	3,900	3,660	16,389
Antimony	2,323	2,224	500	-	-	-	2,724

Source: Rapport Annuel sur l'industrie Minière pour 1965, of the Direction des Mines et de la Géologie.

Table 29 : Value of ore production in Algeria

(in 10 Algerian Dinars)

Ores	1963	1964	1965
Lead	818,704	673,249	738,639
Zinc	1,664,717	2,443,810	2,371,476
Copper	202,230	210,600	197,640
Total	2,685,651	3,327,659	3,307,755

No information was available on production costs in Algeria. The value of production has been calculated from the value of exports, that is at fob prices.

Production of the larger mines in 1965 was as follows:

Mine	Tons of concentrates Lead	Zinc	Copper
Ouarsenis	1,940	11,655	-
Sidi Kamber	3,432	2,960	-
Ain Barbar	395	1,470	3,660
El Abed	2,424	11,414	-
Oued Zounder	6,731	36,418	-
Total	14,922	63,917	3,660

The production of lead and zinc ores in 1965 was at the level of 1960. The production of copper ore has increased and the production of antimony ore decreased since 1963.

Exports, imports and domestic demand

All ore concentrates are exported. The differences between the quantities of production and export may be explained by differences in stocks or inaccuracies in statistics. Table 30 gives the quantities and Table 31 the value of exported ores.

Table 30 : Exports of ores from Algeria

Ores	Tons of concentrates 1961	1962	1963	1964	1965
Lead	5,461	5,088	2,205	12,941	12,796
Zinc	209,253	69,372	67,769	52,491	67,673
Copper	1,558	-	4,479	-	3,673
Antimony	2,636	804	-	-	-

Table 31 : Value of export of ores from Algeria

(in 10 Algerian Dinars)

Ores	1961	1962	1963	1964
Lead	287,422	225,930	153,591	640,750
Zinc	2,115,293	1,654,352	2,020,200	2,178,466
Copper	78,907	-	242,042	-
Antimony	46,462	19,255	-	-
Total	2,528,084	1,899,537	2,415,833	2,819,224

Small amounts of ores are imported. Tables 32 and 33 give the quantities and value of them.

Table 32 : Import of ores into Algeria

Ores	Tons of concentrates			
	1961	1962	1963	1964
Lead	1,502	326	55	14
Aluminium	2,500	-	750	-
Zinc	432	-	-	-
Antimony	-	-	5	3
Titanium	461	-	101	-

Table 33 : Value of import of ores into Algeria

in 10 Algerian Dinars

Ores	1961	1962	1963	1964
Lead	89,885	27,874	8,564	1,997
Aluminium	4,626	-	1,800	-
Zinc	8,892	76	-	-
Antimony	-	-	1,135	750
Titanium	17,475	-	3,848	-
Total	120,878	27,950	15,347	2,747

The value of the net demand together with stock differences are calculated for the years 1963 and 1964 as shown in the following table.

Table 34 : Net demand value of ores in Algeria

in 10 Algerian Dinars

Ores	1963	1964
Lead	673,677	34,488
Zinc	- 355,483	265,344
Copper	- 39,812	210,600
Other	6,783	750
Total	285,165	511,182

The minus value for zinc and copper in 1963 means that in this year the ores produced in former years were exported.

Employment

Employment data for the years 1963, 1964 and 1965 are given in Table 35.

Employment may be divided into four groups:

1. Management and senior technicians.
2. Junior technicians and supervisors.
3. Administrative and clerical staff.
4. Workers.

Table 35 : Employment at mines in Algeria

	1963	1964	1965
Senior technicians	25	19	34
Junior technicians	78	107	124
Administrative and clerical staff	35	47	56
Workers	1,199	1,440	1,510
Total	1,337	1,613	1,724

Employment increased during these three years by 24 per cent and the production of concentrates by only 16 per cent, showing that the productivity of labour decreased.

Input requirements and value added

The information on these matters in the document: L'industrie Algerienne en 1964 concerning non-ferrous metal mineral mines is not complete.

The number of employees (page 18) is given there as 568 at the end of 1964 and the number of establishments as 2 (page 8).

A more detailed document of the Directorate of Mines and Geology gives the number of employees at the end of 1964 as 2,078 and the number of establishments as five. Therefore all quantities of the earlier document concerning production value, value added and costs are too small and were not taken into account in this study.

All calculations and estimates have been prepared on the basis of the Annual Report 1965 of the Directorate of Mining and Geology.

For the input requirements, information from Morocco was used.

Table 36 gives the data for 1964 calculated in this manner.

Table 36 : Input structure of industry ISIC No.

Country: Algeria
Year 1964

(in 1,000 Dinars)

		Absolute values		Input coefficients
		Total	of which imported	2 as % of 1
		1	2	3
0	Agriculture, etc.			
1	Mining and quarrying			
20	Food manufacturing ind.			
21	Beverages industry			
22	Tobacco industry			
23	Textile industry	7		0.0002
24	Footwear, wearing apparel	23		0.0007
25	Wood industry	469		0.0140
26	Furniture and fixtures			
27	Pulp and paper	94		0.0028
28	Printing and publishing			
29	Leather	10		0.0003
30	Rubber	130		0.0039
31	Chemical industry	2,175		0.0654
32	Petrol and coal	1,222		0.0367
33	Non-metallic mineral products	207		6.0062
34	Basic metal industries	313		0.0093
35	Metal products	2,824		0.0852
36/37	Machinery			
38	Transport equipment	261		0.0078
39	Miscellaneous industries			
4	Construction			
5	Electricity, gas, water	915		0.0275
61	Wholesale and retail trade			
62/63	Banking, insurance			
64	Real estate	22		0.0006
7	Transport and communications	1,629		0.0490
8/9	All other services	426		0.0127
	Total intermediate outputs	10,727		0.3224
	Salaries and wages	12,200		0.3666
	Rest	10,350		0.3110
	Total gross output	33,277		1.0000

The main quantities are as follows:

Total gross output	33,277,000 Dinars	100%
Intermediate inputs	10,727,000 Dinars	32.24%
Salaries and wages	12,200,000 Dinars	36.66%
Rest	10,350,000 Dinars	31.10%
Value added	22,550,000 Dinars	67.76%

Investment

No information is available on investment for the period 1960-1965.

The investment in 1964 given in the document: L'industrie Algerienne en 1964 of the Ministry of Finance and Plan is very small, 157,000 Dinars.

This year was exceptional for Algeria and one cannot take it as a basic year for future investment.

Projections for the future

Production. Table 37 gives the estimates of future production in three variants for the years 1970, 1975 and 1980; Table 38, the same for the five-year periods; Table 39, production values calculated at the fob values of 1964.

One can divide the estimates of the future production into three parts:

1. Existing mines.
2. Mines under construction.
3. Mines in projection.

The reserves of the five existing mines permit the conclusion that their production can be at least maintained (low variant) or can increase to the extent of 10-25 per cent by 1980.

The mines under construction are:

1. Djebel Gustar with a capacity of 1,100 tons of lead concentrate and 14,250 tons of zinc.
2. Kherset Youssef with a capacity of 3,600 tons of lead concentrate and 33,400 tons of zinc concentrate.

Djebel Gustar has to reach this capacity in 1967, Kherset Youssef in 1972. One assumes that Djebel Gustar will reach full capacity in 1970 in all variants, and Kherset Youssef 50-75 per cent in 1970, and 75-100 per cent in 1975.

Table 37 : Production - Future estimation for Algeria

(in 1,000 tons of concentrates)

Mines	Low variant				Middle variant				High variant			
	Lead	Zinc	Lead	Copper	Lead	Zinc	Lead	Copper	Lead	Zinc	Lead	Copper
1965	14.9	63.9	78.8	3.7	14.9	63.9	78.8	3.7	14.9	63.9	78.8	3.7
1970												
Existing mines	15.0	64.0	79.0	3.7	15.0	64.0	79.0	3.8	15.0	64.0	79.0	3.9
Djebel Gustar	1.1	14.3	15.4	-	1.1	14.3	15.4	-	1.1	14.3	15.4	-
Kherset Youssef	1.8	16.7	18.5	-	2.4	20.7	23.1	-	2.7	25.0	27.7	-
Production in 1970	17.9	95.0	112.9	3.7	18.5	99.0	117.5	3.8	18.8	103.3	122.1	3.9
1975												
Existing mines	15.0	64.0	79.0	3.7	16.5	70.0	86.5	4.0	17.5	75.0	92.5	4.2
Djebel Gustar	1.1	14.3	15.4	-	1.2	15.0	16.2	-	1.3	15.5	16.8	-
Kherset Youssef	2.7	25.0	27.7	-	3.6	33.4	37.0	-	3.6	33.5	37.1	-
New mines	-	-	-	-	2.1	4.3	6.4	-	4.2	8.7	12.9	-
Production in 1975	18.8	103.3	122.1	3.7	23.4	122.7	146.1	4.0	26.6	132.7	159.3	4.2
1980												
Existing mines	15.0	64.0	79.0	3.7	17.0	74.0	91.0	4.2	18.0	80.0	98.0	4.4
Djebel Gustar	1.1	14.3	15.4	-	1.3	15.5	16.8	-	1.5	16.0	17.5	-
Kherset Youssef	3.6	33.4	37.0	-	3.8	34.0	37.8	-	4.0	35.0	39.0	-
New Mines	2.1	4.3	6.4	-	6.3	13.0	19.3	-	9.5	19.0	28.5	-
Production in 1980	21.8	116.0	137.8	3.7	28.4	136.5	164.9	4.2	33.0	150.0	183.0	4.4

Table 38 : Future estimations in five-year periods for Algeria

(in 1,000 tons of concentrates)

Mines	Low variant				Middle variant				High variant			
	Lead	Zinc	Lead and Zinc	Copper	Lead	Zinc	Lead and Zinc	Copper	Lead	Zinc	Lead and Zinc	Copper
1966-1970												
Existing mines	75.0	320.0	395.0	18.5	75.0	320.0	395.0	18.7	75.0	320.0	395.0	19.0
Mines under construction	7.2	77.5	84.7	-	8.7	87.5	96.2	-	9.5	98.2	107.7	-
Total production	82.2	397.5	479.7	18.5	83.7	407.5	491.2	18.7	84.5	418.2	502.7	19.0
1971-1975												
Existing mines	75.0	320.0	395.0	18.5	78.7	335.0	413.7	19.5	81.2	347.5	428.7	20.2
Mines under construction	16.7	175.7	192.4	-	26.0	219.2	245.2	-	32.2	240.0	272.2	-
Total production	91.7	495.7	587.4	18.5	104.7	554.2	658.9	19.5	113.4	587.5	700.9	20.2
1976-1980												
Existing and erected mines	96.2	537.5	633.7	18.5	108.5	604.7	713.2	20.5	114.7	637.5	752.2	21.5
Mines under construction	5.2	10.7	15.9	-	21.0	43.2	64.2	-	34.2	69.2	103.4	-
Total production	101.4	548.2	649.6	18.5	129.5	647.9	777.4	20.5	148.9	706.7	855.6	21.5
1966-1980												
Total production	275.3	1,441.4	1,716.7	55.5	317.9	1,609.6	1,927.5	58.7	346.8	1,712.4	2,059.2	60.7

Table 39 : Production values - Future estimations for Algeria

(in 1,000 Algerian Dinars)

Periods	Low variant				Middle variant				High variant			
	Lead	Zinc	Copper	Total	Lead	Zinc	Copper	Total	Lead	Zinc	Copper	Total
1965	7,387	23,714	1,976	33,077	7,387	23,714	1,976	33,077	7,387	23,714	1,976	33,077
1970	8,963	39,425	1,998	50,386	9,157	41,085	2,052	52,294	9,306	42,869	2,106	54,281
1966-1970	40,689	164,962	9,990	215,641	41,431	169,112	10,098	220,641	41,827	173,553	10,260	225,640
1975	9,306	42,869	1,998	54,173	11,583	50,920	2,160	64,663	13,167	55,070	2,268	70,505
1971-1975	45,391	205,715	9,990	261,096	51,826	229,993	10,530	292,349	56,133	243,812	10,908	310,853
1980	10,791	48,140	1,998	60,929	14,058	56,647	2,268	72,973	16,335	62,250	2,376	80,961
1976-1980	50,193	227,503	9,990	287,686	64,102	268,878	11,070	344,050	73,705	293,280	11,610	378,595
1966-1980	136,273	598,180	29,970	764,423	157,359	667,983	31,698	857,040	171,665	710,645	32,778	915,088

The mines in production are:

	Lead concentrate	Zinc concentrate
Boudoukha	2,000	5,600
Oued Mecadut	2,400	5,100
Djebel Tehmoul	6,000	-
Guerrouma	2,200	7,500
Guergour	-	7,800
Total	12,600	26,000

It is proposed for the low variant, that only one of these mines will be erected, for the middle variant that two or three of them will be erected, and for the high variant that four will produce and the fifth will be in erection. The quantities of production are given in the table.

Copper ore will be produced in the Ain Barbar mine as now there being only small differences in the quantities of production from 3,700 tons to 4,400 tons yearly.

The quantities of production for five-year periods have been calculated on this basis. The values of one ton of concentrate have been taken as follows:

Lead	49.5 Dinars/ton
Zinc	41.5 Dinars/ton
Copper	54.0 Dinars/ton

Investment

As stated above, no information on investment in the past or on projects has been given. Nevertheless, an attempt will be made to give a rough estimate using the information from Morocco, namely the index of 64 Dinars/ton for lead and zinc (for maintaining production) and 2 million Dinars for the capacity of 1,000 tons of concentrates in new mines.

The (maintaining) index for copper will be taken at 271 Dinars/ton.

Using these indices, the estimated investment for the three variants are given in Table 4C.

The total value for the whole period 1966-1970 is:

Low variant	-	220 million Dinars
Middle variant	-	275 million Dinars
High variant	-	301 million Dinars

Table 40 : Investment - Future estimations for Algeria

(in 1,000 Algerian Dinars)

	Low variant			Middle variant			High variant		
	Lead and Zinc	Copper	Total	Lead and Zinc	Copper	Total	Lead and Zinc	Copper	Total
1966-1970									
Existing mines	25,300	5,000	30,300	25,300	5,000	30,300	25,300	5,100	30,400
Djebel Gustar and Kherset Youssef	44,600	-	44,600	53,600	-	53,600	58,600	-	58,600
Geological researches	-	-	3,500	-	-	3,500	-	-	3,600
Total	69,900	5,000	78,400	78,900	5,000	87,400	83,900	5,100	92,600
1971-1975									
Existing mines	25,300	5,000	30,300	26,500	5,300	31,800	27,400	5,500	32,900
Kherset Youssef	18,500	-	18,500	20,400	-	20,400	15,400	-	15,400
New mines	-	-	-	20,000	-	20,000	30,000	-	30,000
Geological researches	-	-	5,000	-	-	6,000	-	-	7,000
Reserve	-	-	10,000	-	-	10,000	-	-	10,000
Total	43,800	5,000	63,800	66,900	5,300	88,200	72,800	5,500	95,300
1976-1980									
Existing and erected mines	40,500		40,500	45,600	5,500	51,100	48,100	5,800	53,900
New mines	20,000	-	20,000	30,000	-	30,000	40,000	-	40,000
Geological researches			7,000			8,000			9,000
Reserve			10,000			10,000			10,000
Total			77,500	30,000		99,100	88,100	5,800	112,900
1966-1980 Total			219,700			274,700			300,800

The production values are:

Low variant -	764.4 million Dinars
Middle variant	857.0 million Dinars
High variant -	915.0 million Dinars

The proportions of investment to the value of production are:

Low variant -	28.8 per cent
Middle variant-	32.1 per cent
High variant -	32.9 per cent

These proportions are higher than in Morocco which may be explained by the higher percentage of investment in new mines, and a higher percentage of zinc ore with smaller unit value than the ores produced in Morocco. The estimates should be revised after receiving information on real investment costs from projects.

Final statement

The main economic data are gathered in Table 41, giving gross output, value added, exports, imports, domestic demand, employment and investments

		1975	1980
Zinc ore: for foundry	'000 tons	70	85
for export	'000 tons	53	51
	'000 Dinars	22,000	21,165

All other ore for export.

Table 41 : Production, demand, employment and investments 1960-1980

Country: Algeria
Middle variant

	Units	1964	1965	1966-70	1970	1971-75	1975	1976-80	1980
1. Capacity									
2. Gross output									
a. value	1000 Alg. D.	33,277	33,077		52,294		64,663		72,973
3. Value added	1000 Alg. D.	22,550	22,414		35,812		43,970		49,621
4. Exports									
a. value	1000 Alg. D.	28,192	28,004			(net)	35,743		33,491
5. Imports									
a. value	1000 Alg. D.	27	27						
6. Domestic demand (= 2 + 5 - 4)									
a. value	1000 Alg. D.	5,112	5,100						
7. Employment, total									
of which	persons	1,613	1,724		2,580		3,200		3,600
Senior technicians	persons	19	34		50		65		75
Junior technicians	persons	107	124		200		235		265
Administrative staff	persons	47	56		80		100		110
Workers	persons	1,440	1,510		2,250		2,800		3,150
8. Fixed capital formation	1000 Alg. D.			87,400		88,200		99,100	

CHAPTER V

TUNISIA

General situation

It has not been possible to get any information from Tunisia on its non-ferrous metal minerals mining. The responsible officials of the Ministry of Trade and Industry and the Director General of Mining Office promised to furnish this information before the middle of December 1967. But by the end of February 1968, this information had not been sent to the expert preparing the study.1/

Therefore one can only describe the actual situation and projections until 1970 using the statistics and the Four-year Plan 1965-1968 of the Republic of Tunisia.

It is impossible to make responsible projections for the future without knowledge of geological reserves by deposits and of new projects.

Gross output in quantities and values

The quantities and values of production are as follows:

Table 42 : Ores production of Tunisia

Ores	Unit	1960	1961	1962	1963	1964	1965
Lead	1,000 tons	28	22	23.4	25.0)	27	
Zinc	1,000 tons	7	6	8	8)		
Mercury	1 ton	6	2	-	-	5	-
Total value	1,000 dinars	1,182	817	773	830	2,059	1,432

Source: Statistiques industrielles I.C.1.

1/ Now available.

Exports

The quantities and values of exports are given below:

Table 43 : Exports of ores from Tunisia

Ores	Unit	1960	1961	1962	1963	1964	1965
Zinc	tons	4,257	9,697	6,760	7,002	8,984	4,988
Mercury	tons	3.0	5.7	-	-	2.1	6.2
Other metallic minerals	tons					4	3,434
Zinc	dinars	77,962	174,987	93,668	120,709	139,160	87,730
Mercury	dinars	7,391	13,332	-	-	5,898	38,237
Other metallic minerals	dinars	-	-	-	-	-	162,734
Total value	dinars	85,353	188,319	93,668	120,709	145,058	288,701

Source: Foreign Trade Statistics.

Imports

Small quantities of ores are imported as follows:

Table 44 : Imports of ores into Tunisia

Ores	Unit	1960	1961	1962	1963	1964	1965
Lead	tons	3	1	1	8	6	-
Mercury	tons	0.2	0.3	0.7	22	0.3	0.1
Other metallic minerals	tons	3	16	22	30	1	3
Lead	dinars	294	331	114	850	825	-
Mercury	dinars	427	1,133	1,817	22,902	1,004	266
Other metallic minerals	dinars	702	11,762	10,880	24,940	468	673
Total value	dinars	1,423	13,226	12,820	48,692	2,302	939

Source: Foreign Trade Statistics.

Net demand

There are lead foundries in Tunisia where all lead ore is used. Zinc and mercury concentrates are exported.

D = P - E + I
D = Net Demand
P = Production
E = Export
I = Import

Calculation of values of the net demand as a whole:

1960	1,018,000 dinars
1961	642,000 dinars
1962	632,000 dinars
1963	758,000 dinars
1964	1,916,000 dinars
1965	1,144,000 dinars

These quantities include local consumption and stock changes.

Employment

Employment can be divided into direction personnel and others. Their number and salaries are as follows:

Table 45 : Employment in the non-ferrous metals industry in Tunisia

(in 1,000 dinars)

	Persons			Salaries		
	Direction	Other	Total	Charges	Salaries	Total
1960	30	1,924	1,954	200	503	703
1961	20	1,386	1,406	128	398	526
1962	22	1,782	1,804	153	526	679
1963	84	2,215	2,299	200	675	875
1964	31	2,659	2,690	182	719	901
1965	23	1,846	1,869	133	479	612

Source: Statistiques industrielles Y.C.I. de la Tunisie.

Investment

The value of investment divided into groups and total was as follows:

Table 46 : Investment

Title of expenditure	Unit	1960	1961	1962	1963	1964
Total	1,000 dinars	143	98	25	169	295
Buildings	1,000 dinars	60	34	-	1	15
Machinery and equipment	1,000 dinars	58	16	25	168	193
Renovations and repairs	1,000 dinars	25	48	-	-	87

There is no information available for 1965; but investment is estimated as equal to 1964.

Input requirements and value added

The total of inputs is taken from the "Statistiques industrielles I.C.1, octobre 1966", Table 3. Some details are in Table 4 of these statistics. The others were estimated using the structure of Morocco mines. Table 47 gives the data.

The main quantities are:

Total gross output	2,059,000 Tunisian dinars
Intermediate inputs	701,000 Tunisian dinars
Salaries and wages	901,000 Tunisian dinars
Rest	457,000 Tunisian dinars

Projections for the future

The Four-year Plan 1964-1968 forecasts the following production quantities for 1968:

Lead	30,000 tons
Zinc	30,000 tons and 40,000 tons in 1971
Mercury	100,000 kg

The investment necessary for this purpose is as follows:

Lead	2,950,000 Tunisian dinars
Zinc	2,150,000 Tunisian dinars
Mercury	450,000 Tunisian dinars
Total	5,550,000 Tunisian dinars

Table 47 : Tunisia : Input structure of non-ferrous metal minerals industry - 1964

(in 1,000 Tunisian dinars)

		Absolute values		Input coefficients	
		Total	of which imported		2 as % of 1
		1	2	3	4
0	Agriculture, etc.	-		-	
1	Mining and quarrying	-		-	
20	Food manufacturing industries	-		-	
21	Beverages industries	-		-	
22	Tobacco industries	-		-	
23	Textile industries	1		0.0005	
24	Footwear, wearing apparel	2		0.0010	
25	Wood industries	31		0.0150	
26	Furniture and fixtures	-		-	
27	Pulp and paper	6		0.0029	
28	Printing and publishing	-		-	
29	Leather	1		0.0005	
30	Rubber	8		0.0039	
31	Chemical industries	140		0.0680	
32	Petrol and coal	112		0.0544	
33	Non-metallic mineral products	13		0.0063	
34	Basic metal industries	24		0.0116	
35	Metal products)				
36/37	Machinery)	184		0.0894	
38	Transport equipment	17		0.0082	
39	Miscellaneous industries	-		-	
4	Construction	-		-	
5	Electricity, gas, water	84		0.0408	
61	Wholesale and retail trade	-		-	
62/63	Banking, insurance	-		-	
64	Real estate	1		0.0005	
7	Transport and communications	33		0.0160	
8/9	All other services	44		0.0214	
	Total intermediate inputs	701		0.3404	
	Salaries and wages	901		0.4376	
	Rest	457		0.2220	
	Total gross output	2,059		1.0000	

The investment for lead is divided into 10 mines. The main ones are:

New mine, Sidi Driss	535,000 Tunisian dinars
Mine in reconstruction - Djebel Hallouf	500,000 Tunisian dinars
New mine, Foussana	800,000 Tunisian dinars
Mine in reconstruction Bou Yabeur	400,000 Tunisian dinars
Mine in reconstruction - Ladjered	175,000 Tunisian dinars
Mine in reconstruction - Djebel Smêne	150,000 Tunisian dinars
Mine in reconstruction - Djalta	160,000 Tunisian dinars

The investment for zinc is:

New mine - Fedj Assine	2,000,000 Tunisian dinars
New mine, Boukhil	150,000 Tunisian dinars

Mercury

The known reserves of the deposit Djebel Arja are:

150,000 tons with the content of 2kg/ton, and
450,000 tons with the content of 1kg/ton.

It makes together 750,000 kg of mercury. The investment is calculated at 150,000-450,000 Tunisian dinars. The larger sum will be necessary if a distillation plant has to be built.

Because there is no information[1/] on the capacities of mines, on deposits and on new projects, the 1975, 1980 projections are taken at the level of this plan. The production of mercury will however be stopped before 1980, because reserves will be exhausted.

The production in quantity and value for the middle variant will be:

Ore	Unit	1964	1970	1975	1980
Lead	1,000 tons)	27	30	30	30
Zinc	1,000 tons)		30	40	40
Mercury	1,000 kgs	5	100	100	-
Lead	1,000 dinars)		2,628	2,628	2,628
Zinc	1,000 dinars)	2,059	981	1,308	1,308
Mercury	1,000 dinars)		487	487	-
Total value		2,059	4,096	4,423	3,936

1/ Information now available gives lead production in 1970 at 21,000 tons concentrate and mixtures of lead and zinc at 12,000 tons. In 1975 however, with increased production from the Sidi Bon Aonani mine these figures rose to 42,000 and 55,000 tons respectively.

The production for the low variant may be 20 per cent less and for the high variant 10 per cent more. The investments for the five-year periods 1971-1975 and 1976-1980 for the maintaining of production and research may be estimated at about one million Tunisian dinars for each five years. The value of the production is calculated on the prices of 1964, that is for lead concentrate - 87.6 Tunisian dinars/ton, zinc concentrate - 32.7 Tunisian dinars/ton, mercury concentrate - 4.87 Tunisian dinars/kg.

Final statement

The main data are gathered in Table 48. The gross output will increase from 2,059,000 Tunisian dinars in 1964 to 4,096,000 Tunisian dinars in 1970 and 4,423,000 Tunisian dinars in 1975. A decrease will occur in 1980 to about 3,900,000 Tunisian dinars owing to the cessation of mercury production. The value added is at the level of 65.95 per cent of the gross output. Employment will increase from 2,690 persons in 1964 to 4,840 persons in 1970. Then it will decrease to 3,870 persons. Investment, after a big increase for the period 1965-1970, is estimated for the maintaining of production only. It is possible that if suitable deposits will be found, production and investments will increase.

Table 48 : Non-ferrous metal minerals industry: Production, demand, employment and investment 1960-1980 - Tunisia

	Units	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971/1975	1976/1980
1. Capacity														
2. Gross output														
a. value	1000 Dinars	1182	817	713	830	2059	1432					4096	4423	3936
3. Value added	1000 Dinars	623	404	321	425	1358	944					2701	2917	2596
4. Exports														
a. value	1000 Dinars	85	188	94	121	145	289						(net) 923	436
5. Imports														
a. value	1000 Dinars	1	13	13	49	2	1							
6. Domestic demand (=2+5-4)														
a. value	1000 Dinars	1018	642	632	758	1916	1144							
7. Employment,														
total of which	Persons	1954	1406	1804	2299	2690	1869					4840	4700	3830
Direction	Persons	30	20	22	84	31	23					60	70	70
Other	Persons	1924	1386	1782	2215	2659	1846					4780	4630	3760
8. Fixed capital formation	1000 Dinars	143	98	25	169	295			5550[a]				1000	1000

[a] Four-Year Plan 1965-1968.

CHAPTER VI

LIBYA

Present knowledge of Libya's mineral resources is still very incomplete. One can only say that from the geological point of view, there is a chance that traces of non-ferrous metal minerals may exist. But it is also possible that after investigation, no traces will be found or that they will not have any economic value.

Several traces of manganese have been found (Ghat, Guira, Kufra and Nalut area), but the quality and extent are inadequately known. In this situation one can only suggest that geological research be carried on but no production or investment can be foreseen.

Preparing of an extensive geological survey is included in the Five-Year Plan 1968-1972 of Libya.

CHAPTER VII

UNITED ARAB REPUBLIC

General situation

Manganese ore is the only ore produced in the United Arab Republic in the last years from non-ferrous metal minerals. It was produced in the Sinai Peninsula.

There are chromite deposits in the Red Sea desert but the quantities are not known and there is no production of them.

Lead and zinc ore deposits are also known in this area. They are estimated on two million tons of ore with a content of 8 per cent of zinc and one per cent of lead. They are situated 55 km from the port of Kosser. A project of the production is in preparation.

One deposit of copper at Om Seminki in the Red Sea district is discovered. The reserves are not known.

Titanium ore is known in two districts: Black Sands near Rosetta in the Nile Delta and the Abu Shalga in the Red Sea district. It is not produced because there have been difficulties in marketing.

The known reserves are the following:

Manganese ore	4 million tons
Black sands	50 million tons
Ilmenite of the Red Sea district	9 million tons
Lead and zinc ore	2 million tons

Gross output in quantities and values (production)

Tables 49 and 50 give the quantities and values of ores production. It was possible to get information on quantities from 1960 to 1965, but on values for 1964 and 1965 only.

Table 49 : Production of ores in UAR

	Tons of concentrates					
	1960	1961	1962	1963	1964 a/	1965
Manganese	276,000	278,447	185,682	171,827	187,000	182,145
Lead	400	175	2,528	1,855	-	-
Chromite	300	1,390	-	-	-	-
Ilmenite	12,000	43,069	44,643	541	21	-
Rutil	1,000	-	91	4	-	-
Zirconium	370	95	171	36	41	-

Source: Industrial Statistics of UAR, Minerals Yearbook, 1965, United States Bureau of Mines.

a/ The production of 1964 is taken from the information of the Industrial Organization.

Table 50 : Production values of ores in UAR in £E

Ores	1964	1965
Manganese	351,037	731,859
Ilmenite	840	-
Zirconium	610	-
Total	852,487	731,859

The values of the production of manganese ores are counted by export prices, that is:

4,551 £E in 1964 and
4,018 £E in 1965.

Exports, imports and domestic demand

The whole production of ores is exported. The differences between the produced and exported quantities are in stocks only. Table 51 gives the quantities and values of exported ores.

Table 51 : Exports of ores from UAR

Ores	1961	1962	1963	1964	1965	1966
Manganese (tons)	239,755	159,616	122,769	182,447	163,081	122,227
Manganese (£E)	1,076,608	1,006,506	771,023	830,391	655,221	487,978

No imports of ores are mentioned in the bulletins of foreign trade for 1964 and 1965.

The net demand of 1964 is in £E.

852,487 - 830,391 = 22,096; and for 1965: 731,859 - 655,221 = 76,638

Employment

The employment data of the manganese mines are as follows:

1960/61	1964/65	1965/66
1,744	2,583	2,631

Workers

There is no information available on other kinds of employees. Estimates are taken as for the employment structure in Morocco:

Workers	89.0%
Senior technicians	1.3%
Junior technicians and other personnel	9.7%
	100.0%

Investments

No information on investments by minerals are available. Values of investment for the whole mining and quarrying industry were obtained, however:

	LF
1960/61	1,015,000
1961/62	2,220,000
1962/63	3,249,000
1963/64	6,792,000
1964/65	3,694,000
1965/66	2,753,000

Production costs

The cost of one ton of manganese cleaned in the mine was $10.01 in 1965/66, which is equal to 4,350 LE. This cost was obtained from the Industrialization Office.

Projections for the future

Production - Manganese

The production of manganese for the future can be prepared on the level of 200,000 tons in 1970 to 300,000 tons in 1980. The values will be counted by the price 4,350 LE/ton. The results are given in the following table.

Table 52: Production of manganese

	1965	1970	1975	1980
Quantities (tons)	182,145	700,000	750,000	300,000
Values (1,000 LE)	732,300	870	1,087	1,305

The quantities and values for five-year periods are as follows:

	1961-65	1966-70	1971-75	1976-80	1966-80
Quantities (in 1,000 tons)	1,005	950	1,125	1,375	3,450
Values (in 1,000 EL)	-	4,132	4,894	5,981	15,007

The production of other non-ferrous metal minerals cannot be proposed now because the necessary information is not available, or the geological situation is not yet known.

Investments

The investments of the manganese industry will be estimated using the maintaining index from Morocco, that is 14 dirhams/1 ton or 1,230 EL/1 ton.

The manganese mine has the capacity of 300,000 tons, because it reached the production of 328,000 tons in 1964. Therefore the future investment costs may be estimated on this basis. The results of this estimation are as follows:

	1966-70	1971-75	1976-80	1966-80
Investments in EL	1,168,500	1,383,750	1,691,250	4,243,500
Geological research in EL	300,000	400,000	500,000	1,200,000
Total EL	1,468,500	1,783,750	2,191,250	5,443,500
In round quantities (EL)	1,500,000	1,800,000	2,200,000	5,500,000

The proportions of the value of the investments to the value of the production is, for the period 1966-1980:

$$\frac{5,500,000}{15,007,000} = 36.6\% \text{ with geological research, and}$$

$$\frac{4,243,500}{15,007,000} = 28.3\% \text{ without geological research.}$$

As there will be one product only without erection of new mines, it seems not necessary to prepare three variants although it is understood that the quantities of the production and investments give a range of them only with a margin of 10% more or less.

Table 53 : Non-ferrous metal mineral mines

Country: UAR
Input structure of industry ISIC No. 1
Year 1964

(in 1,000 Dirhams)

		Absolute values		Input coefficients	
		Total	of which imported		2 as % of 1
		1	2	3	4
0	Agriculture, etc.	-		-	
1	Mining and quarrying	-		-	
20	Food manufacturing industry				
21	Beverages manufacturing industry	-		-	
22	Tobacco industry	-		-	
23	Textile industry	0.2		0.0002	
24	Footwear, wearing apparel	0.6		0.0007	
25	Wood industry	11.8		0.0139	
26	Furniture and fixtures	-		-	
27	Pulp and paper industry	2.4		0.0028	
28	Printing and publishing industry			-	
29	Leather industry	0.3		0.0003	
30	Rubber industry	3.3		0.0039	
31	Chemical industry	55.4		0.0650	
32	Petrol and coal industry	31.1		0.0365	
33	Non-metallic mineral products	5.3		0.0062	
34	Basic metal industry	7.9		0.0093	
35	Metal products)	71.9	)	0.0844	
36/37	Machinery)		)		
38	Transport equipment	6.6		0.0078	
39	Miscellaneous industry	-		-	
4	Construction	-		-	
5	Electricity, gas, water	23.3		0.0273	
61	Wholesale and retail trade	-		-	
62/63	Banking, insurance	-		-	
64	Real estate	0.6		0.0006	
7	Transport and communications	41.5		0.0487	
8/9	All other services	10.8		0.0127	
	Total intermediate inputs	273.0		0.3204	
	Salaries and wages	267.1		0.3135	
	Rest	311.9		0.3661	
	Total gross output	852.0		1.0000	

Table 54 : Production, demand, employment and investments 1960-1980
Country: UAR. Industry: ISIC No. 1

	Units	1960	1961	1962	1963	1964	1965	1966-70	1970	1971-75	1975	1976-80	1980
1. Capacity													
2. Gross output													
a. value	1000 EL					852	732	4132	870	4894	1087	5981	1305
3. Value added	1000 EL					579	498		592		740		890
4. Exports													
a. value	1000 FL					830	655		870		1087		1305
5. Imports													
a. value	1000 EL					-	-		-		-		-
6. Domestic demand (=2+5-4)													
a. value	1000 EL					22	77		-		-		-
7. Employment, total													
of which	persons	1960				2900	2950		3200		3520		3870
Senior technicians	persons	20				38	38		40		45		50
Junior technicians	persons	190				279	281		310		335		370
Workers	persons	1744				2583	2631		2850		3140		3450
8. Fixed capital formation	1000 EL							1500		1800		2200	

CHAPTER VIII

SUDAN

Sudan has a very small production of manganese ore and chromite only. Deposits of copper, lead and zinc, molybdenum and columbium ores are known but only the copper ore deposit of Hofrat en Nahas is well known. So geological research at first is important.

Manganese ore in quantities of 1-1.5,000 yearly is exploited in the Red Sea Hills near Halaib Port in Kasala Province. There is another manganese deposit near Simhat by the railroad to Port Sudan but it is not in use now. The reserves of the manganese ore are not known. The existing mine is small and worked from the surface. Chromite is produced from Ingessana Hills near Er Roseires in Blue Nile Province. The yearly production is from 8-30,000 tons. It is open-cast mining.

The copper deposit of Hofrat En Nahas is very long known. It was worked about the middle of the 19th century by natives. At the end of this century the production ceased, because it became uneconomical. Beginning since 1920 the deposits have been investigated several times and prospecting work is being done.

The deposit is situated in south-west Darfar at latitude $9^{\circ}45^{1}$ and longitude $24^{\circ}18^{1}$, 220 miles from Nyala, the present railway terminus.

The Geological Survey Department of the Sudan began its own investigations in 1957. Bulletin No. 10 of 1961 gives the details and results of this investigation. One hundred and thirty-two auger bore-holes with an average depth of six feet and 15 diamond drill holes with an average depth of 375 feet per hole were dug.

From the results, it could be concluded that this deposit is an iron-copper-uranium mine with minor amounts of gold and silver. The mineralization occurs in three lodes.

The proved quantities are estimated at 10 million tons with an average content of 2.78 per cent copper. It is 280,000 tons of copper. The deposit is now further investigated by means of a United Nations project.

This project, which started in November 1967, is a mineral investigation project. Three selected areas are being investigated:

1. Ameria on the eastern border of Ethiopia.
2. Hofrat En Nahas copper district.
3. Mica area in the north of Sudan on the western bank of the Nile.

The economic value of the above-mentioned mineral deposits and of others will be determined. The project, **which value is $3.5** million will continue for three years and nine months.

Returning to the Hofrat En Nahas copper deposit, the reserves of ore estimated by the Geological Department are now 5 million tons of ore with 2.5 per cent of copper.

Gross output in quantities and values

Table 55 gives the quantities and values of produced ores. The values are counted by export prices of 1964 (chromite) and 1965, 1966 (manganese).

Table 55 - Production of ores in Sudan - quantities and values

Ores	Unit	1960	1961	1962	1963	1964	1965	1966
Manganese	tons	-	-	1,000	-	1,200	800	1,500
Manganese	SL	-	-	5,686	-	6,823	4,549	11,107
Chromite	tons	-	-	8,000	17,000	30,000	11,000	17,391
Chromite	SL	-	-	56,672	120,428	212,520	77,924	123,319
Total value		-	-	62,358	170,428	219,343	82,473	134,426

Source: Ministry of Industry and Mining of the Republic of Sudan, Geological Survey Department.

Exports, imports and domestic demand

Table 56 gives the quantities and values of exported ores.

Table 56 : Exports of ores from Sudan - Quantities and values

Ores	Unit	1960	1961	1962	1963	1964	1965	1966
Manganese	tons	-	-	-	-	-	1,000	1,150
Manganese	SL	-	-	-	-	-	5,688	8,516
Chromite	tons	-	-	-	-	11,000	-	-
Chromite	SL	-	-	-	-	77,920	-	-
Total value	SL	-	-	-	-	77,920	5,688	8,516

Source: Foreign Trade Statistics of the Republic of Sudan.

Only a small part of the produced ores is exported. As there is no metallurgy in Sudan, the whole difference between the production and export remains in stocks.

The values of these stocks have increased as follows:

1964	-	S.£ 142,633
1965	-	S.£ 76,785

The increase is mainly in chromite. There is no import of ores into Sudan.

Other aspects

There is no information on employment, costs and investments by the production of the above-mentioned ores.

Projection for the future

One cannot propose any quantities of future production of ores in Sudan in actual conditions.

Exports of manganese is in very small amounts, the export of chromite ceased in 1964. So the actual production has an experimental character only.

The future production of copper ore in the Hofrat En Nahas district is very probable but it is too early to fix any quantities of production and investments now.

Geological research is necessary and justified. The funds for them depend on the results in the near future. It seems not reasonable to make any suggestions now. They can be taken from a general reserve that has to be provided in the perspective plan.

Table 57 : Production, demand, employment and investments 1964-1980
Sudan

	Units	1964	1965	1970	1975	1980
1. Capacity						
2. Gross output						
a. value	1,000 S.£	219.3	82.5	-	-	-
b. quantity						
3. Value added		149.2	56.1	-	-	-
4. Exports						
a. value		77.9	5.7	-	-	-
b. quantity						
5. Imports						
a. value		-	-			
b. quantity						
6. Domestic demand (= 2 + 5 - 4)						
a. value		141.4	76.8	-	-	-
b. quantity						
7. Employment, total of which		N.A.	N.A.	-	-	-
8. Fixed capital formation		-	-	-	-	-

CHAPTER IX

GENERAL OBSERVATIONS AND SUMMARY

All main quantities and values for countries are gathered in Tables 58-69. Table 69 which is form 1 of the terms of reference gives the summary for the whole North African sub-region.

One can see from it that the value of the production will rise from $53,454,000 in 1964 to $65,420,000 in 1980, that is 22 per cent, value added from $36,237,000 to $44,319,000 and employment from 16,888 persons to 20,800 persons. The investment is estimated on $201.7 million.

The quantities and values of export and domestic demand can be given when the study of metallurgy is ready.

Tables 70-74 give the distribution of the total resources for countries. Table 75 gives supply/demand balance and trade matrix for the sub-region. These quantities represent the middle variant. The data for the low and high variants are given in the chapters describing each country.

It is necessary to stress at the end of the study that the forecasts, especially for the mining industry, which depends so much on natural, and not exactly known conditions, may be erroneous. One must add to this that a lot of necessary information was not available for the study.

Geological research, erection of new mines and reconstruction of some old ones will be necessary to get the production on the level foreseen in the study. Government support will be necessary in this domain and in the domain of education of engineers and technicians.

Table 58 : Gross output of ores

(Value in 1,000 US$)

Country	1964	1965	1970	1975	1980
Morocco	40,200	35,701	38,293	38,093	40,137
Algeria	6,742	6,701	10,595	13,101	14,784
Tunisia	3,922	2,728	7,803	8,426	7,498
Maghreb	50,864	45,130	56,691	59,620	62,419
UAR	1,960	1,684	2,001	2,500	3,001
Sudan	630	237	-	-	-
Total	53,454	47,051	58,692	62,120	65,420

Table 59 : Value added

(in 1,000 US$)

Country	1964	1965	1970	1975	1980
Morocco	27,320	24,260	26,025	25,891	27,274
Algeria	4,569	4,541	7,256	8,908	10,053
Tunisia	2,587	1,798	5,145	5,557	4,945
Maghreb Sub-total	34,476	30,699	38,426	40,356	42,272
UAR	1,332	1,145	1,362	1,702	2,407
Sudan	429	161	-	-	-
Total	36,237	31,905	39,788	42,058	44,319

Table 60 : Gross output of manganese ores

Country	Tons							Value in 1000 US$			
	1960	1962	1964	1965	1970	1975	1980	1965	1970	1975	1980
Morocco	483,084	469,357	341,078	375,881	350,000	300,000	250,000	6,147	5,720	4,902	4,085
Algeria	-	-	-	-	-	-	-	-	-	-	-
Tunisia	-	-	-	-	-	-	-	-	-	-	-
Maghreb sub-total	483,084	469,357	341,078	375,881	350,000	300,000	250,000	6,147	5,720	4,902	4,085
UAR	276,000	185,682	187,000	182,000	200,000	250,000	300,000	1,688	2,001	2,500	3,001
Sudan	-	1,000	1,200	800	-	-	-	13	-	-	-
Total	759,084	656,039	529,278	558,681	550,000	550,000	550,000	7,848	7,721	7,402	7,086

Table 61 : Gross output of lead ores

Country	Tons							Value in 1000 US$			
	1960	1962	1964	1965	1970	1975	1980	1965	1970	1975	1980
Morocco	135,124	131,284	103,944	113,260	130,000	145,000	160,000	19,160	22,043	24,586	27,123
Algeria	14,821	12,917	13,601	14,922	18,500	23,400	28,400	1,496	1,855	2,347	2,848
Tunisia	28,000	23,400	21,000	25,000	30,000	30,000	30,000	1,296	5,006	5,006	5,006
Maghreb sub-total and total	177,945	167,601	138,545	153,182	178,500	198,000	218,400	21,952	28,904	31,939	34,971

Table 62 : Gross output of zinc ores

Country	Tons							Value in 1000 US$			
	1960	1962	1964	1965	1970	1975	1980	1965	1970	1975	1980
Morocco	82,268	58,354	80,974	95,015	105,000	85,000	100,000	6,101	6,743	5,459	6,422
Algeria	65,178	70,057	64,274	63,917	99,000	122,700	136,500	4,804	8,324	10,316	11,477
Tunisia	7,000	8,000	6,000	7,000	30,000	40,000	40,000	136	981	1,308	1,308
Maghreb, sub-total and total	154,446	136,411	151,248	165,932	234,000	247,700	276,500	11,041	16,048	17,083	19,207

Table 63 : Gross output of copper ores

Country	Tons							Value in 1000 US$			
	1960	1962	1964	1965	1970	1975	1980	1965	1970	1975	1980
Morocco	5,020	7,696	6,504	6,278	7,000	7,000	10,000	1,348	1,502	1,502	2,146
Algeria	435	2,900	3,900	3,660	3,800	4,000	4,200	400	427	459	481
Maghreb, sub-total and total	5,455	10,596	10,404	9,938	10,800	11,000	14,200	1,748	1,929	1,961	2,627

Table 64 : Employment

(in persons)

Country	1964	1965	1970	1975	1980
Morocco	9,685	9,811	9,700	9,500	9,500
Algeria	1,613	1,724	2,580	3,200	3,600
Tunisia	2,690	1,869	4,840	4,700	3,830
Maghreb, sub-total	13,988	13,404	17,120	17,400	16,930
UAR	2,900	2,950	3,200	3,520	3,870
Sudan	. . . . . no information				
Total	16,888	16,334	20,320	20,920	20,800

Table 65 : Employment - senior technicians

Country	1964	1965	1970	1975	1980
Morocco	128	144	130	130	130
Algeria	19	34	50	65	75
Tunisia	. . . . . no information				
Maghreb, sub-total	-	-	-	-	-
UAR	38	38	40	45	50
Sudan	-	-	-	-	-

Table 66 : Employment - junior technicians

Country	1964	1965	1970	1975	1980
Morocco	921	962	930	920	920
Algeria	154	180	280	335	375
Tunisia	. . . . . no information				
Maghreb, sub-total	-	-	-	-	-
UAR	279	281	310	335	370
Sudan	. . . . . not available				

Table 67 : Employment - Workers

Country	1964	1965	1970	1975	1980
Morocco	8,636	8,705	8,640	8,450	8,450
Algeria	1,440	1,510	2,250	2,800	3,150
Tunisia	. . . . . no information				
Maghreb sub-total	-	-	-	-	-
UAR	2,583	2,631	2,850	3,140	3,450
Sudan	. . . . . not available.				
Total	-	-	-	-	-

Table 68 : Fixed capital formation

(in 1,000 US$)

Country	1960/65	1966/70	1971/75	1976/80
Morocco	20,843	30,739	33,311	35,325
Algeria	N.A.	17,707	17,869	20,076
Tunisia	2,438	9,620	1,905	1,905
Maghreb sub-total	..	58,066	53,085	57,308
UAR	..	3,450	4,140	5,060
Sudan	-	-	-	-
Total	23,281	61,516	57,225	62,368

Table 69 : North African Sub-region: Non-ferrous metal ore mining - production, demand employment and investments 1960-1980

	Units	1964	1965	1966	1967	1968	1969	1970	1971/75	1975	1976/80	1980
1. Capacity												
2. Gross output												
a. value	1000$	53,454	47,051					58,692		62,120		65,420
b. quantity												
3. Value added	1000$	36,237	31,905					39,788		42,058		44,319
4. Exports												
a. value	1000$	38,993	46,481									
b. quantity												
5. Imports												
a. value	1000$	562	900									
b. quantity												
6. Domestic demand (= 2 + 5 - 4)												
a. value	1000$	15,023	1,470									
b. quantity												
7. Employment, total	1000$	16,888	16,334					20,320		20,920		20,800
8. Fixed capital formation	1000$				61,516				57,225		62,368	

Table 70 : Morocco: Non-ferrous metal ores mining distribution of total resources of products, 1964

	Value 1,000 dirhams
Final destination, total	156,239
Consumption: a. private	-
b. public	-
Fixed capital formation	-
Changes in stocks (+ or -)	-
Exports	156,239
Intermediate destination, total	50,001
Basic metal industries	50,001
Total resources	206,240
Imports	2,800
Total gross output	203,440

Table 71 : Algeria: Non-ferrous metal ores mining distribution of total resources of products, 1964

	Value 1,000 Algerian dinars
Final destination, total	28,192
Consumption: a. private	-
b. public	-
Fixed capital formation	-
Changes in stocks (+ or -)	-
Exports	28,192
Intermediate destination, total	5,112
Basic metal industries	5,112
Total resources	33,304
Imports	27
Total gross output	33,777

Table 72 : Tunisia: Non-ferrous metal ores mining distribution of total resources of products of industry - 1964

	Value 1,000 Tunisian Dinars
Final destination, total	145
Consumption: a. private	-
b. public	-
Fixed capital formation	-
Changes in stocks (+ or -)	-
Exports	145
Intermediate destination, total	1,916
Basic metal industries	1,916
Total resources	2,061
Imports	2
Total gross output	2,059

Table 73 : UAR: Non-ferrous metal ores mining distribution of total resources of products of industry, 1964

	Value 1,000 E.£
Final destination, total	830
Consumption: a. private	-
b. public	-
Fixed capital formation	-
Changes in stocks (+ or -)	-
Exports	830
Intermediate destination, total	22
Basic metal industries	22
Total resources	852
Imports	-
Total gross output	852

Table 74 : Sudan: Non-ferrous metal ores mining distribution of total resources of products of industry, 1964

	Value 1,000 Sudanese £
Final destination, total	219.3
Consumption: a. private	-
b. public	-
Fixed capital formation	-
Changes in stocks (+ or -)	+ 141.4
Exports	77.9
Total resources	219.3
Imports	-
Total gross output	219.3

Table 75 : Supply/demand balance and trade matrix: North Africa
Non-ferrous metal ores mining (1964)

(US$ 1,000)

Exporting country \ Importing country	Morocco	Algeria	Tunisia	Libya	Maghreb	UAR	Sudan	North Afr. sub-region	Africa	Rest of world	France	Italy	Germany (FR)	Netherlands	Belgium/ Luxembourg	USA	Total exports
1. Morocco	-	-	2	1	3	-	-	3	3	31141	2214	133	646	12	178	175	31144
2. Algeria	520	-	-	-	520	-	-	520	520	5192	3420	-	160	210	110	100	5712
3. Tunisia	-	-	-	-	-	-	-	-	-	-	276	-	-	-	-	-	276
4. Libya	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Maghreb	520	-	2	1	523	-	-	523	523	36609	5910	133	806	222	288	275	37132
6. UAR	-	-	-	-	-	-	-	-	-	1909	-	531	244	-	398	-	1909
7. Sudan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	224	224
8. North African sub-region	520	-	2	1	523	-	-	523	523	38742	5910	664	1050	222	686	499	39265
9. West African sub-region	15	-	-	-	15	-	-	15									
10. East African sub-region	-	-	-	-	-	-	-	-									
11. Central African sub-region	-	-	-	-	-	-	-	-									
12. Africa	535	-	2	1	538	-	-	538									
13. Rest of world of which:	18	5	2	-	25	-	-	25									
14. France	11	-	-	-	11	-	-	11									
15. Italy	-	-	-	-	-	-	-	-									
16. West Germany	7	-	1	-	8	-	-	8									
17. Netherlands	-	-	-	-	-	-	-	-									
18. Belgium/Luxembourg	-	-	-	-	-	-	-	-									
19. USA	-	-	-	-	-	-	-	-									
20. Total imports	553	5	4	1	563	-	-	563									
21. Domestic production	40200	6742	3922	-	50864	1960	630	53454									
22. Total supply	40753	6747	3926	1	51472	1960	630	54017									
23. Exports	31144	5712	276	-	37132	1909	224	39265									
24. Domestic consumption	9609	1035	3650	1	14295	51	406	14752									

Note: No exports to West African, East African and Central African sub-regions.

ANNEX I

COAL MINING: PRELIMINARY INFORMATION

Introduction

Production of coal is very small in the North African countries.

Only Morocco and Algeria produce anthracite and coal. A coal mine is in erection in the United Arab Republic in the Sinai Peninsula. Imported amounts of coal are also small so coal is not of great importance in the economy of North African countries. Nevertheless, it deserves more detailed study as the expert could only spend a few days preparing this information.

World situation

World production of coal and export and import for the years 1960, 1964 and 1965 is shown in Table 1. It may be seen that world production was

in 1960	2,590 million tons
in 1964	2,710 million tons
in 1965	2,760 million tons

The main producing countries are: United States of America, USSR, China (Mainland), Great Britain, Germany (FR) and Poland. The main exporting countries: United States of America, USSR, Poland and Germany (FR). Coal is imported by all developed countries which do not produce enough for their purposes.

Coal is now in great competition with petrol and natural gas but it keeps its position as main fuel and energy supplier in various fields; iron metallurgy and electroenergy production use big amounts of coal.

The price of exported Moroccan anthracite rose from US$14.41 in 1961 to US$17.76 in 1964, i.e. by 23 per cent.

The price of imported coal in Tunisia was US$17.98 in 1961 and US$16.46 in 1964, i.e. 8.4 per cent less. The price of imported coal in the UAR was US$ 15.52 in 1964.

This gives general information on prices of coal in this period, although differences in prices may also proceed from differences in quality of the imported or exported product.

Table 1 : Coal - World production and trade

Region	Production in million long tons			Exports in million long tons		
	1960	1964	1965	1960	1964	1965
World	2,590	2,710	2,760			
USA	385	447	468	34.2	45.2	44.4
USSR	369	402	420	12.1	22.9	21.8
Mainland China (estimate)	413	290	300			
Great Britain	186	187	180	5.5	5.5	3.8
Germany (FR)	140	140	133	17.3	13.5	13.0
Poland	103	115	117	17.2	19.0	20.7
France	55	52	51	1.4	0.9	0.7
India	52	61	66	1.1	1.2	0.7
Japan	50	50	49		0.1	0.1
Belgium/Luxembourg	24	21	19	2.2	2.1	1.8
Czechoslovakia	26	28	27	2.2	2.5	2.3
	Imports in million long tons					
France	9.9	13.9	11.7			
Italy	9.7	9.9	10.1			
Belgium/Luxembourg	8.2	11.4	11.1			
Japan	8.2	13.0	16.8			
Germany (Eastern)	7.9	10.2	9.3			
Germany (FR)	6.6	6.9	7.0			
Denmark	3.9	3.7	3.4			
Austria	3.7	3.7	3.5			
Finland	2.9	2.4	2.5			
Czechoslovakia	2.4	5.0	4.5			

Geological situation and reserve

Coal deposits in North Africa are small. The reserves of the south Oran Saharan deposits in Algeria are estimated at one billion tons and those of the Jerada basin of Morocco at 120 million tons. The known reserves in the Sinai Peninsula are estimated at 40 million tons.

They may be described according to the Explanatory Note to the coal map of Africa edited by ASCA, Paris 1966.

Morocco possesses one coal basin of economic importance. The basin of Jerada in the eastern part of the country, on the edge of the high plateau, 50 km south, south-west of Oujda, at an altitude of 1,100 metres. It comprises five workable seams 0.40-0.75 metres thick. The fuel is anthracite with an ash content of 4-5 per cent and volatiles 5-6 per cent.

Algeria possesses a medium-size coal basin in the southern Oran region along the northern edge of the Saharan platform. The seams are thin (less than one metre thick) but constant. The coal has coking properties but its exact characteristics are not known to the author. Therefore one cannot state what metallurgical quality coke made from this coal will have and whether it will be necessary to add certain amounts of good imported coking coal to get good metallurgical coke. There are two parts of this basin: The Colomb-Bechar-Kenadsa basin with 30 million tons. Its coal contains 31-32 per cent volatiles.

The coal deposits in Sinai Peninsula are estimated at 40 million tons of coal with coking properties. A mine with a capacity of 0.3 million tons yearly is in operation.

These are the main known coal deposits of Northern Africa.

Output, import, export, domestic demand

Quantities for 1964 are shown in Table 2. It may be seen that the total production of coal and anthracite for the whole sub-region was 446,000 tons. Morocco produced 400,000 tons of anthracite and Algeria 46,000 tons of coal.

Coke was produced in UAR only to the extent of 35,000 tons.

Morocco exported 140,000 tons of anthracite; 21,000 tons to Algeria.

355,000 tons of coal and 247,000 tons of coke were imported, mainly by the UAR.

Total domestic demand was 682,000 tons of coal and 282,000 tons of coke of which 43 per cent of coal and 89 per cent of coke was from the UAR.

Table 2: Coal and coke production and demand in 1964

	Production		Export		Import		Domestic demand	
	tons	value 1,000 DH	tons	value 1,000 DH	tons	value 1,000 DH	tons	value 1,000 DH
Morocco								
Anthracite and coal with brichets	400,000	35,672	140,207	12,592			259,793	23,080
Coke	–	–	–	–	14,415	1,800	14,415	1,800
Total	400,000	35,672	140,207	12,592	14,415	1,800	274,208	24,880
Algeria		1,000DA		1,000DA		1,000DA		1,000DA
Coal	46,313	2,918	–	–	10,676	673	56,984	3,591
Anthracite from Morocco	–	–	–	–	21,041	1,629	21,041	1,629
Coke	–	–	–	–	10,544	2,310	10,544	2,310
Total	46,313	2,918	–	–	42,261	4,612	88,574	7,530
Tunisia						1,000DT		1,000DT
Coal	–	–	–	–	34,207	225	34,207	225
Coke + semicoke	–	–	–	–	6,614	154	6,614	154
Total	–	–	–	–	40,821	379	40,821	379
Libya						1,000LL		1,000LL
Coal + coke	–	–	–	–	2,307	44.6	2,307	44.6
UAR						1,000LE		1,000LE
Coal	–	1,000LE	–		301,353	2,034	301,353	2,034
Coke	35,000	350	–		216,000	2,430	251,000	2,780
Total	35,000	350	–		517,353	4,464	552,353	4,814
Sudan						1,000LS		1,000LS
Coal	–	–	–	–	6,362	35	6,362	35
Coke	–	–	–	–	909	8	909	8
Total					7,271	43	7,271	43

(continued)

Table 2: Coal and coke production and demand in 1964 (continued)

Country item	Production tons	Production value 1,000 DH	Export tons	Export value 1,000 DH	Import tons	Import value 1,000 DH	Domestic demand tons	Domestic demand value 1,000 DH
Maghreb								
Coal and anthracite	446,313		119,166		47,190		374,337	
Coke	-		-		31,573		31,573	
Total	446,313		119,166		78,763		405,910	
North African Sub-region								
Coal and anthracite	446,313		119,166		354,905		682,052	
Coke	35,000		-		247,573		282,573	
Total	481,313		119,166		602,478		964,625	

Notes: Export from Morocco to Algeria is subtracted from the Maghreb and sub-region export.

The values for Algeria are calculated at Tunisian prices, and for Sudan by UAR prices.

Some remarks on the future development of the coal industry in North Africa

Coal reserves in North Africa are very scarce in comparison to world reserves. On the contrary, the petrol and natural gas reserves are very high. The reserves and production of Algeria and Libya are very important. Recently petroleum deposits have also been found and investigations are also being made in the UAR and in other countries of the Sub-region. As petrol products and natural gas can take the place of coal in many fields, one must be very careful in making proposals for development of the coal industry in this Sub-region.

But there is however one important domain where petrol and natural gas cannot take the place of coal for technological reasons, that is, in production of iron. Metallurgical coke made from special kinds of coal is indispensable for this purpose, although some amounts of natural gas or petrol products injected into the blast furnaces can diminish the quantities of coke required.

The development of the production of good coking coal in order to produce metallurgical coke would therefore be profitable in North Africa. If the coal in Algeria has good coking properties, then one could consider developing its production together with that of the iron ores also available in Algeria in order to produce iron. The coal for this purpose must be of the special quality called orthocoke or meta-coke coal in the international classification.

The same remarks are also valid for the development of coal production in the Sinai Peninsula in the United Arab Republic. The erection of a coal mine with a capacity of 0.3 million tons yearly will be completed when the general situation allows it. It seems that the production of the very pure anthracite in Morocco (small ash content) may stay at the present level of 400,000 tons yearly.

Table 3: Morocco - Input structure of industry ISIC, coal, 1964

		Absolute values		Input coefficients	
		1	2	3	4 (2 as % of 1)
0	Agriculture, etc.				
1	Mining and quarrying		84		0.0150
20	Food manufacturing ind.				
21					
22					
23					
24					
25			508		0.0907
26					
27			24		0.0043
28					
29			6		0.0011
30			4		0.0007
31			174		0.0311
32			50		0.0089
33			18		0.0032
34			60		0.0107
35			390		0.0696
36/37			4		0.0007
38					
39					
4			2		0.0004
5			460		0.0821
61					
62/63			626		0.1118
64					
7			511		0.0912
8/9					
Total intermediate inputs			2,920		0.5214
Salaries and wages			4,200		0.7500
Indirect taxes less subsidies			70		0.0125
Rest			-1,590		-0.2839
Total gross output			5,600		1.0000
Employment			4,526		
Capital formation			526		

ANNEX II

IRON ORE

A. World situation

The world situation is described fully in the report by the Economic Commission for Europe, World Market for Iron Ore, from which the following details are extracted.

Consumption of iron ore

(in million tons)

	1950	1960	1961	1962	1963	1964
Agglomerated						
Western Europe	11.2	59.4	66.2	75.1	83.3	96.8
Eastern Europe	11.3	67.3	77.1	80.9	96.3	107.2
North America	14.4	56.7	57.1	61.8	74.3	83.8
Asia	0.8	4.9	9.0	12.3	14.8	16.9
Australia	0.7	1.6	2.5	2.5	3.0	3.6
World	37.7	189.9	211.9	238.5	272.1	309.5
Unagglomerated						
Western Europe	65.0	109.9	103.7	88.1	74.4	72.1
Eastern Europe	35.5	32.1	30.8	29.1	26.4	24.0
North America	92.2	50.0	45.2	40.7	44.5	55.0
Latin America	0.2	5.4	6.2	6.7	7.5	8.3
South Africa	1.1	2.7	3.1	3.3	3.3	3.8
Asia	4.6	15.9	18.7	18.1	20.1	24.4
Australia	2.2	2.7	2.1	2.6	2.5	2.5
World	200.7	218.6	209.8	188.5	178.8	190.1
Iron content						
Agglomerated	18.2	96.8	109.5	123.7	142.8	164.7
Unagglomerated	94.6	99.2	95.6	87.4	87.1	97.4
+ in steel-making	2.7	4.1	3.7	4.4	3.8	4.4

In terms of iron content, world consumption of iron ore has increased by one-third since 1960, i.e., at an annual rate of about 7.4 per cent, the increase being entirely in agglomerated ore, i.e., sintered and pelletised.

In comparison, the development of world iron ore production has been as follows:

Production of iron ore and reserves

(in million tons Fe content)

	1950	1960	1961	1962	1963	1964	Reserves (1)	(2)
Western Europe	28.3	51.3	52.5	50.9	48.0	51.1	20	5
Eastern Europe	23.3	60.2	67.1	73.3	79.5	84.6	104	14
North America	51.1	58.0	49.7	54.5	56.4	66.2	53	93
South America	3.5	25.7	23.8	24.3	25.4	29.5	50	42
Africa	3.9	9.0	9.8	10.4	12.5	18.9+	13	14
Asia	4.0	33.0	32.8	30.0	35.8	35.8	8	29
Australia	1.5	2.9	3.4	3.2	3.6	3.8	8	7
World	115.6	240.2	239.0	246.5	261.2	289.9	256	205

(1) Measured, indicated and inferred
(2) Potential addition
\+ of which Algeria 1.5
Morocco 0.5
Tunisia 0.5

World trade

World trade is increasing in relation to production, also when inter-trading between the European Coal and Steel Community countries, Eastern Europe and North America is excluded.

World output and trade in iron ore

(million tons)

	1950	1960	1964
Output	243.6	513.6	573.2
Trade	41.0	154.7	198.4
Ex inter-trading	25.6	97.6	123.7

The principal trading areas in 1964 were as follows:

Production, imports, exports of iron ore in 1964

(in million tons)

	Production	Imports	Exports
Western Europe	135.5	90.9	51.3
Eastern Europe	156.4	26.6	22.6
North America	117.8	48.6	38.0
South America	48.2	1.0	39.6
Africa	31.8	-	27.5
Asia	86.7	31.1	19.6
Australia	6.1	0.3	0.3

Excluding inter-trading, the main increases in recent years have been in supplies from Africa.

Exports of iron ore excluding inter-trading

	1960 per cent	1964 per cent
Western Europe	26.1	23.0
USSR	0.4	0.7
Africa	13.3	21.6
North America	7.5	6.6
South America	36.0	31.9
Far East	16.4	15.9
Australia	0.3	0.3

Further expansion is considered most likely in Australia, Brazil and West Africa. Exports from North Africa are under pressure from higher grade ores available elsewhere while, moreover, extraction costs are above average as are also port handling charges. To some extent, it may be possible to obtain new outlets in the Central and Eastern Mediterranean, where the short sea haul may offset these factors.

Prices.

The trend in iron ore prices has been downwards, perhaps by 10 per cent, during the last five years and a downward tendency is likely to persist in view of the increasing availabilities.

Price	1958	1960	1964	1965
Combined index of Mesabi, Kiruna, Minette, Itabira and Orinoco ores 1960 = 100	101	100	89.4	88.2

Future demand

World production of pig iron is forecast at 600 million tons in 1980 compared with 510 million in 1975 and 313.4 in 1964, i.e., an annual increase of 4.3 per cent up to 1975 and 3.3 per cent afterwards.

B. North African situation

Of the North African countries, only Morocco, Tunisia, and Algeria are in a position to export iron ore and these are facing increasing competition from more favourably placed countries so that their share of world production is falling.

Production of iron ore

(million tons Fe content)

	Average 1953-55	Average 1963-65
Algeria	1.72	1.44
Morocco	0.78	0.55
Tunisia	0.57	0.54
All developing countries	18.5	64.7
World	161.6	306.9

The three countries now account for only 0.8 per cent of world production as against 1.9 per cent ten years ago. At the same time, their prices fall in line with world prices, e.g., the f.o.b. price of Moroccan ore from $8.5 per ton in 1960 to $7.9 in 1964 and Tunisian ore from $7.8 in 1962 to $6.4 in 1965.

Moreover the reserves of iron ore in the sub-region available for export are not large. Accepting the proposals for iron and steel development contained in the Basic Metals report, the position is as follows:

Morocco. Reserves are now estimated at only 25 million tons from 1970 onwards. The proposed iron and steel works will require 300,000 tons in 1980 and assuming normal expansion 675,000 per annum by 1990. It would not seem wise therefore to attempt to increase exports much above present levels of about 1 million tons per annum even if that were possible.

Algeria. The position here is somewhat different in that there are large reserves estimated at 765 million tons at Gara Djebilet which, although never likely to be competitive in the export trade, could supply a domestic industry. The proposed iron and steel developments will take 1 million tons per annum of iron ore by 1980 which will come from the deposits at present going to export, which have reserves of about 130 million tons and a present annual output of about 3 million tons. It would therefore be possible to export at the rate of 2 million tons per annum in 1980 and to maintain this subsequently, provided the Gara Djebilet deposits are worked.

Tunisia. Reserves are estimated at about 75 million tons, current output at about 1.2 million per annum and requirements for the projected iron and steel industry in 1980 at about half a million tons per annum. It would be reasonable, therefore, to continue exports at about the present rate of 1 million tons per annum.

Projected exports of iron ore (1980)

	'000 tons	$ million
Morocco	1,000	7.5
Algeria	2,000	14.0
Tunisia	1,000	6.8

Table 1: Iron ore: Production and demand

	1964	1965	1966	1970	1975	1980
Morocco						
Export: Quantity '000 tons	994	957	790	1,000	800	700
Value $ million	8.0	7.7	6.5	7.5	6.0	5.2
Gross output:						
Quantity '000 tons	890	951	1,017	1,000	1,000	1,000
Value $ million	8.5	7.0		-	-	-
(official estimated ex-mine)	2.7	2.9		3.0	3.0	3.0
Domestic demand:						
Quantity '000 tons	-	-	-	-	200	300
Value $ million (est. delivered works)	-	-	-	-	0.9	1.4
Employment:	2,700					
Algeria						
Export: Quantity '000 tons	2,828	2,994		2,650	2,370	2,000
Value $ million (estimate)	19.8	21.0		18.5	16.6	14.0
Gross output:						
Quantity '000 tons	2,739	3,222		3,000	3,000	3,000
Value $ million (official)	-	22.0		-	-	-
(estimated ex-mine)	8.1	9.6		9.0	9.0	9.0
Domestic demand:						
Quantity '000 tons	-	-		350	630	1,000
Value $ million (est. delivered works)	-	-		1.4	2.5	4.0
Employment:	4,567					
Operatives	4,089					
Foremen	199					
Employees	215					
Engineers and admin.	55					

Table 1: Iron ore: Production and demand (continued)

	1964	1965	1966	1970	1975	1980
Tunisia						
Export: Quantity '000 tons	831	910	876	1,370	1,180	1,000
Value $ million	5.4	5.8	5.5	9.3	8.0	6.8
Gross output: Quantity '000 tons	939	1,117	1,287	1,500	1,500	1,500
Value $ million (estimated ex-mine)	2.8	3.3	3.9	4.5	4.5	4.5
Domestic demand: Quantity '000 tons	-	-	70	130	320	500
Value $ million (est. delivered works)	-	-	0.3	0.6	1.6	2.5
United Arab Republic						
Export: Quantity '000 tons	-	-	-	-	-	-
Value $ million	-	-	-	-	-	-
Gross output: Quantity '000 tons	447	507	442	1,030	1,930	3,400
Value $ million (est. ex-mine)	1.4	1.5	1.3	3.1	5.8	10.2
Import:	-	-	-	-	-	-
Domestic demand: Quantity '000 tons	-	450	-	1,030	1,930	3,400
Value $ million (est. delivered works)	-	2.0	-	4.6	8.7	15.3

Note on Table 1

All the iron ore produced in Morocco, Algeria and Tunisia was for export up to 1966, when the Menzel Bourgiba works in Tunisia came into production, while all the ore produced in the UAR is for home use. Value figures are only occasionally published and these are often not correct, for example, Algeria gives an average value of $15 per ton for iron ore exported in 1963, which is about twice the proper price; while Morocco gives in 1964 a higher average value for iron ore produced than for iron ore exported, which is not reasonable. It seems best to take f.o.b. export prices as being normally correct and to estimate ex-mine prices when required by subtracting transport and f.o.b. charges. In general, the costs of producing iron ore by open cast are for all countries round about $3 per ton to which may be added from $1 to $2 transport cost to a port and $3 for loading and f.o.b. charges for export. Most countries have also an export tax, for example, in Morocco about $0.8 per ton.