OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

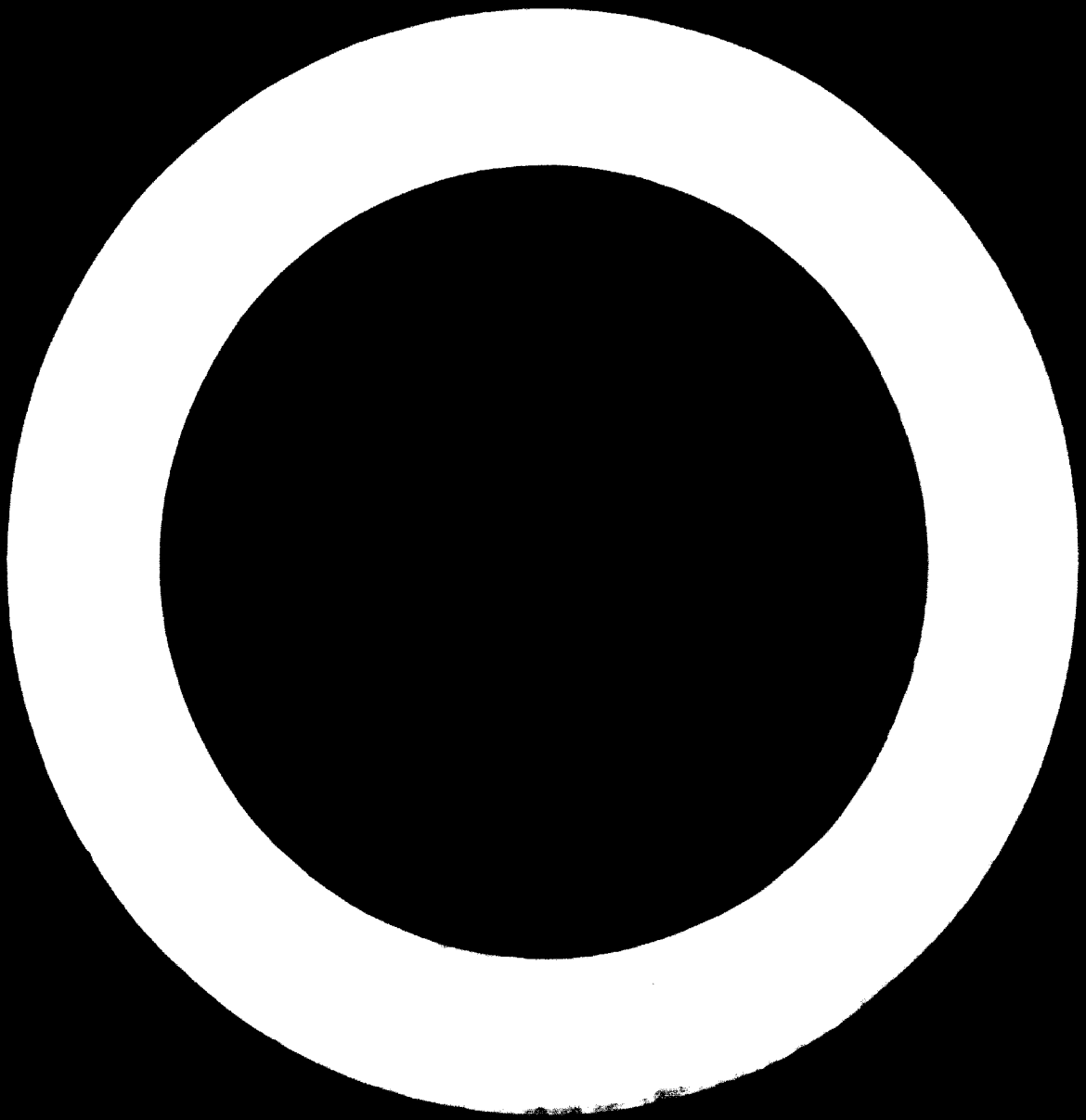
FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org



06935

RESTRICTED

FS 0267

THE MARKETING POSSIBILITIES OF IRON-ORE PELLETS FROM NADOR FOR "LA SOCIÉTÉ D'EXPLOITATION DES MINES DU RIF"

S E F E R I F - MOROCCO

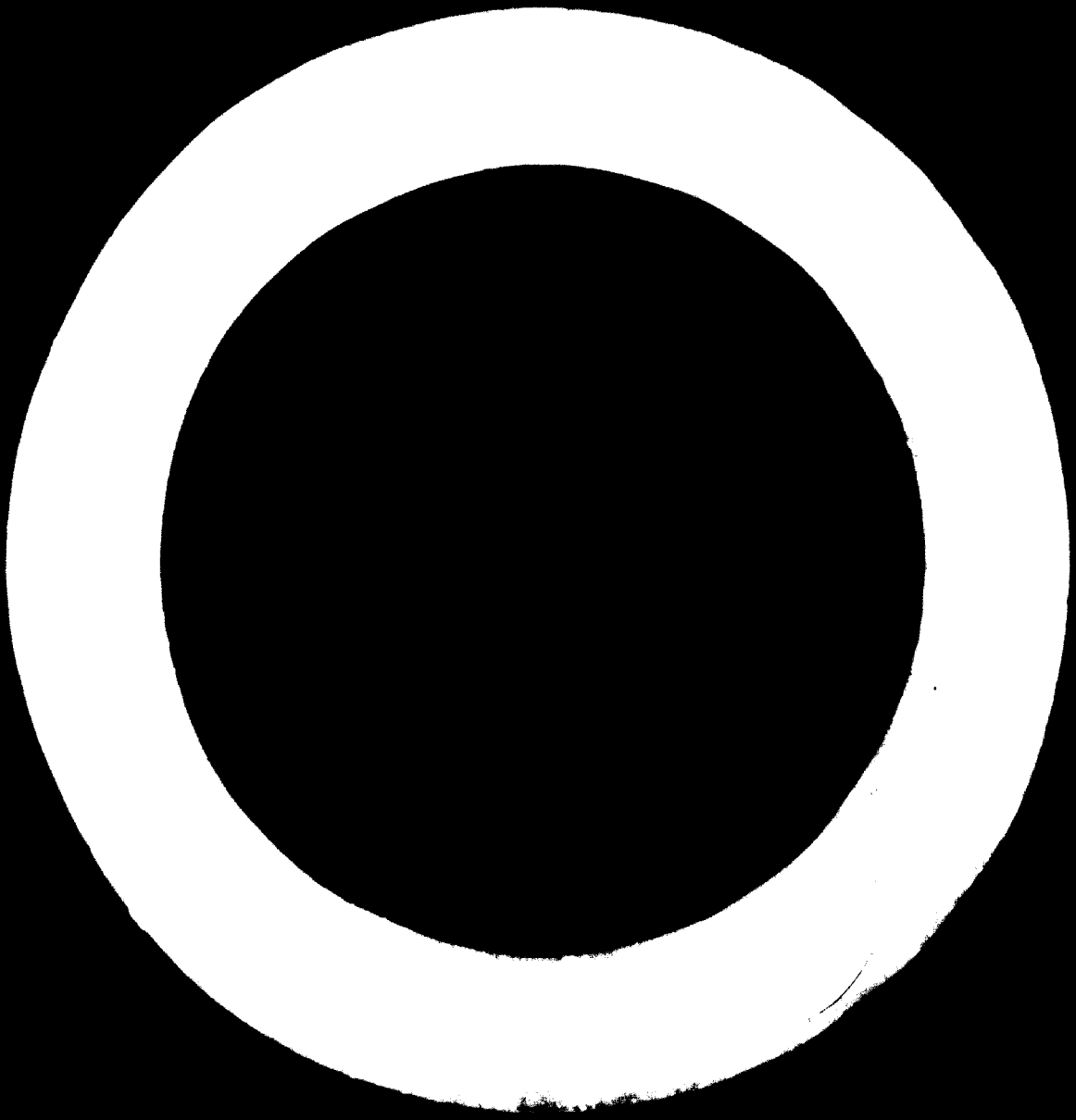
S/F IRON & STEEL

C/F MOROCCO

p 48
+ App

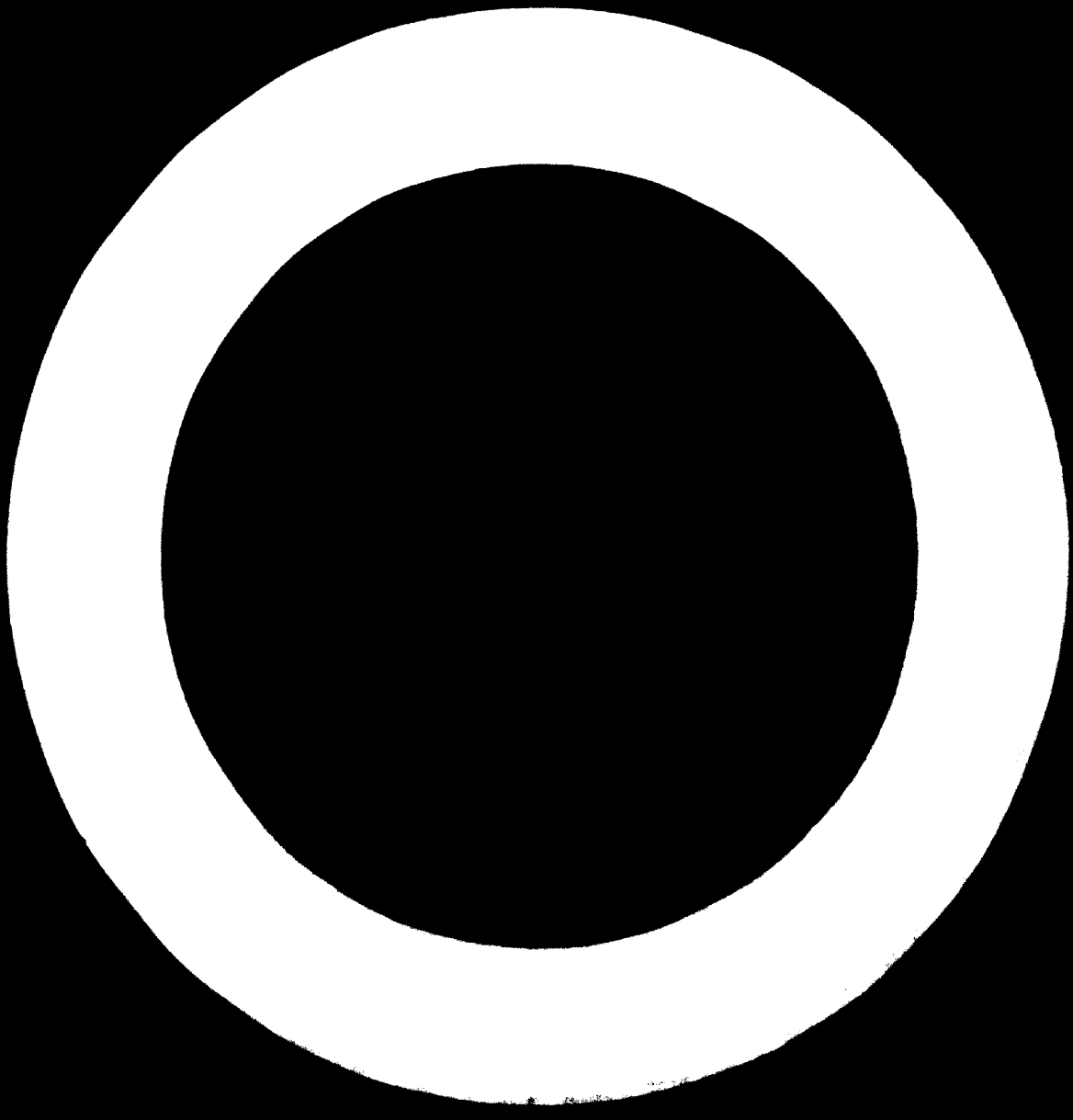
26 June 1970

M. SNIDAR
Marketing expert-iron ore pellets



CONTENTS

ANNEXES



1. INTRODUCTION

The Government of Morocco is considering the establishment of a plant for iron ore pelletizing after optimal beneficiation of the iron ore fines mined at Nador, Northern Morocco. Critical examination of the marketing potential for the iron ore pellets, particularly for the export markets, is sought in this context.

This report contains the results of marketing possibilities of iron ore pellets which will be produced at the projected pelletizing plant. It also forecasts the c.i.f. pellet prices which may be achieved in 1975, 1980 and later on. The competition caused by higher outputs of the pellet production in other countries is described. It should be borne in mind that the forecasts contained in this report may vary in small ranges due to the fact that a very fast development of some deposits can occur, as for example the quite unexpected growth of the Australian iron ore industry.

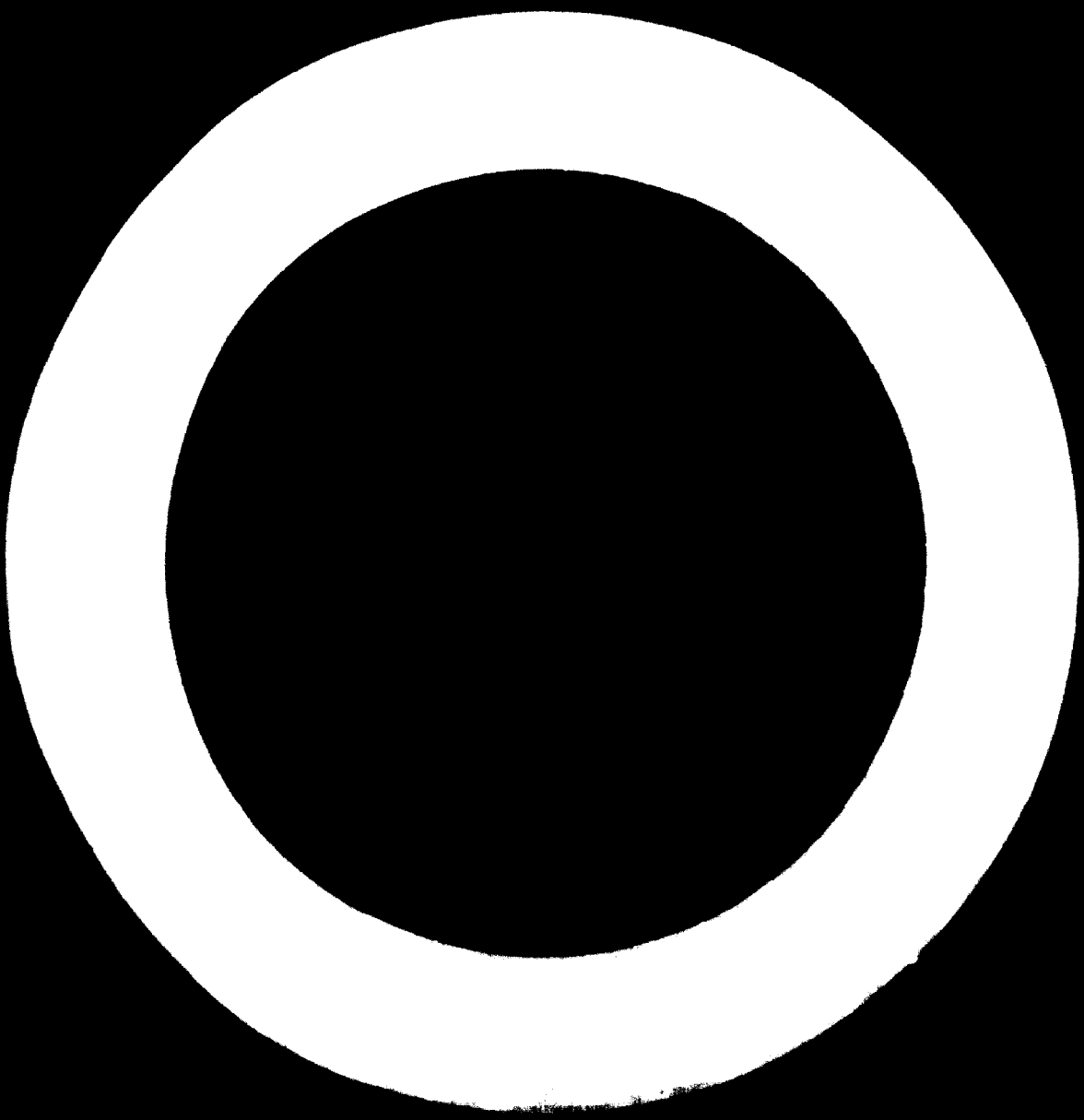
The possibility of improvements in Melilla port, which could enable loading into bulk-carriers of 15,000 to 20,000 dwt., is finally calculated with the influence on f.o.b. and c.i.f. prices and in comparison with the competitive prices from other countries.

2. THE NADOR PELLET PLANT AND PELLET QUALITY

This chapter gives only some general information.

2.1 Iron ore deposits.

The deposits Uixan, Axara, Setolazar and Granss are situated some 10 km from Nador and 25 km from Melilla in the eastern part of the Rif mountains. The Mine du Rif ore is composed of magnetite of finely granular structure, containing coarse grained irregular masses of pyrite with fine inclusions of magnetite. A very



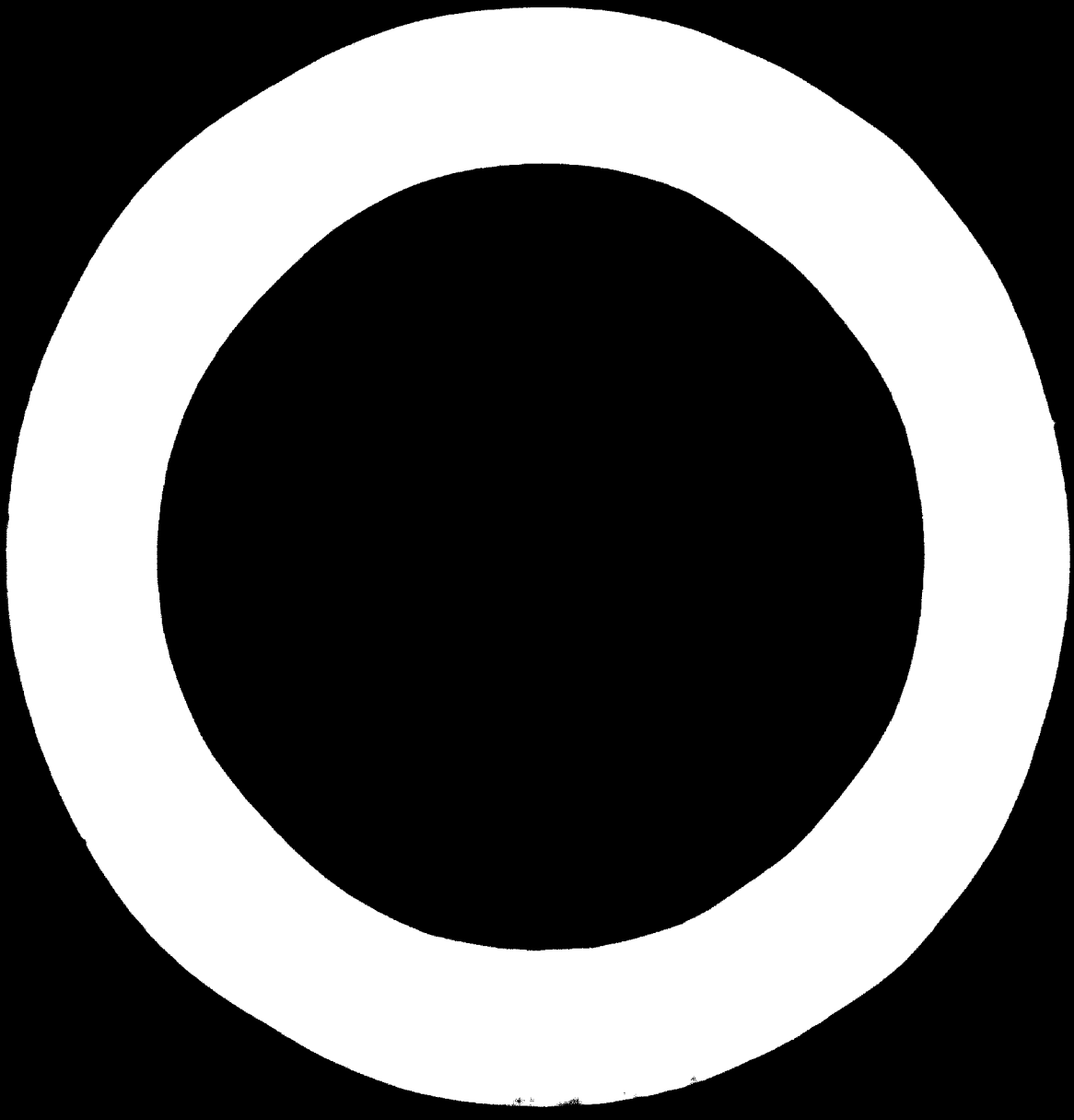
small amount of sulphide was detected after concentration of pyrite. The silica content in the ore amounts to about 10 % maximum and the calcite content is very low. About 70 % of total iron appears in the form of magnetite, 7.5 % as pyrite, the remainder as hematite (martite) or silicates in the form of very fine grained associations of the magnetic iron bearing mineral.

Ore reserves in situ are about 32.737 million tons. Proposed mining rate is 1.2 million tons with 15 % dilution i.e. 1.38 million tons per year, with mostly underground mining operations within 25 years. Description of both, mining and benefication methods is not necessary to mention in order to shorten this report. The average iron content (total) in the ore feed to the concentrator after dilution is presumed to be 49 % Fe.

2.2 Pelletizing.

The advantage of producing pellets as a blast furnace burden is well known and need not be described in this report. Two shaft furnaces will be used for the pelletization with an estimated output of 850 - 950 thousand tons per year. Only 850,000 tons pellets are estimated for the iron ore market. A small amount of pyrites (70,000 tons per year) with a content of 53.4 % S represents a byproduct which is easy to sell in Western Europe.

There are only some test results available, which were obtained from different samples in several laboratories and compared with one another. The chemical analysis of the product is shown as follows: (see next page)



Constituent	% in ore	% in concentrate	% in pellets
Fe (total)	33	67.1 - 66.8	65.9 - 66.4
Fe^{++}	-	21.7 - 21.4	0.95 - 1.68
SiO_2	7.0 - 8.0	2.20 - 2.30	2.69 - 2.42
Al_2O_3	-	1.06 - 1.20	1.13 - 1.24
CaO	2.0	0.70 - 0.80	0.71 - 0.90
MgO	2.0	0.06 - 0.06	0.05 - 0.09
S	4.0	0.02 - 0.30	0.005 - 0.007
P	0.04	0.066	0.008 - 0.010
TiO_2	0.01		

Basicity $(CaO + MgO):(Al_2O_3 + SiO_2)$ is about 0.485 - 0.525.

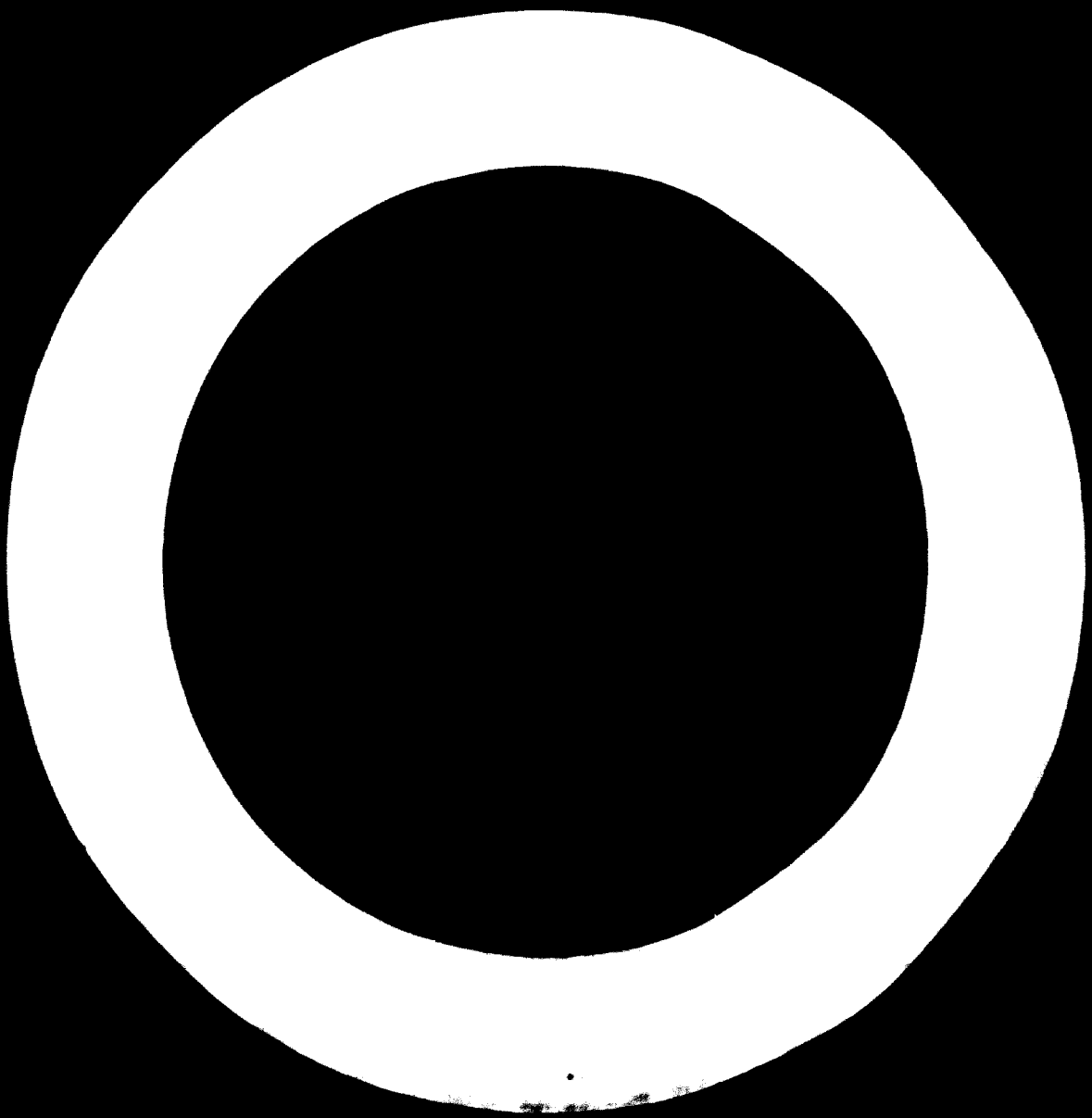
The semiquantitative spectrographic Analysis of the final iron concentrate is as follows (in %)

Cr ... 0.06	Ti ... 0.2	SiO_2 ... 2.0
Co ... 0.03	Va ... 0.01	CaO ... 0.1
Mn ... 0.06	ZrO_2.. 1.0	MgO ... 1.0
Ni ... 0.005	K_2O .. 1.0	Al_2O_3 .. 1.0
Sn ... 0.005	As ... traces	

All the test samples had the Fe content higher than 66 % and only a low silica content. Because of varying of the Fe content it is most probable to get a lower quality of the run of mine ore during the further mining period, containing more silica. For the marketing study, therefore, a 65 % Fe content and 3 % Al_2O_3 content were taken in consideration as average grades.

The normal pellet size will vary between -1/2" and + 7/16" it means between 11.0 and 12.7 mm.

The average compression strength for pellets of 10 - 12 mm should be at least 150 kg. All tests showed that this strength was higher than 150 kg. The samples produced with Peruvian bentonite had the average compression strength 220 kg which is acceptable. The average of



oil tumble tests on fired pellets using Moroccan bentonite was 3.63 % passing 20 mesh (0.59 mm), which is also acceptable. The specific gravity for hard, fire 11 - 13 mm pellets with 66 % Fe is 1.8 - 2.0 t/m^3.

When comparing the Nador pellets with some others pellets produced by certain industrial plants (see table 1) the position of the first mentioned in the European market could be very promising.

8.9 Economic Analysis

The economic analysis, compiled in the light of the situation in 1988 - 1989 by Wright Engineers Limited, Vancouver, Canada, was developed on the basis of 38.8 cents per iron unit with 66 % Fe. This value was taken into account as the common price of pellets on European markets during the last year. It was compared with a similar price, based on 32.0 cents per iron unit. They have believed the price of 38.8 cents per iron unit is a reasonable projection over the whole project life of 26 - 27 years.

The following calculation executed at SEPEMI is more careful. They have considered only 66 % Fe content and 30 cents per iron unit c.i.f. Rotterdam, which seems to be very reasonable for the first five years of production. The Nador pellet price c.i.f. Rotterdam could be about US $ 33.0 per ton. The difference between c.i.f. and f.o.b. values is calculated $ 8.70, so that f.o.b. price at Melilla is only $ 24.3. Under these conditions the projection indicates that the project will mean an important contribution to the Moroccan economy.

Although, there may be some slight or higher adjustment downward or change in the immediate future or later on. In this case the time for repayment of the loan capital and interest will be longer and

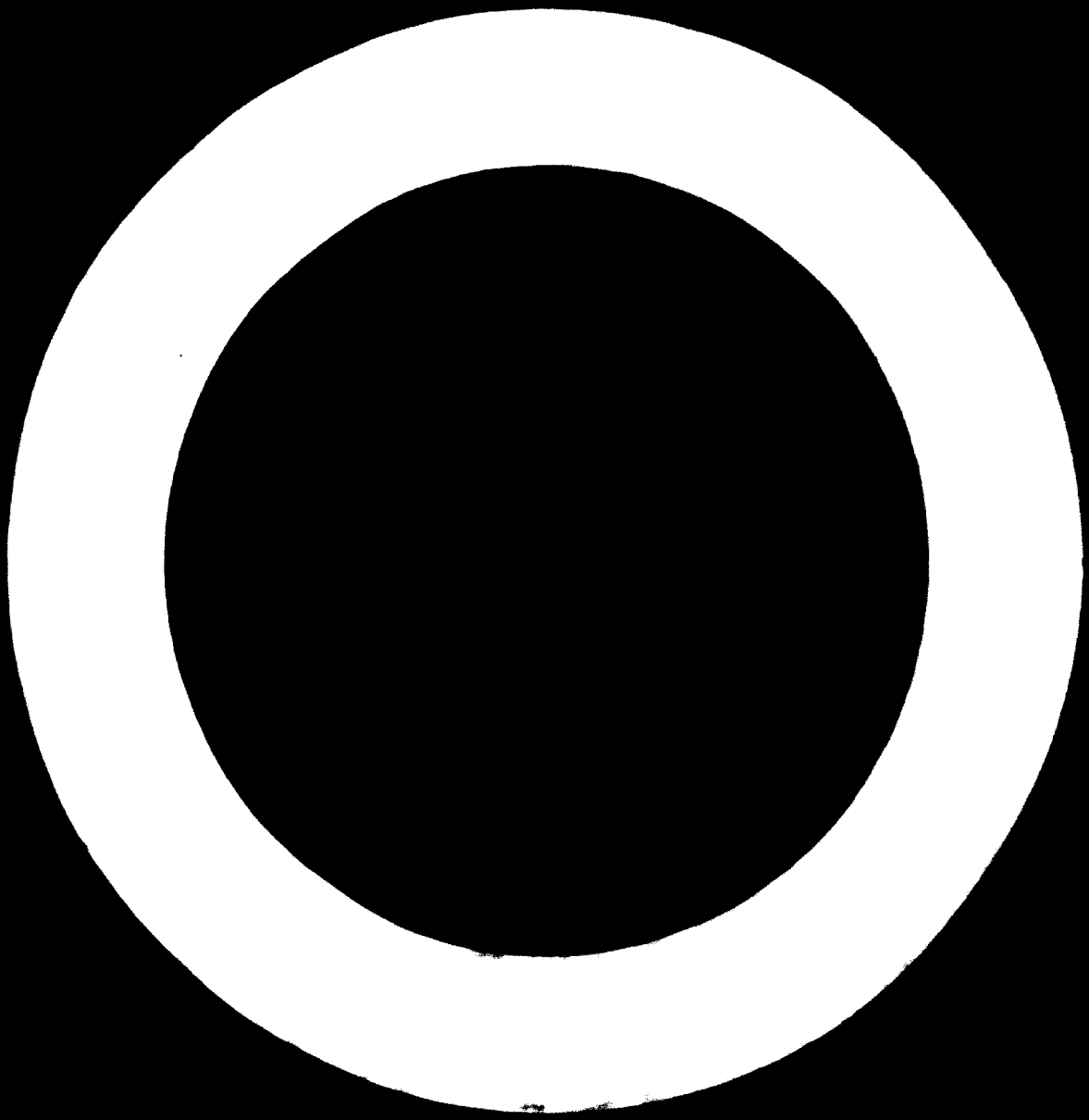
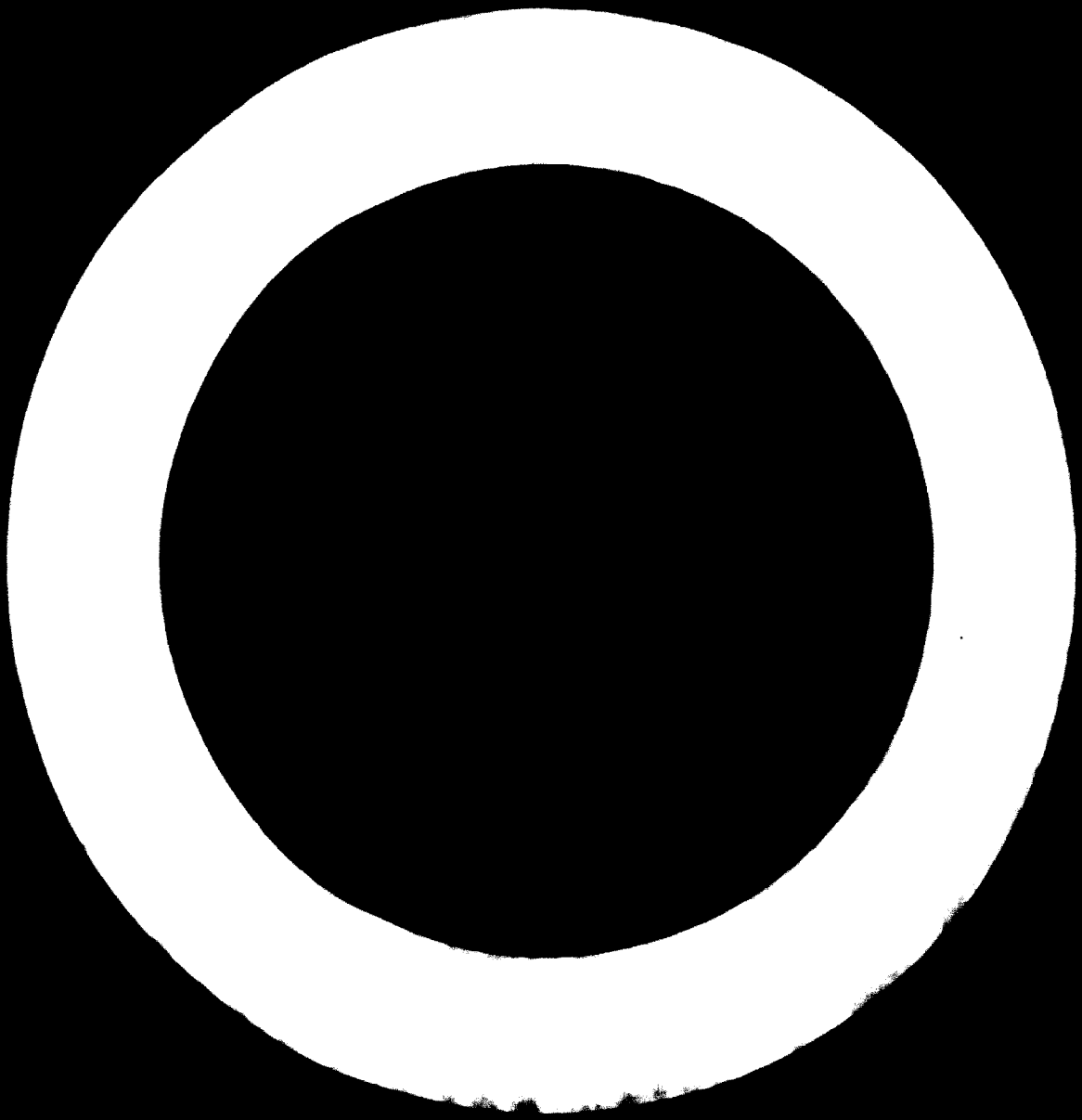


Table 1 - Chemical analysis and strength of pellets
(Average percentages)

Plant	Country	Fe	SiO_2	Al_2O_3	CaO	MgO	P	S	Strength kg
Nador	Morocco	66.5	2.00	1.20	0.80	0.97	0.026	0.008	200
Malmberget	Sweden	66.6	0.70	0.36	0.48	0.30	0.013	0.011	150
Kiruna	Sweden	64.6	4.00	1.15	0.62	0.63	0.045	0.007	150
Ha-I-Gran	Norway	66.0	4.00	0.21	0.10	0.28	0.015	0.120	200
Carol Lake	Canada	65.0	5.80	0.25	0.00	0.05	0.010	0.000	105
Copper Cliffs	Canada	66.0	1.50	0.05	0.25	0.30	0.020	0.010	-
Republic	USA	65.0	4.80	0.50	0.20	0.81	0.000	0.005	-
Grace Mine	USA	66.6	2.80	0.70	0.50	1.00	0.005	-	-
Marcona	Peru	67.5	1.00	0.45	0.18	0.25	0.010	0.000	227
Nimba	Liberia	64.50	4.20	2.00	1.10	0.05	0.05	0.003	-
Pellenica	Italy	66.00	2.17	0.52	2.34	0.61	0.010	0.015	120
Sokolovsk	USSR	66.30	3.30	0.58	0.74	0.00	-	0.010	70
Savage River	Austral.	67.50	1.50	0.25	-	-	0.020	-	-



smaller profit could be achieved. In this case the production costs and freight charges should have to be decreased to enable a higher profit achievement.

No mention is made in this report of the possibilities to depreciate the production costs partly because sufficient figures of the new technology are not available. On the other hand the new technology may cause some difficulties and lower output capacity in the first two years from the beginning the pellet production. To improve this and the technology in general will be the task for the whole staff and remains as a reserve in the production costs.

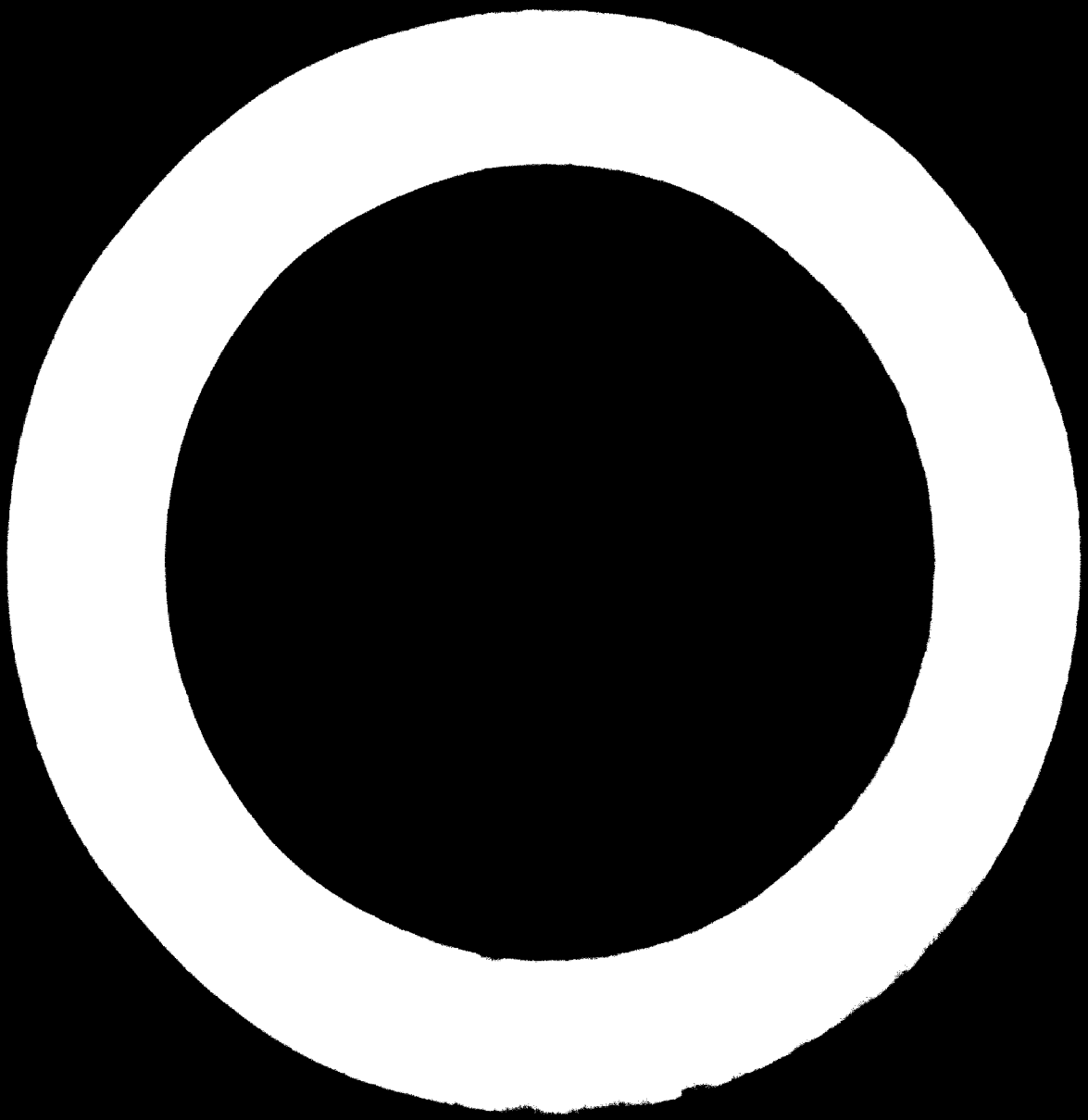
Improvements of loading facilities at Melilla and decreasing of transport costs are reviewed in chapter 8, which also includes a brief assessment of the problem from the commercial and economic point of view.

3. MARKET FOR IRON-ORE AND PELLET PRODUCTION

3.1 Types of Ore.

The iron ore industry has during the past two decades undergone considerable change, not only in technology applied in mining and processing of iron ore, but also in its structure and in the product and geographical pattern of its output. The main cause of such changes are the fluctuations in the market for iron and steel products.

The substantial part of iron ore was designated for blast furnaces. An important element in blast furnace productivity is, of course, the use of a well-prepared burden and use of high-grade ores from overseas, which, in many cases, replaced depleted or high-cost domestic sources.



The increased use of sinter and pellets has already gradually reduced the proportion of unprepared ore in blast-furnace charges and it is to be expected that this trend will persist. The countries of the European Coal and Steel Community have only recently begun to use sinter on a large scale; but in 1965, 27 % more sinter than ore were charged. Consumption of iron ore in steel-making will grow in proportion to the increase in steel production, while the use of pellets in steel plants will remain limited.

The consumption of fines to produce sinter has increased since the early 1960's, as can be seen in table 2.

Table 2 - Estimated distribution of iron ore consumption in Western Europe by physical form, 1960 - 80

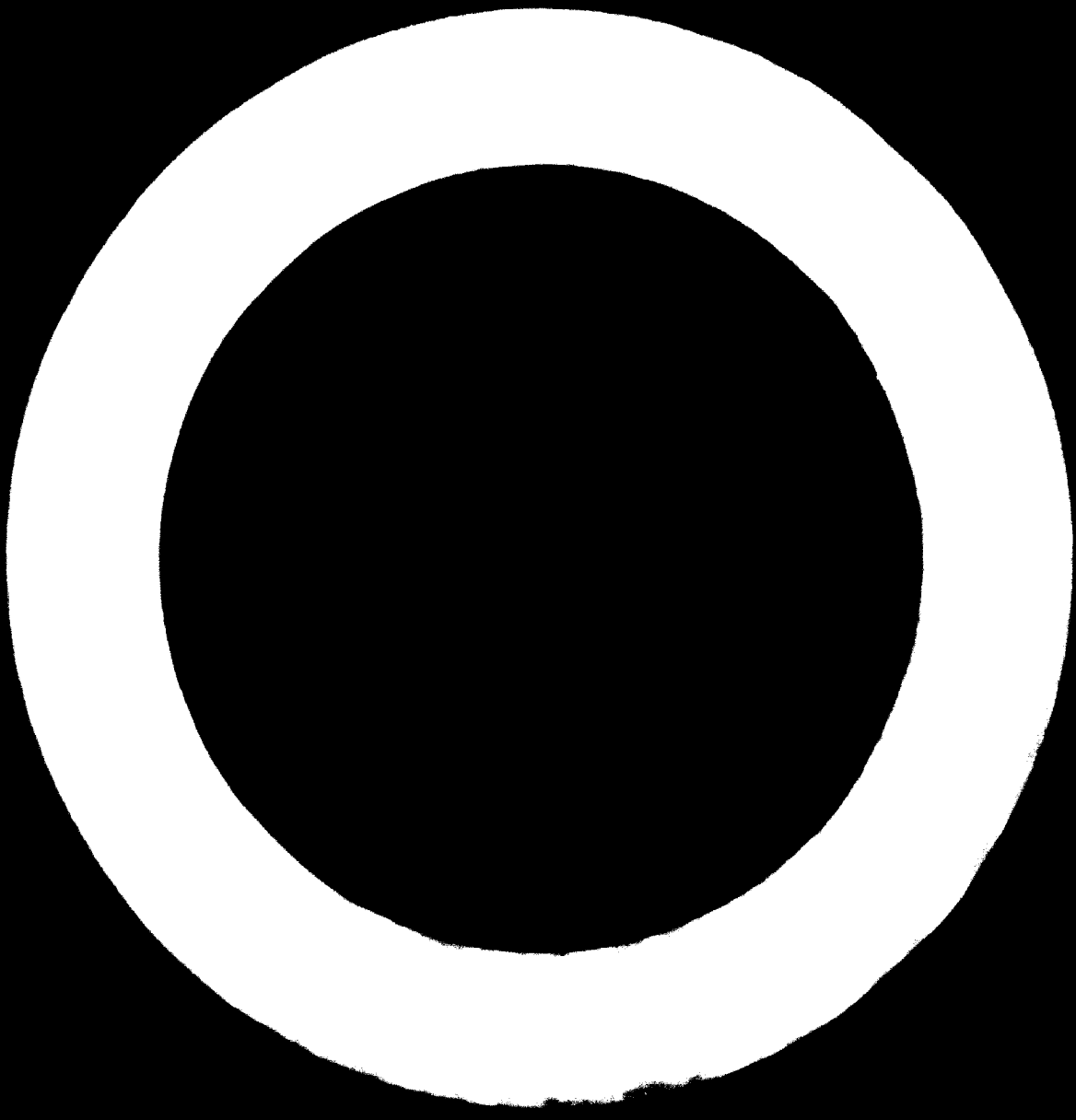
(Million Metric Tons)

Year	Lump Ore	Sinter Fines	Pellets	Total
1960	110.0	54.1	0.4	165.4
1965	72.2	103.0	3.0	178.2
1970	63.5	111.0	12.0	186.5
1975	58.1	126.0	20.0	204.1
1980	46.0	140.0	30.0	216.0

(Source: Battelle estimates)

Pellets and sinter each has certain advantages or disadvantages with respect to production, transportation, and use factors. The question of sinter versus pellets in the future development of West European consumption patterns is controversial.

The large sintering plants installed after World War II still have many years of effective life remaining and will continue to be used. Sintering capacity in the ECSC has increased by 11.7 percent between 1960 and 1970,



At the same time the demand for pellets is much higher throughout Europe.

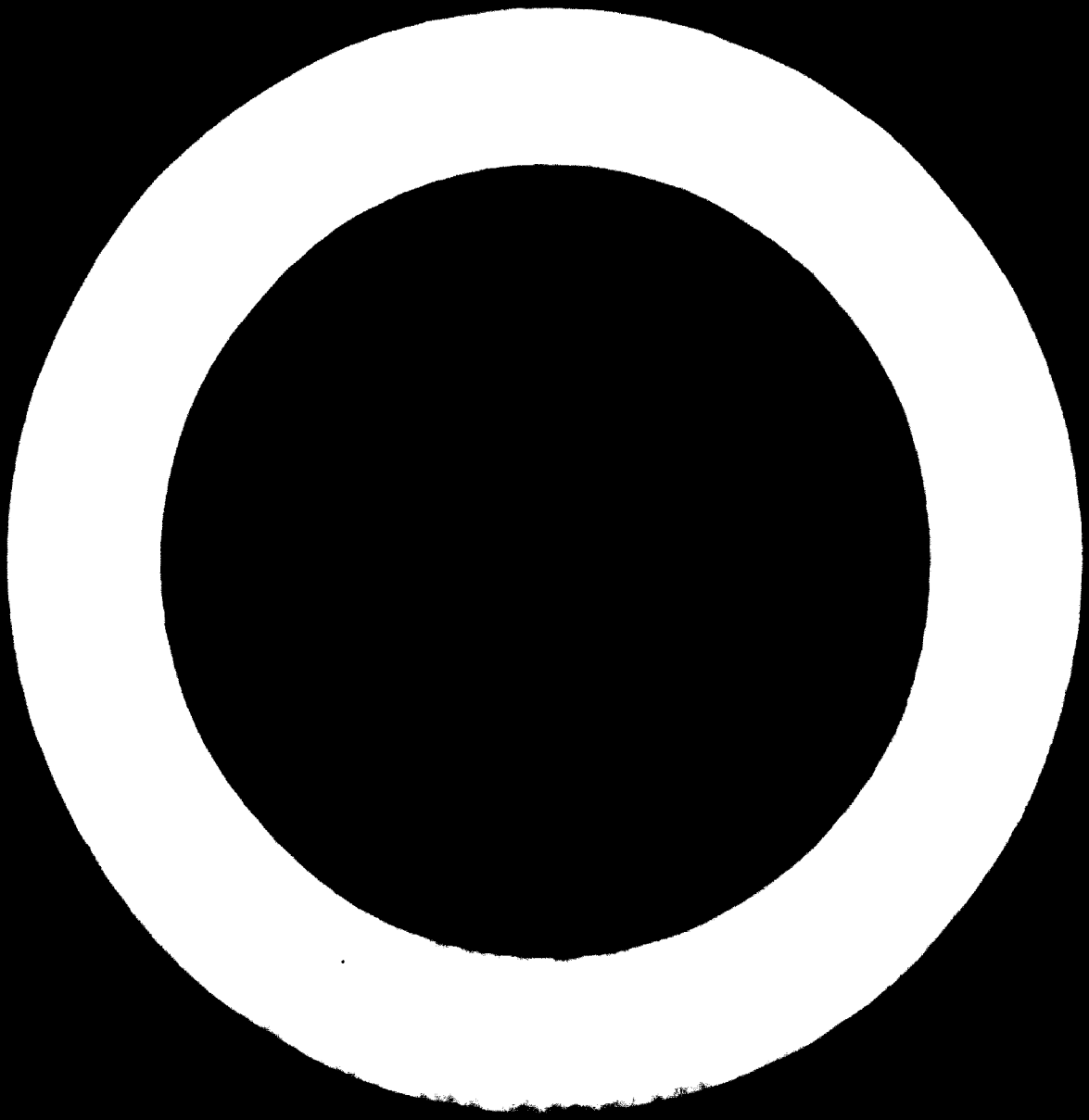
Good lump ore will remain important in European domestic consumption and also in trade, mainly over medium and short distances, however, it represents only a small proportion of exported ores from overseas. Increasing quantities of pellets are now coming on the market to supplement lump ores.

Future developments in the export market for pellets in comparison to lump ore depends on the level of individual works. A steel plant might either extend its sinter plant or manufacture pellets. The decisive factor will be the relative price of sinter feed, lumpore and pellets. In the long run, the prices of pellets and of graded lump ores will probably tend towards the cost of the sinter, taking into account differences in metallurgical value.

Prereduced iron ore pellets can be adapted to a number of diverse uses, as for example in electric arc, converter and openhearth furnaces. The inclusion of metallized pellets in blast furnace feeds has had the most impact on iron making. Well reduced pellets can improve the productivity of an existing furnace by 75 %, while cutting the usage of coke almost by half. The still unresolved question is that of economic feasibility, so that no great consumption is expected in the next 10 years.

3.2 Price developments.

It is rather difficult to study the evolution of iron ore and pellet prices. Published statistics are scarce and often incomplete. No international quotations similar to those existing for certain base metals (copper, zinc, lead, etc.) are available for iron ore. Some prices in the United States or the f.o.b. quotations for Kiruna ores are only reference figures, which often differ considerably from the immediate prices negotiated.



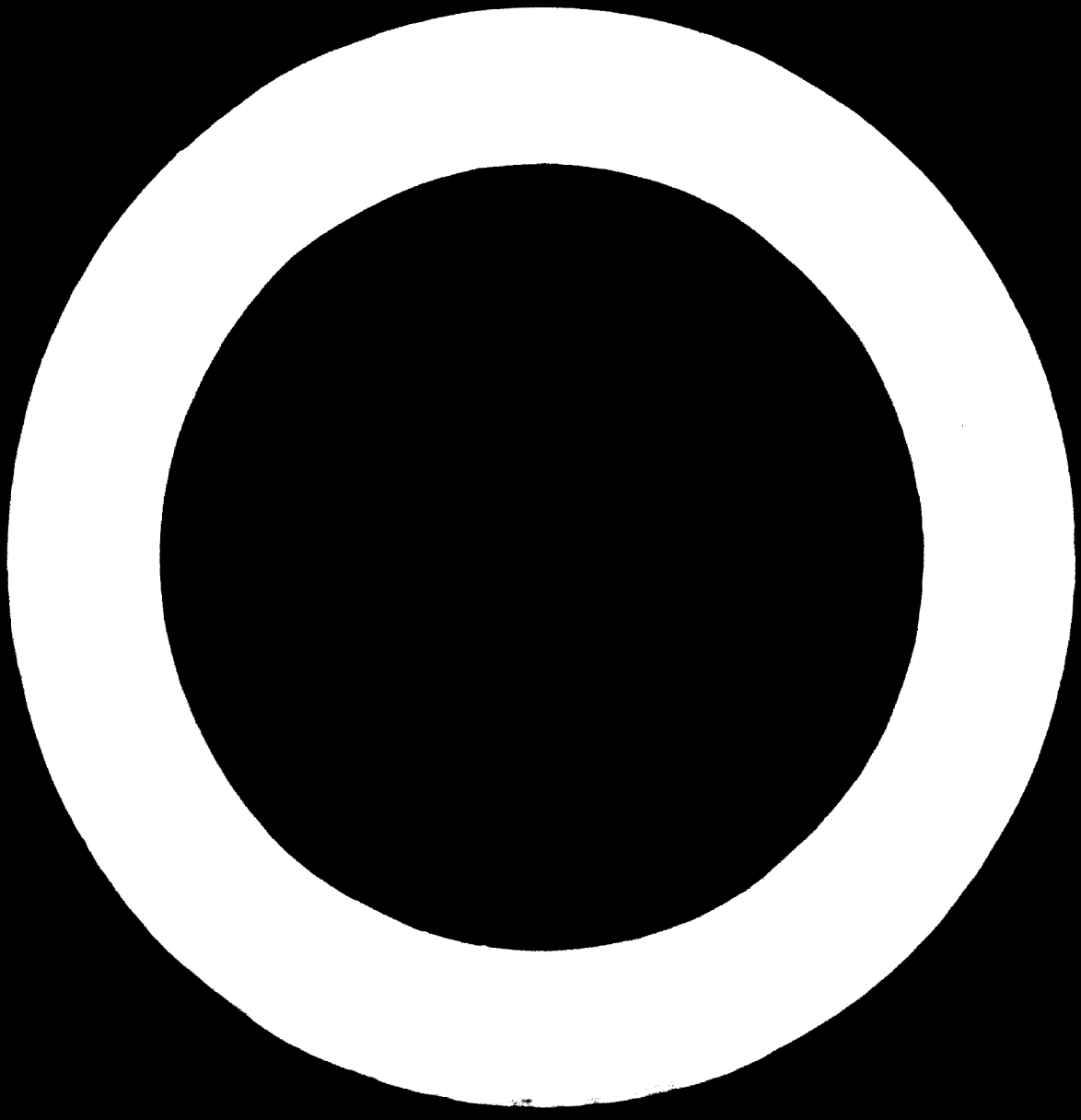
Other quotations specify chemical analyses which may not in fact be achieved. Such contract prices also relate often to ores with closely specified characteristics, making comparison with prices of other ores difficult.

For most ore transactions, however, the price is established in contracts between buyers and sellers, taking into account the quantity and time range of deliveries, the iron content, the size range, the impurities (silica, phosphorous, sulphur, etc.) and other physical and chemical characteristics which influence the operation of the blast furnace. The usual practise of West European consumers in purchasing overseas ore is to negotiate shortterm contracts (1 or 2 years duration) at the best possible price per unit of iron delivered, which permits a great deal of flexibility. Relatively little overseas iron ore comes from mines owned or controlled by iron and steel companies, who are consumers of ore and can, therefore, control to a certain extent the iron ore prices.

The price paid for an iron ore varies according to the Fe content. This is usually called the "telquel" price, or the "effective" price. A detailed forecast of the c.i.f. iron ore and pellet prices is given in chapter 6.

4. IRON ORE REQUIREMENTS IN 1975, 1980

The object of this chapter is to estimate iron ore requirements of the bigger importers for 1975 and 1980, taking into account the known imports of iron ore and pellets in 1970. For this purpose a number of statistical data were available, however, with a substantial variability of the relevant figures (averages are given in table 3).



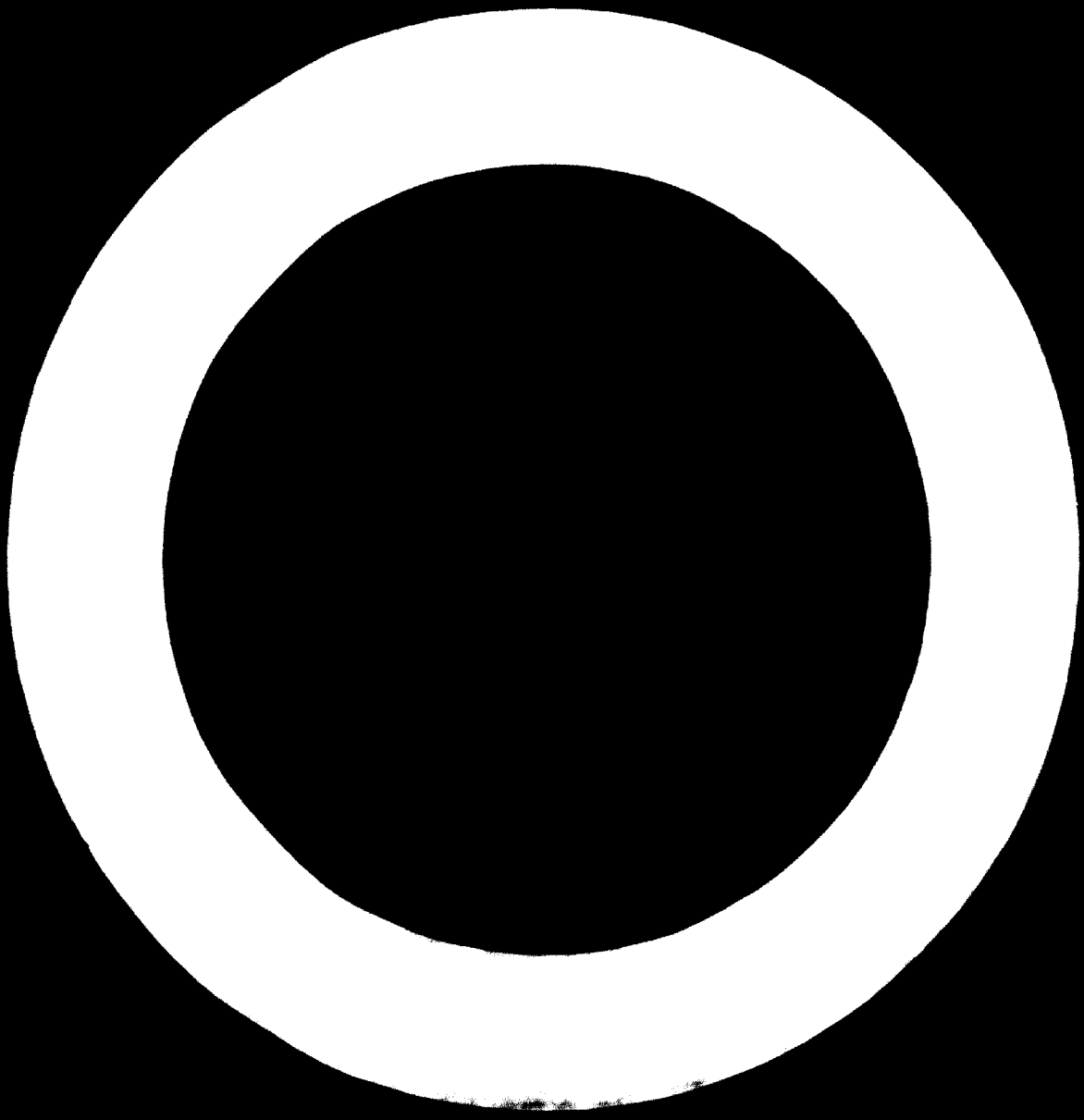
4.1 Iron ore consumptions in 1970

World steel production in 1970 is put at 550-600 million tons. The range of pig iron output forecast for the same period is 430 million to 440 million tons. World consumption of iron ore in terms of iron content will increase up to about 360 million tons, which gives an average growth rate of about 5.1 % from 1965 up to 1970. Iron ore consumption 1965, 1968 and estimates for 1970 are given in table 3. (In million tons of iron content).

It should be noted that the United States will not increase its imports substantially by 1970. On the other hand the imports of ECSC countries and United Kingdom will increase considerably. The African export capacity should grow by more than 65 % owing to the large investments made in Mauretania, Angola and Liberia.

Table 3. - Iron ore consumption 1965, 1968 and estimates for 1970 - (Million tons Fe)

	1965	1968	1970 (estimates)
United States	74.0	73.4	75.0
Canada	6.0	6.1	7.6
Japan	33.7	43.1	50.2
United Kingdom	15.2	14.6	18.1
Western Germany	22.6	24.6	26.4
Belgium-Luxembourg	11.7	13.1	13.1
France	14.0	14.9	15.7
Italy	5.1	6.1	8.0
Others	19.3	18.8	20.5
Total	201.6	215.2	243.6
USSR	75.5	84.3	89.0
Total Eastern Europe	96.5	107.6	116.7
Underveloped countries	21.5	22.5	22.6
General Total (Excluding China /mainland/)	319.5	345.2	383.3



The growth of the Japanese imports is excellent, they have more than doubled in the last five years although it has by far the longest ways for the average haul of its supplements. These higher requirements are covered with long-term contracts mainly in Australia.

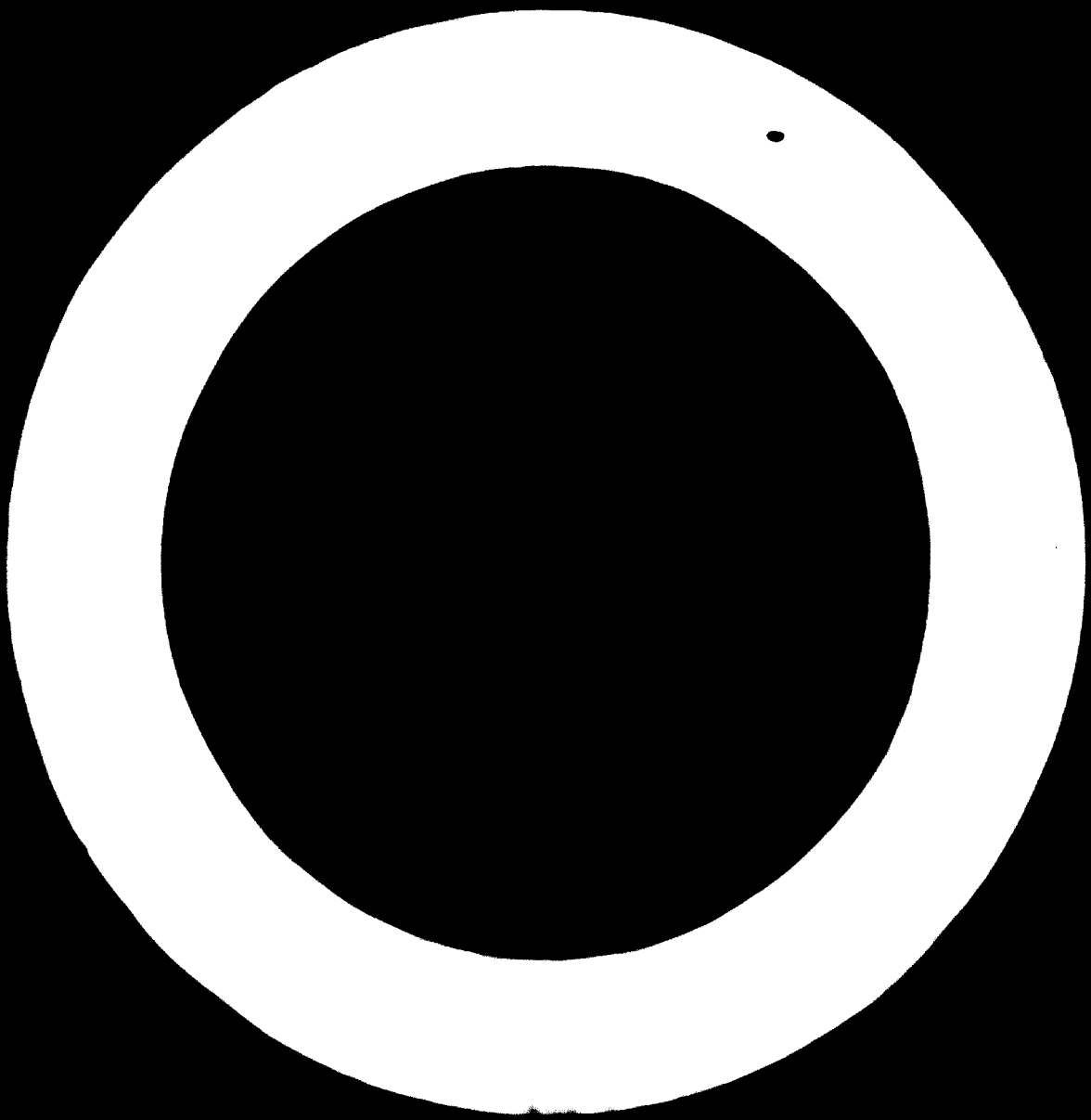
4.2 Iron ore requirements in 1975, 1980.

The planning of large coastal steel works in Western Europe (Fos near Marseille, Dunkerque, Italian steel works), the unexpected growth of the Australian iron ore industry and the substantial increasing of the Japanese raw steel production have led to revisions of nearly all forecasts of iron ore and pellet.requirements.

It should be noted that the figures given in the following tables differ (especially for the 1980 period) from those of the 1968 report issued by the United Nations' Economic Commission for Europe. It is due to the above mentioned facts and also because of including some new projects presently beeing under consideration as for example: Para and Spotibe projects in Brazil, new projects in Chile, South Africa, Liberia, Guinea, Ivory Coast, Gabon, India and Australia.

Table 4. - World iron ore availabilities and requirements in 1975 and 1980 (Million metric tons fe)

		pig iron production	iron ore requirem.	of which from: inland	import
Western Europe	1975	130.4	118.8	27.0	96.2
	1980	150.6	141.3	27.3	116.0
Eastern Europe	1975	100.4	120.2	120.9	3.4
	1980	140.2	148.0	144.2	3.9
North America	1975	113.1	101.7	78.7	23.0
	1980	130.6	114.4	63.3	51.0
Japan	1975	107.2	93.2	1.1	92.2
	1980	131.2	114.1	0.8	113.3
Total	1975	451.1	433.9	227.7	214.8
	1980	552.6	521.7	234.6	284.2



Iron ore export availability after adjustment for internal imports and exports, world total

1975: 180.1 ..... 2000: 224.7

of which from:

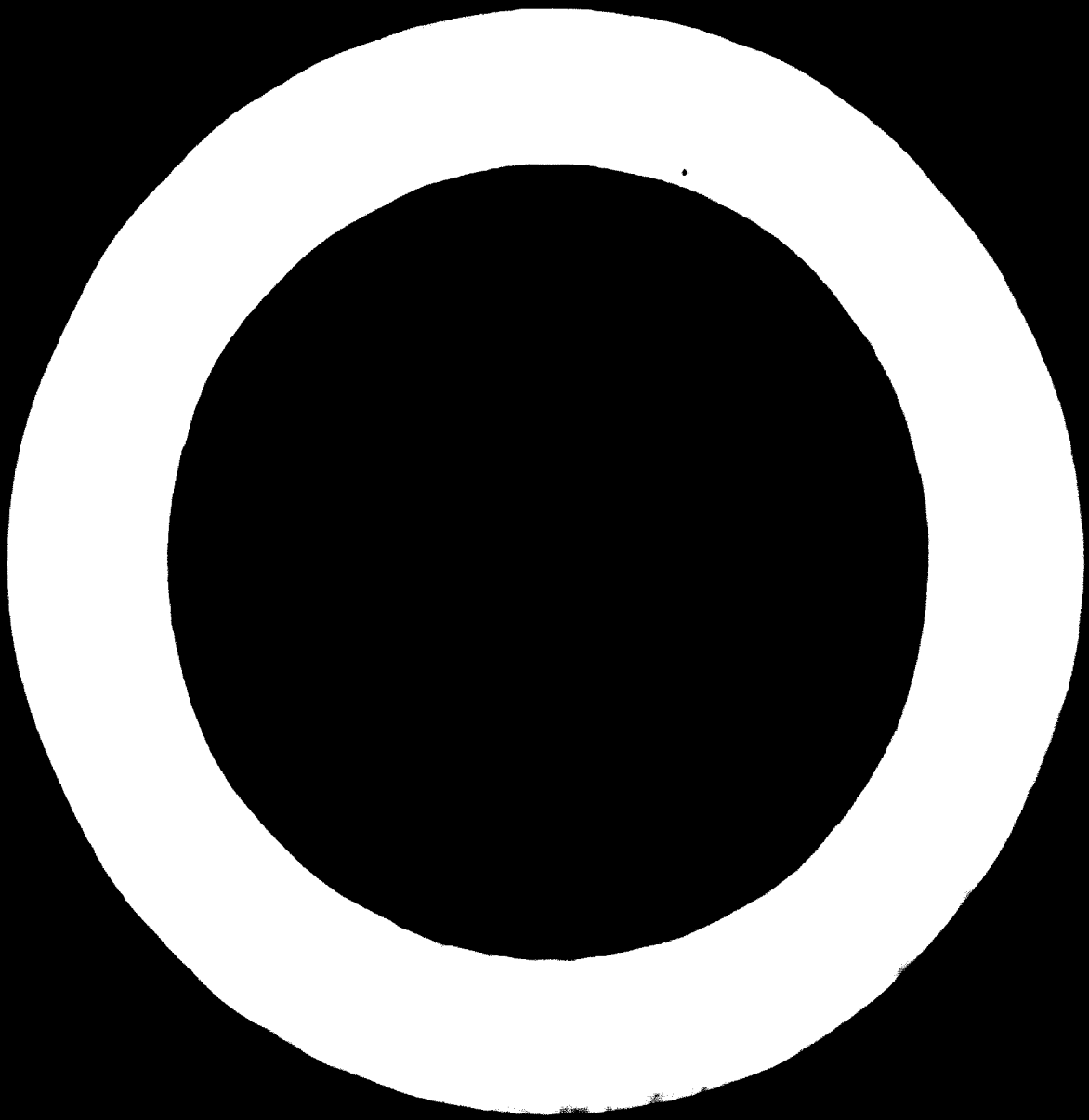
Scandinavia	26.0	27.1
Eastern Europe	1.2	1.1
North America	0.2	0.4
Latin America	58.4	73.7
Africa	37.7	60.0
Asia	19.4	28.2
Australia	36.3	31.2
Resulting iron ore shortage (Fe)	28.7	6.2
in ore of 60 % Fe	39.8	10.3

A steadily growing iron ore shortage after 1978 is confirmed by the result of this forecast. The development of several large mines might again be successful but the projected iron shortage will probably not change before 1976/1977.

The main part of Japan's iron ore requirements has already been covered on a long term basis up to 1980 and new contracts up to 1985 and even 1990 are being discussed. The United States will take the major portion of their requirements from home sources and from Canada. The remainder will be covered from "captive" sources abroad, mainly from South America.

The Comecon countries will remain very marginal importers of Western ore, while the USSR will export only a small part of its iron ore resources to the Western world.

Attention must again be drawn to the fact that Western Europe will undoubtedly be the first to become affected by the coming iron ore shortage, unless European steel makers start with the immediate development of overseas iron ore deposits, as the Japan steel makers have done long time ago.



In annex 1, there is a graph showing the resulting iron ore surplus or shortage in Fe and the iron ore export availability in Fe. As can be seen the iron ore shortage tends to a slow growth up to 1975 when the first of the considerated new ore mines should start production. Afterwards the shortage will be less and may disappear in the early eighties. In case the view mines output is not sufficient to cover all demands for iron ore (all projects need not perhaps be realized), the shortage will continue also after 1980.

Some details about Western Europe iron ore market are given in tables 5 and 6. The Nador pellets might be sold in a certain amount in Eastern Europe as is shown in the next table 7. Other figures about iron ore production and consumption in Africa and especially in North Africa gives table 8. Conclusions which can be derived from tables 5 to 8 for the market possibilities of iron ore, particularly for the Nador pellets, are described in the following chapter. It is to say, that Comecon import from other countries will increase more than given in table 7.

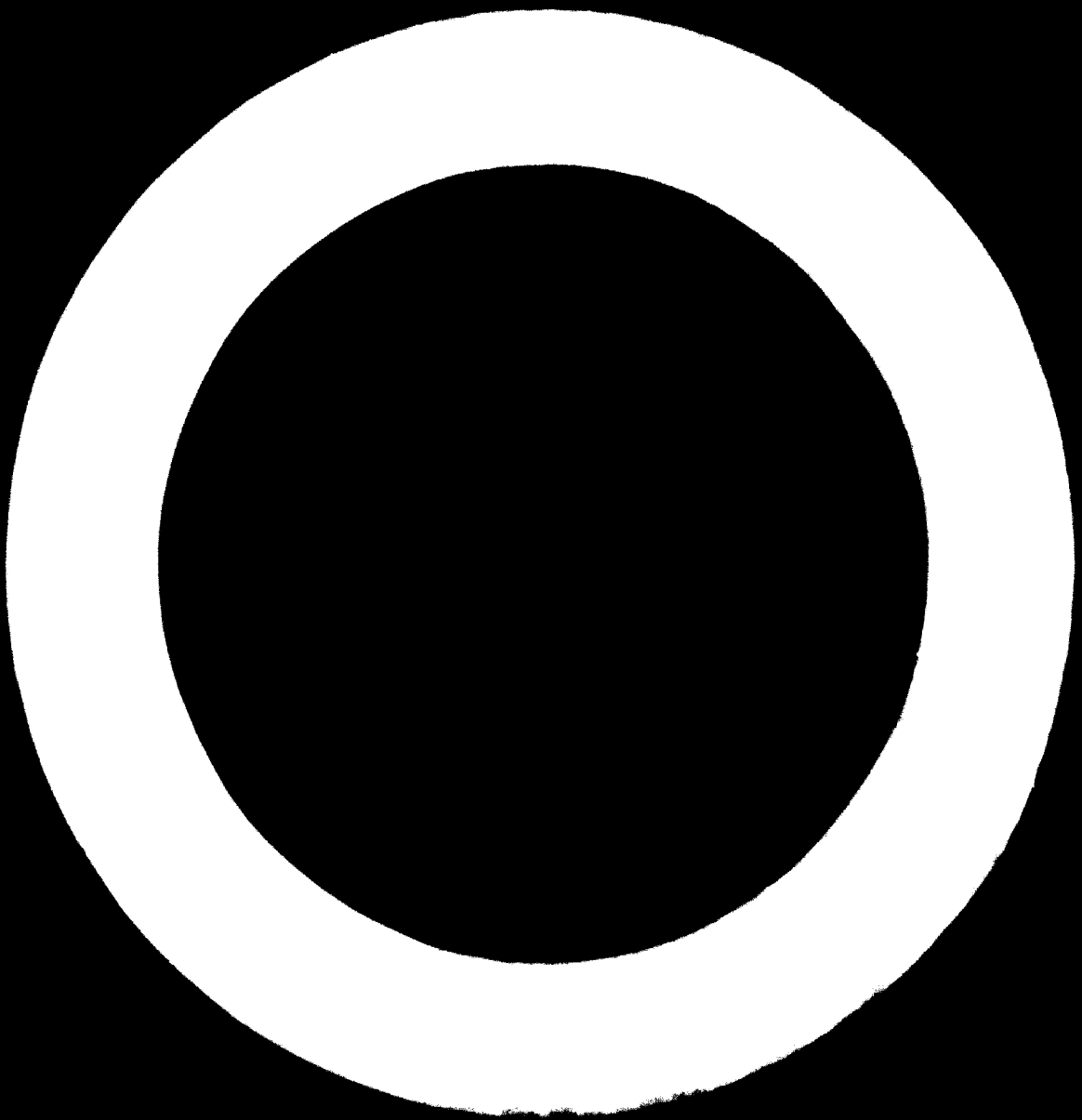


Table 5 - Iron ore demand and consumption in Western Europe

(Million metric tons Fe)

		Pig iron production	Iron ore demand	of which from: inland	of which from: import
Western Europe*	1975	136.4	112.2	27.0	85.2
	1980	156.6	137.3	27.3	110.0
E.C.S.C.	1975	97.2	83.1	16.6	74.5
	1980	117.8	101.5	16.2	83.3
Western Germany	1975	35.6	28.2	2.4	25.8
	1980	40.2	32.2	2.0	30.2
France	1975	21.1	18.4	11.6	2.8
	1980	26.0	22.5	11.6	10.9
Italy	1975	13.5	12.4	0.2	12.2
	1980	17.7	16.2	0.2	16.1
Belgium	1975	14.6	13.0	1.7	11.3
	1980	17.6	16.0	1.7	14.3
Nether-lands	1975	7.2	6.5	-	6.5
	1980	10.6	9.2	-	9.2
Luxemburg	1975	5.0	4.5	2.7	1.8
	1980	5.5	5.0	2.7	2.3
United Kingdom	1975	23.1	19.9	3.0	16.9
	1980	26.6	22.9	2.6	20.3
Spain	1975	5.5	5.0	3.7	1.3
	1980	8.3	7.5	5.0	2.5
Austria	1975	2.5	2.3	1.0	1.3
	1980	2.5	2.3	0.8	1.5
Others	1975	2.1	1.9	0.7	1.2
	1980	3.4	3.1	0.7	2.4

* (excluding Scandinavia and Portugal)

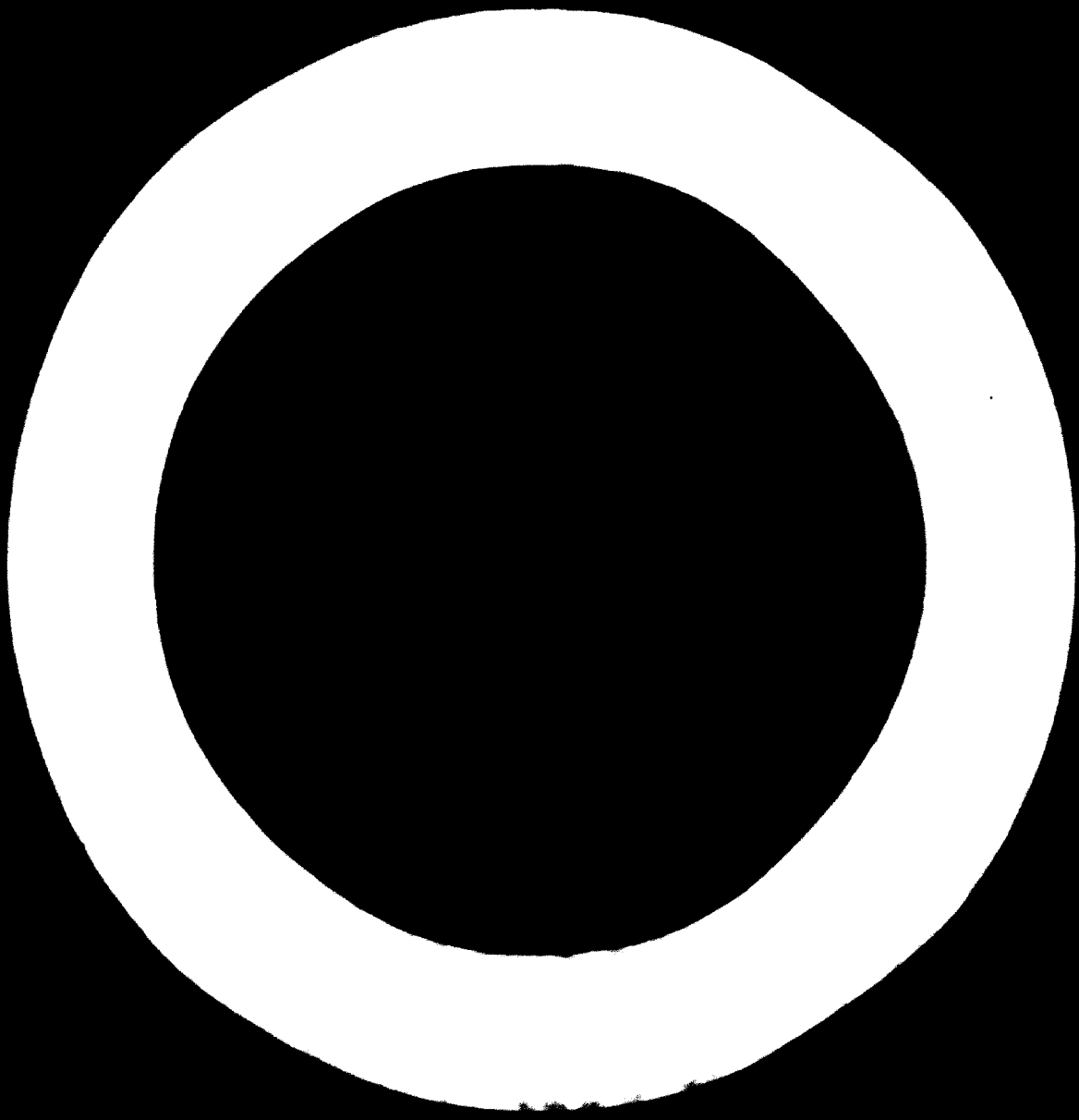


Table 6 - Iron ore imports and exports within Western Europe

(Million metric tons Fe)

		Iron ore production	Export - Import within West. Europe		Inland ore availability
Western Europe*	1975	27.0	4.3	4.3	27.0
	1980	27.3	4.2	4.2	27.3
E.E.C.S.	1975	18.2	3.8	4.3	18.9
	1980	17.8	3.8	4.2	18.2
Western Germany	1975	1.0	-	1.4	2.4
	1980	0.7	-	1.3	2.0
France	1975	15.5	3.8	-	11.8
	1980	15.5	3.8	-	11.8
Italy	1975	0.2	-	-	0.2
	1980	0.2	-	-	0.1
Belgium	1975	-	-	1.7	1.7
	1980	-	-	1.7	1.7
Nether-lands	1975	-	-	-	-
	1980	-	-	-	-
Luxemburg	1975	1.5	-	1.2	2.7
	1980	1.5	-	1.2	2.7
United Kingdom	1975	2.0	-	-	2.0
	1980	2.0	-	-	2.0
Spain	1975	4.1	0.4	-	3.7
	1980	5.2	0.2	-	5.0
Austria	1975	1.0	-	-	1.0
	1980	0.8	-	-	0.8
Others	1975	0.7	-	-	0.7
	1980	0.7	-	-	0.7

* (excluding Scandinavia and Portugal)

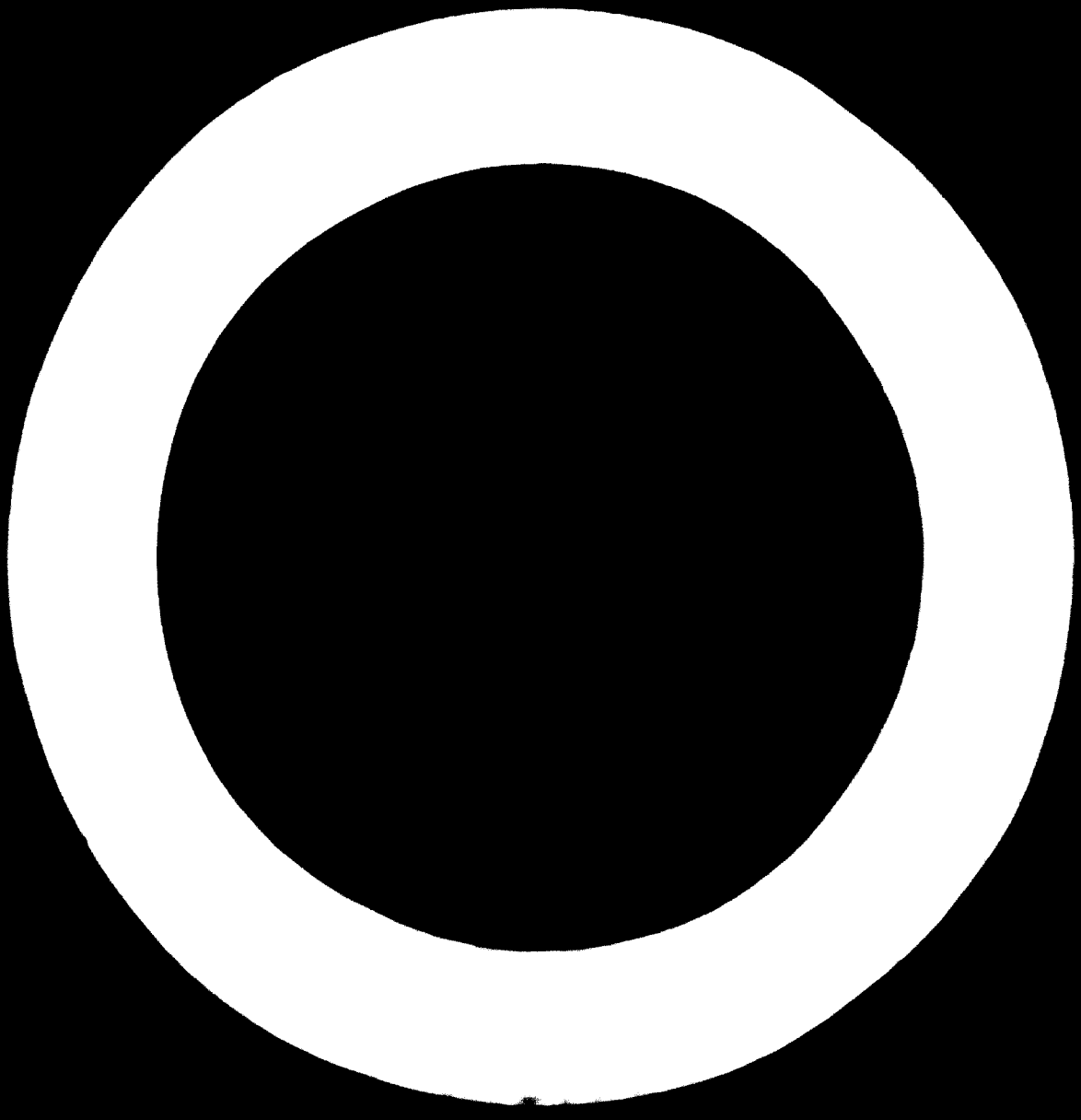


Table 7 - Iron ore demand in Eastern Europe

(Million metric tons Fe)

		Pig iron production	Iron ore demand	of which import from: COMECON	others
Comecon	1975	142.4	129.3	18.5	3.4
	1980	166.2	153.9	29.7	3.7
U.S.S.R.	1975	118.0	101.0	-	-
	1980	138.1	120.0	-	-
Czecho-	1975	8.8	7.9	6.2	1.2
slovakia	1980	10.1	9.1	7.4	1.2
Poland	1975	9.2	8.2	6.1	1.1
	1980	11.6	10.6	8.3	1.2
Rumania	1975	4.4	4.0	1.7	0.7
	1980	5.8	5.3	2.6	0.9
Hungary	1975	2.1	2.1	1.7	0.2
	1980	2.7	2.4	2.0	0.2
Eastern	1975	3.0	2.7	2.0	0.2
Germany	1980	3.4	3.1	2.4	0.2
Bulgaria	1975	2.7	2.4	0.6	-
	1980	3.5	3.2	1.0	-

U.S.S.R. have about 1.2 million tons Fe (2.3 million tons of iron ore) in 1975, respectively 1.1 (2.0) million tons in 1980 available for export to other than Comecon countries which seems to be to low.

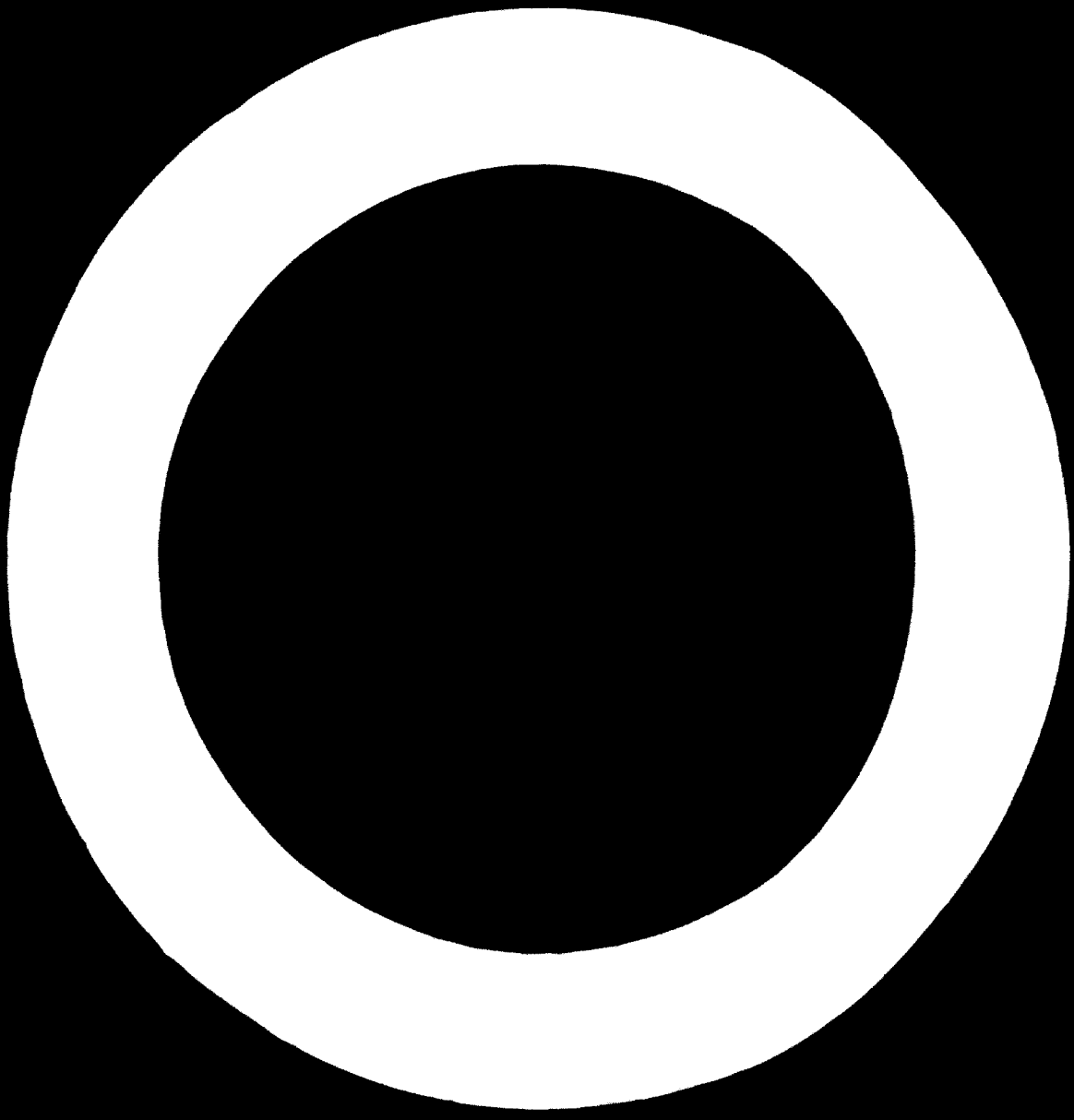
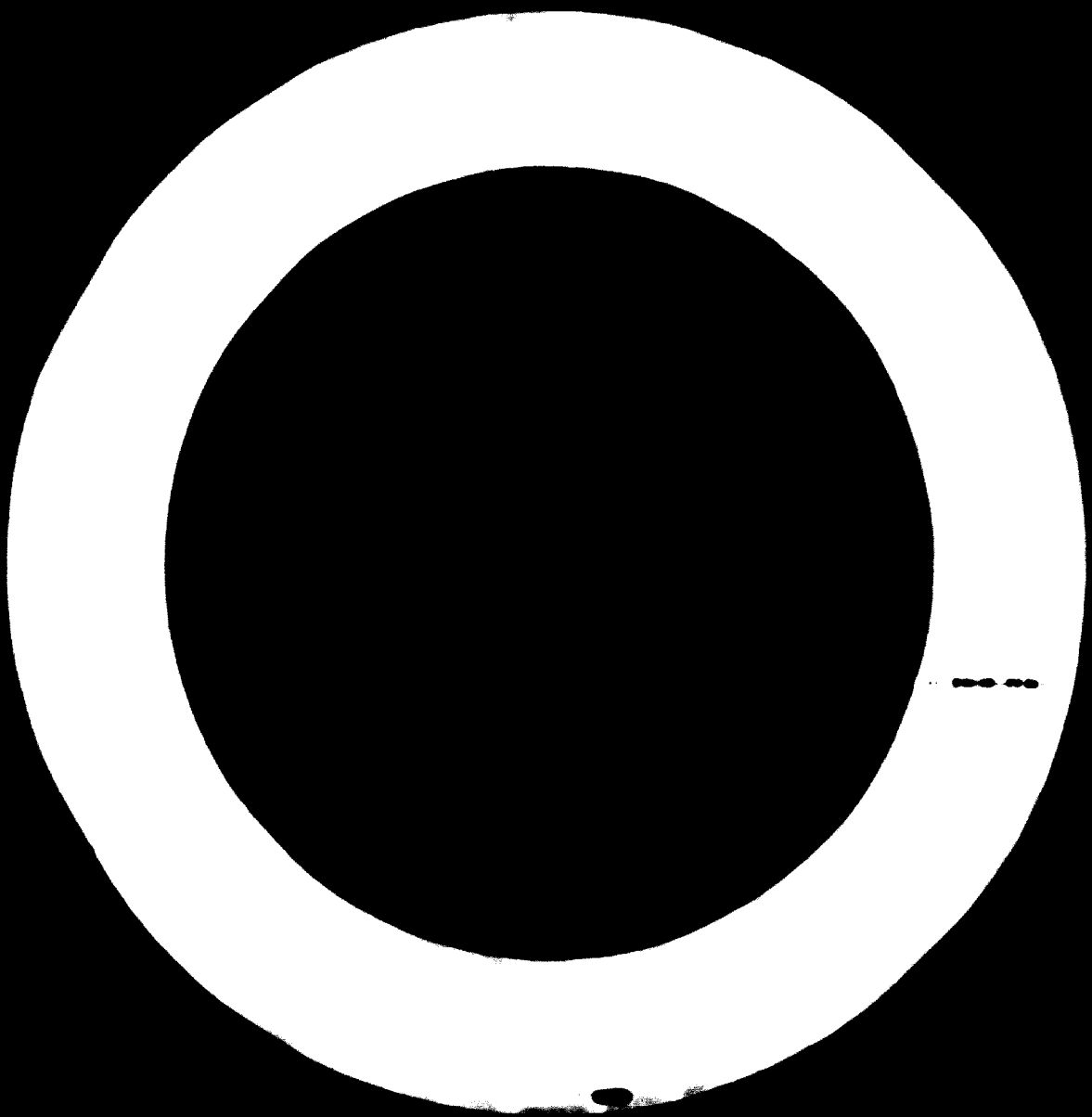


Table 5 Iron ore production and export in Africa

(Million metric tons Fe)

		Iron ore production	Home consumption	Export availability ore	Export availability pellets
Africa	1975	31.1	0.7	30.2	3.3
	1980	76.3	10.5	30.6	7.5
Algeria	1975	2.1	0.5	1.6	-
	1980	2.3	1.0	1.3	-
Morocco	1975	0.6	-	-	0.6
	1980	0.6	-	-	0.6
Tunesia	1975	0.5	0.1	0.4	-
	1980	0.5	0.2	0.4	-
Angola	1975	3.5	0.1	3.4	-
	1980	8.5	0.9	7.6	0.6
Gabon	1975	-	-	-	-
	1980	6.4	-	5.1	1.3
Guinea	1975	2.0	-	2.0	-
	1980	9.0	-	9.0	-
Liberia	1975	14.4	0.8	11.2	2.7
	1980	17.4	1.0	12.7	3.7
Mauritania	1975	7.8	-	7.8	-
	1980	9.8	-	9.8	-
Sierra Leone	1975	1.8	-	1.8	-
	1980	1.8	-	1.8	-
Ivory Coast	1975	-	-	-	-
	1980	1.9	-	2.0	1.9

The residual balance to Union of South Africa and Swaziland.



8. EXPORT POSSIBILITIES FOR THE RADOM PELLETS

The typical "ore deficit" regions are concentrated in five areas: in the United States, Japan, Eastern Europe (excluding USSR), the EEC and the United Kingdom. Provided that the United States and Japan will be supplied by other countries and that the demand for iron ore and pellets in Africa will be covered by the regional or local sources, only a part of Europe can be taken into consideration as importing area for Radom pellets.

8.1 Iron ore export from Morocco.

We can assume that under favourable conditions it might be possible to supply the same countries, which are now importing the RIF iron ores. The data of iron ore export from Morocco given in table 8 show the export pattern in the last three years. Except small supplies for Belgium and France, only four countries have bought the RIF iron ore: Western Germany, Spain, Czechoslovakia and United Kingdom. Western Germany is the largest consumer of this ore due to the revaluation of the "Deutsche Mark" and has relieved Spain completely. Spain should probably return to be an importer of RIF ore in the next two or three years.

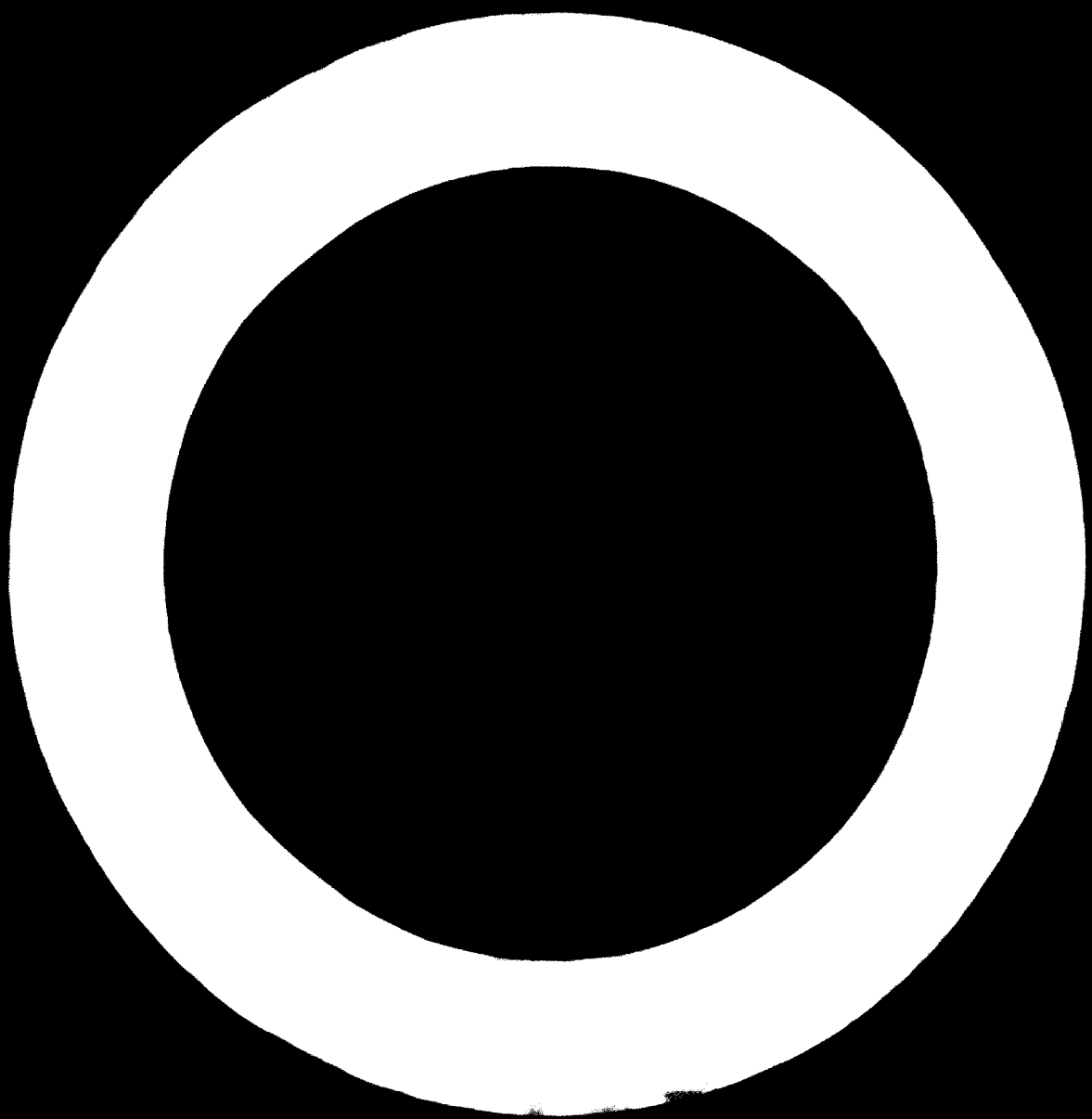


Table 9 - Iron and Steel Scrap Exports to 1968, 1969 and 1970
(Tons of Iron ore).

Year	Country	Company	Quality	Tons	Total
1968	Spain	ENSIDESA	1	159,000	
		UNINSA	1	41,150	
		Altos Hornos	1	16,205	216,000
	Czechoslovakia	Metalimex	1	105,900	105,900
	Western Germany	Rheinstahl	1	27,500	
		Rohstoffhandel	1	27,500	
		Rohstoffhandel	grav.	134,100	189,615
	United Kingdom	Ford Motor	2	80,000	
		Miller	2	8,971	88,000
1968 total					599,500
1969	Spain	ENSIDESA	1	230,450	
		Ensidesa 2	2	79,000	
		Various	1	70,000	344,000
	Czechoslovakia	Metalimex	1	134,000	134,000
	Western Germany	Rohstoffhandel	1	30,000	
		Rohstoffhandel	Grav.	147,000	
		Rheinstahl	1	2,700	
		Salzgitter	2	8,700	
		Luebeck	2	8,500	325,000
	United Kingdom	Ford Motor	2	80,001	
		Miscore	2	94,811	195,674
	Belgium	Miscore	1	9,020	9,020
	France	Miscore	1	9,150	9,150
1969 total					882,020
1970	Demands from 1969				
	Spain	ENSIDESA	1	44,000	
		ENSIDESA	2	20,000	
		UNINSA	1	10,000	80,000
	Czechoslovakia	Metalimex	1	16,000	16,000

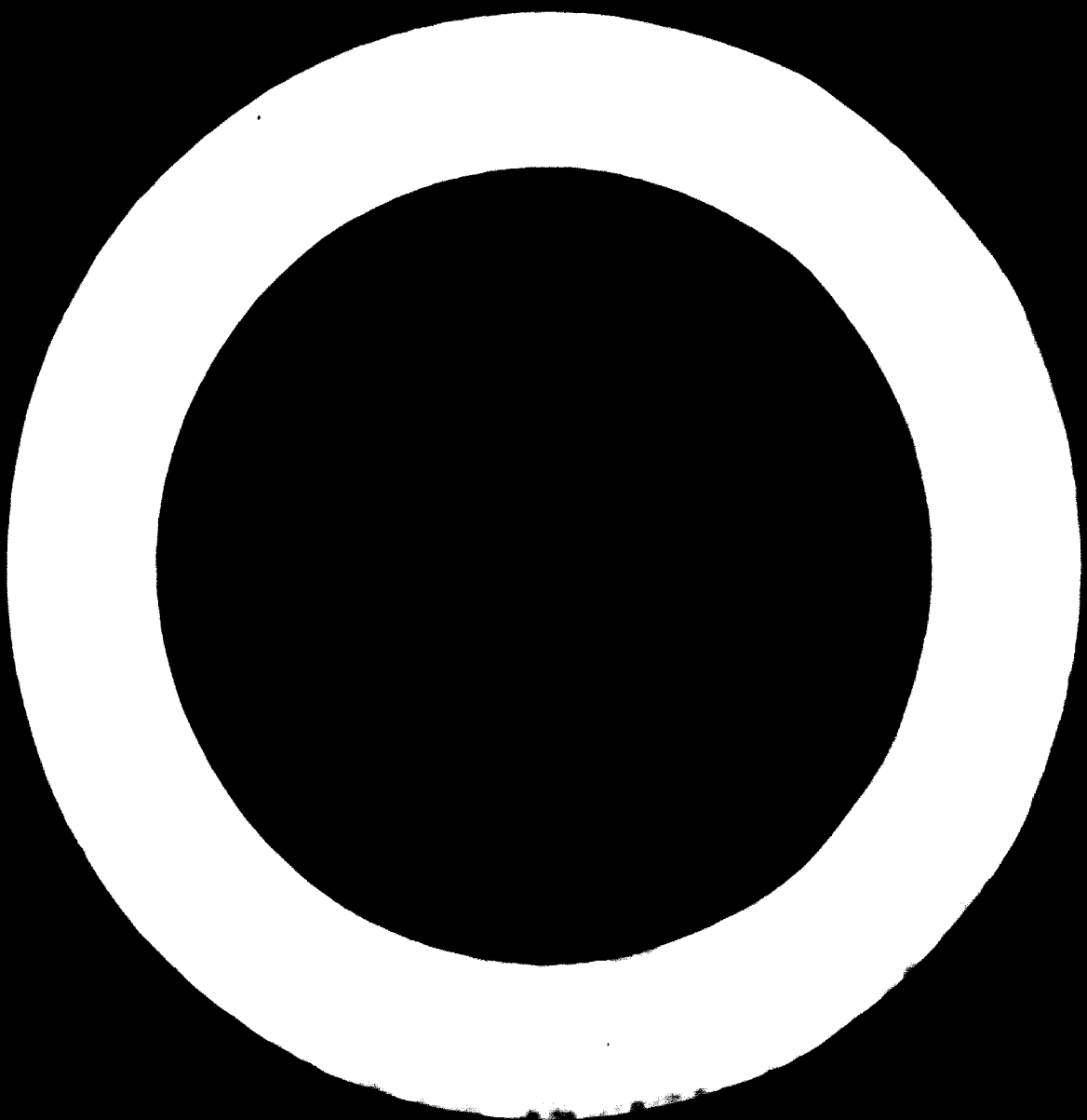


Table 9.-(continued)

Year	Country	Company	Quality	Tons	Total
1970	Western Germany	Haesch	1	11,000	11,100
1970 total remainds from 1969					107,000
1970	Czechoslovakia	Metalimex	1	180,000	180,000
(continued)	Western Germany	Rohstoffhandel	1	230,000	
		Rohstoffhandel	Grav.	180,000	410,000
	United Kingdom	Ford Motor	2	85,000	85,000
	France	Micamar	1	10,000	10,000
	Free for sale	--	2	80,000	80,000
1970 new contracts					765,000
1970 total remainds and new contracts					872,000

Quality: No.1.....+ 25 mm Grav.....+ 10 - 25 mm
No.2.....fines - 10 mm

The importing countries are divided in the following chapter into 3 areas and a detailed description is given of each country.

a) E.E.C.-European Economic Community, which includes France, Western Germany, Italy, Belgium, Netherlands and Luxembourg.

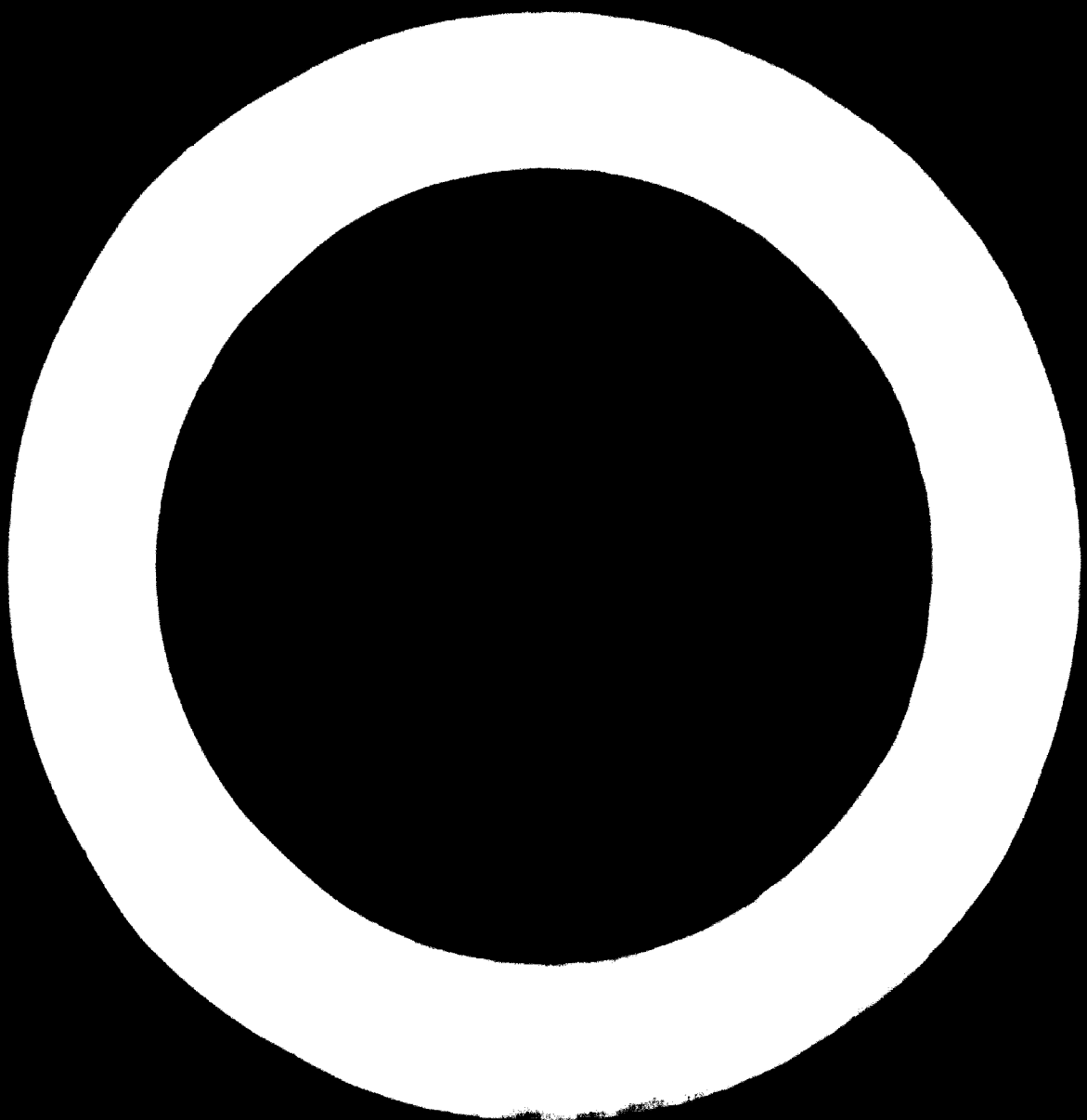
b) Other Western Europe countries, either members of E.F.T.A. (United Kingdom, Austria, Portugal), or others (Spain, Greece, Yugoslavia).

c) Eastern Europe countries, represented by Czechoslovakia, Poland Romania and Eastern Germany.

Results of marketing research in some countries in Western Europe are given in annex 4.

B.2- Iron ore imports into the EEC.

The production by the European Economic Community countries will continue to fall for technical and economical reasons in the next ten years so that only 21 - 23 million tons

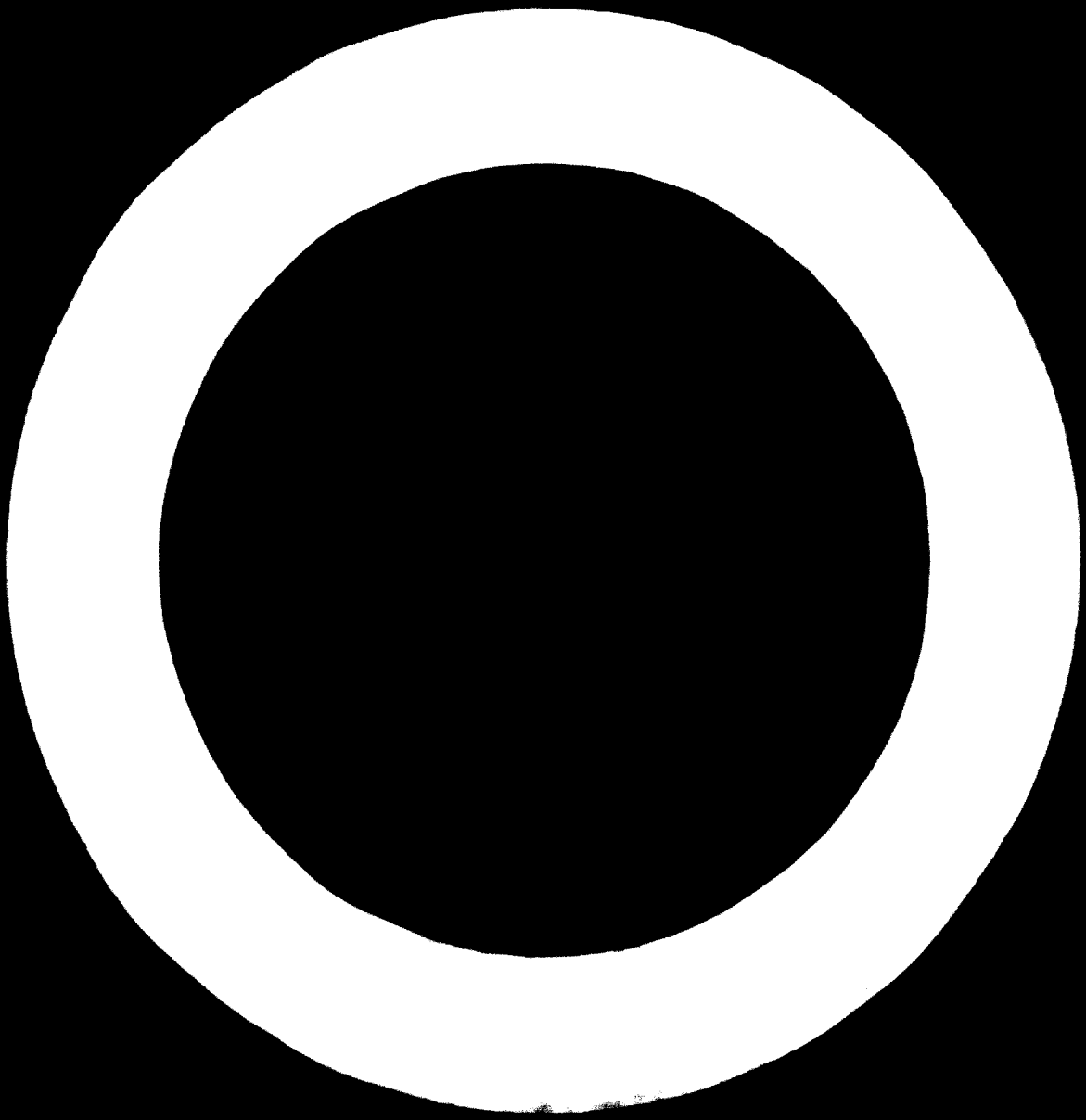


of Fe content will be available per year.It may be possible that the German mines break down their output,but the mines in Lorraine will strenghtened their position although the present works on beneficiating "minette" are not succesful enough.

The competition in the steel industry and the market for the produced equipment have led to using all the economic possibilities for increasing the iron ore quality.The traditional markets have been dropped,therefore,to get the best prices in only short term contracts for a period not longer than 1-2 years.

The steel industry of the EEC countries imported in 1968 67.2 million tons Fe content,i.e.about 66 % of the demands.Only 10 % of this amount are imports from so called "captive" mines with capital investments in Brazil,Mauretania and Liberia.Other countries (Goa-Indie,Canada,Portugal)have got a small capital investment.At present the total production in the mines,captived by the EEC is in the rate of about 16 million tons including the Lamco connections to the German steelworks.The supply of iron ore from Sweden which was the main importer to Western Europe (61% in 1954) dropped down to 22 % in 1968.The North and West African export at present is 31,5 % of the ore requirements, South America supplies some 18 % and the remainder is divided between Canada (5,8 %),India and Australia (3,7 %) and European countries (5 %).

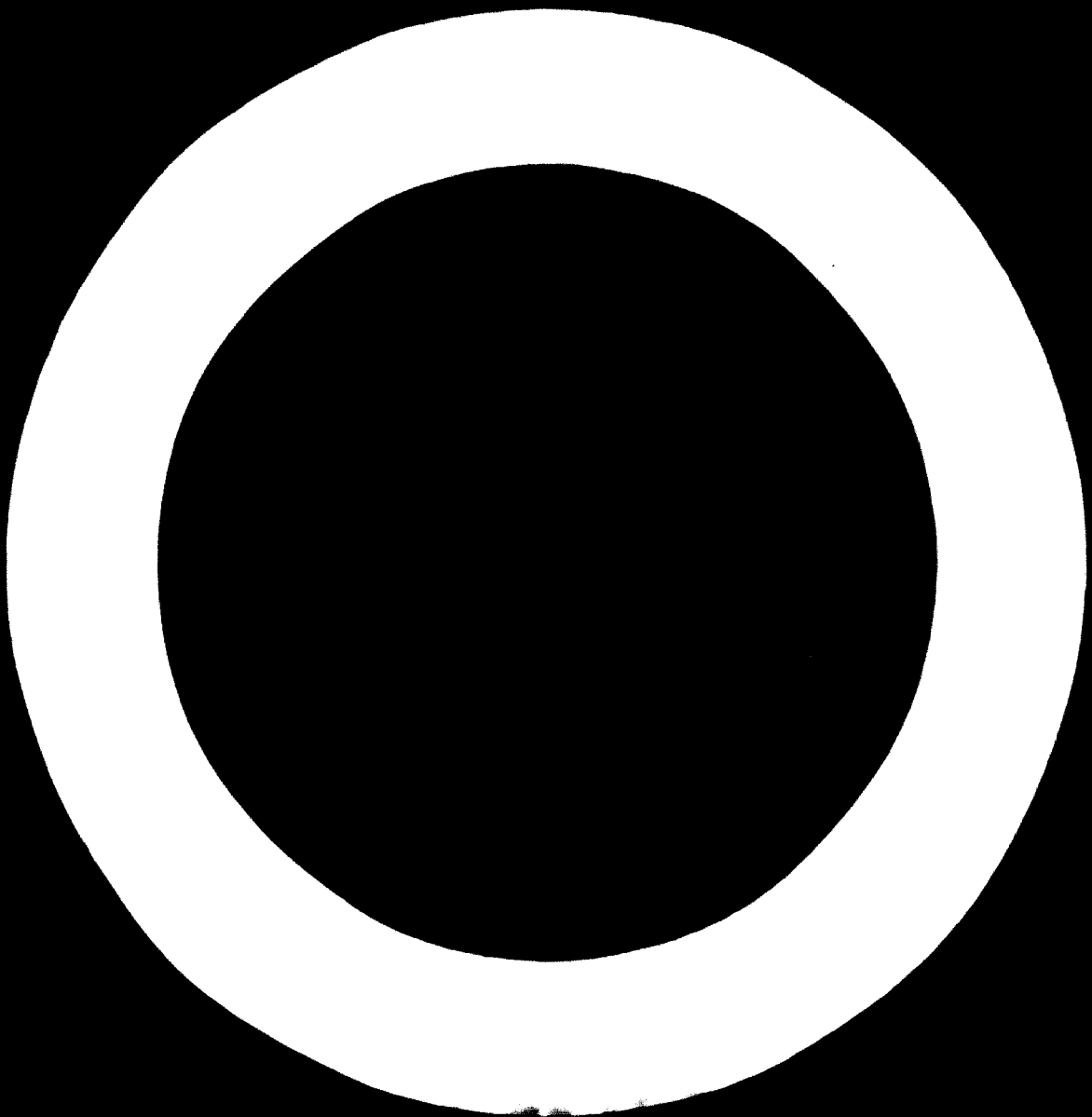
The Western European countries' ore requirements are based essentially on the deposits around the Atlantic Ocean. The increasing in the ore demands can be covered above all from this region.In the last two-three years the Japanese have imported a lot of iron ore from this area so that there is not sufficient ore available for the next ten years from these countries because of their long term contracts with Japan.If the present trends persist,a shortage in the imports of iron ore and the possible choice of iron ore quality and ore type including prices will be very difficult.



Most of the EEC countries steel plants have their own sinter plants and it is therefore of great importance for these plants to buy substantially only sinterfeed or sinterfines. The total capacity of the sinter plants in Western Germany is every year increasing. The largest sinterbelts with a surface of more than 600 m2 are being build in the largest thyssen works at present. Only a few works with insufficient area for increasing the production capacity of sinter buy pellets or lump ore. The steelmakers are therefore afraid of the coming iron ore shortage which can be increased by several political or economic events. The shortage may lead to an uneconomical production of pig iron from iron ores with lower average grade, with higher silica or alumina content, ores with lower strength during the reduction or with an inconvenient phosphorus content. A smaller output of lumpores and pebbles and a higher offer of pellets can be expected. Using of pellets is not so common in the EEC countries because of their higher prices. It is said that the prices from low grade taconites are at least 2,5 to 3 cents per lb. unit higher than those of the sinterof the same quality.

The shortage of some 10 - 15 million tons of iron ore per year in Western Europe in the next ten years is highly favorable for the exports of Moroccan pellets provided they still have the forecasted quality and analysis. Although a great number of new pellet plants will be build in the next years, their distance will be greater (except Portugal and Norway). The yearly output of the Nador pellet plant is comparatively small and it is expected that this amount could be easily sold to various countries in the period of the next ten years.

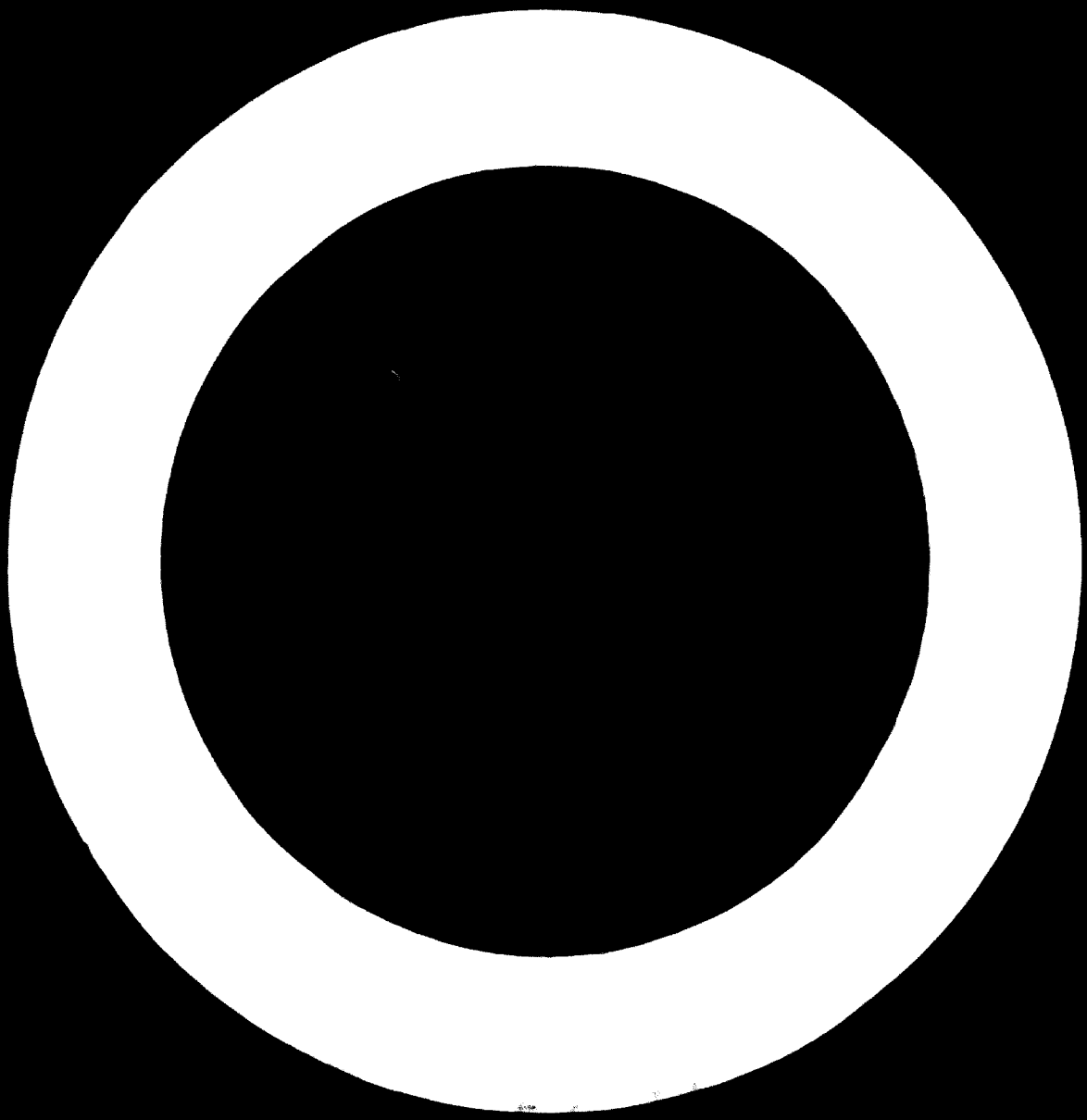
The competition in pellet production is following: Venezuela starts with building a new high-iron briquette plant (1 million tons) and a new pellet plant (2mil.t). Brazil will have two pellet plants in 1975 with an expected output of 5 million tons per year. Peru will increase the pellet production up to 5 - 6 mil.tons per year. A new plant is being built in Argentina (1,1 mil.tons). India wants to have 3 - 4 million tons production capacity. Sweden intends to increase the



output to 7.2 million tons in 1990 from 1.8 mil.tons in 1970.Norway supposes to achieve 1.8 mil. tons of pellets in the same time.The USSR will develope a new technology of production of self-fluxing pellets and the yearly output should achieve 10 - 15 million tons in 1990.Spain is considering to build a plant for 7.5 million tons of pellets per year.Other investigations are coming from Portugal, Italy,Yugoslavia,Finland,etc.In Liberia the large pellet production will be at the rate of at least 2 million tons and another 2 million tons should come from the Bong Range mine.A new plant is likely to be build in Mekambo (Gabon) with a production of 2 million tons of pellets.The iron ore from Gueuma in Algeria will probably be pelletized in order to export that part of the production which cannot be consumed at Annaba.

In the United States the Minnesota Taxing regulations allow not to pay tax on companies production or on their reserves since 1961.Before this date the American investments diverged to Canada.At present the pelletizing capacity in the USA is likely to reach 50 million tons pellets and in Canada about 30 million tons.The competition arising from the growth of pelletizing and the utilization of sintering should facilitate sales of ore fines.The price advantage of lump ore in comparison with fines will therefore,tend to shrink because pellets will become available in even larger quantities.The sintering techniques improve and the price of pellets tends farther towards the c.i.f. price for sintering fines plus the cost of producing good sinter with some additional amount for the saving of investments in sintering capacity at iron and steel-works.

The world pelletizing capacity in 1975 should be about 200 million tons of pellets.In 1980 it will increase up to 240 million tons.Canadian and USA mines should produce 50 and 90 million tons pellets per year,it means almost the entire iron ore output in that region may be pelletized.During the next fifteen years sintering will continue to expand,too.



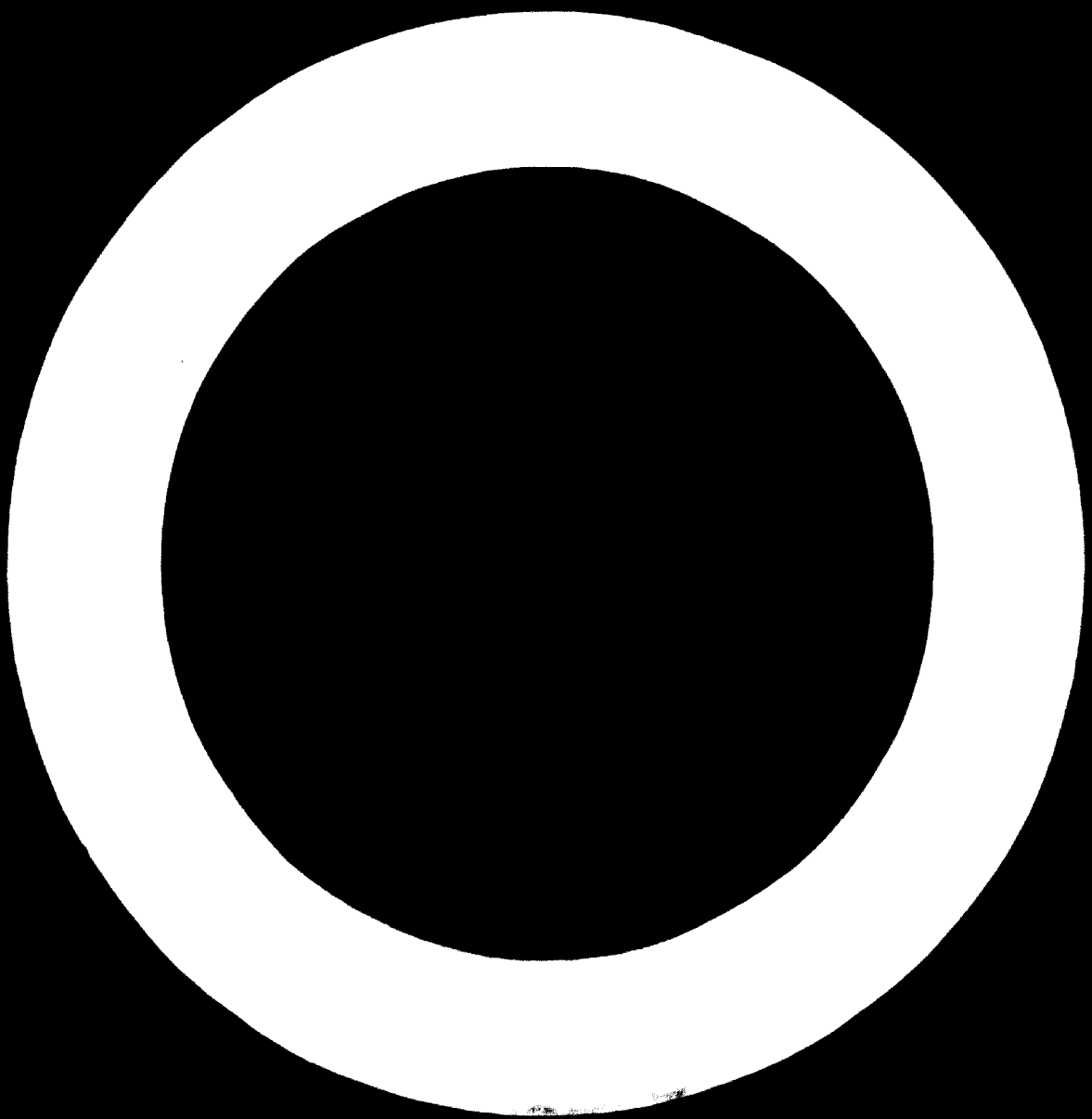
Use of pellets can, in some cases be even more economical than that of sinter. A more uniform size-distribution permits higher blast pressure and better reductibility at lower maximum temperature. The proportion of waste elements in the pellets is low, which reduces the volume of slag and consequently the consumption of coke.

Pellets are at present produced mainly from acid ores and, therefore, fluxes have to be added in the blast furnace. Recent experience has shown that best results are achieved with a blast furnace burden consisting of a mixture of pellets and ultra-basic sinter. It is arguable that first class, well screened sinter which includes all the ingredients of the burden in their correct proportion can give better results than a mixed sinter-pellet or straight pellet burden.

This is the only reason why the EEC countries did not build pellet plant at all. It is of great advantage for these countries to extend their sinter plants that use mainly the sinter-feed or sinter fines. It was learned that even the application of concentrates in a certain amount did not decrease the production capacity to a great extent.

That all means that the present advantages for the producer of pellets will be reduced, especially in view of the fact that pellets will be available on the European market in increasing quantities in the years to come.

In the following some details about imports in 1968 into individual EEC countries are given (source "Studie über die Versorgung der Eisenhüttenindustrie der Gemeinschaft mit Eisenerz, Brüssel, November 1969). The first figure in brackets are thousand tons, the second one are the average c.i.f. prices in $ US per ton.



of France.

Only [illegible] were imported in 1965. The remainder came from the Lorraine area and a small portion [illegible] the Normandy mines. Total [illegible] are imported. Brazil (1,383 - 9,70), Mauretania (1,180 - 9,70), Liberia (1,174 - 9,0), Peru [illegible], Sweden (241 - 10,80) and Algeria (182 - 7,[illegible]), are the largest exporting countries.

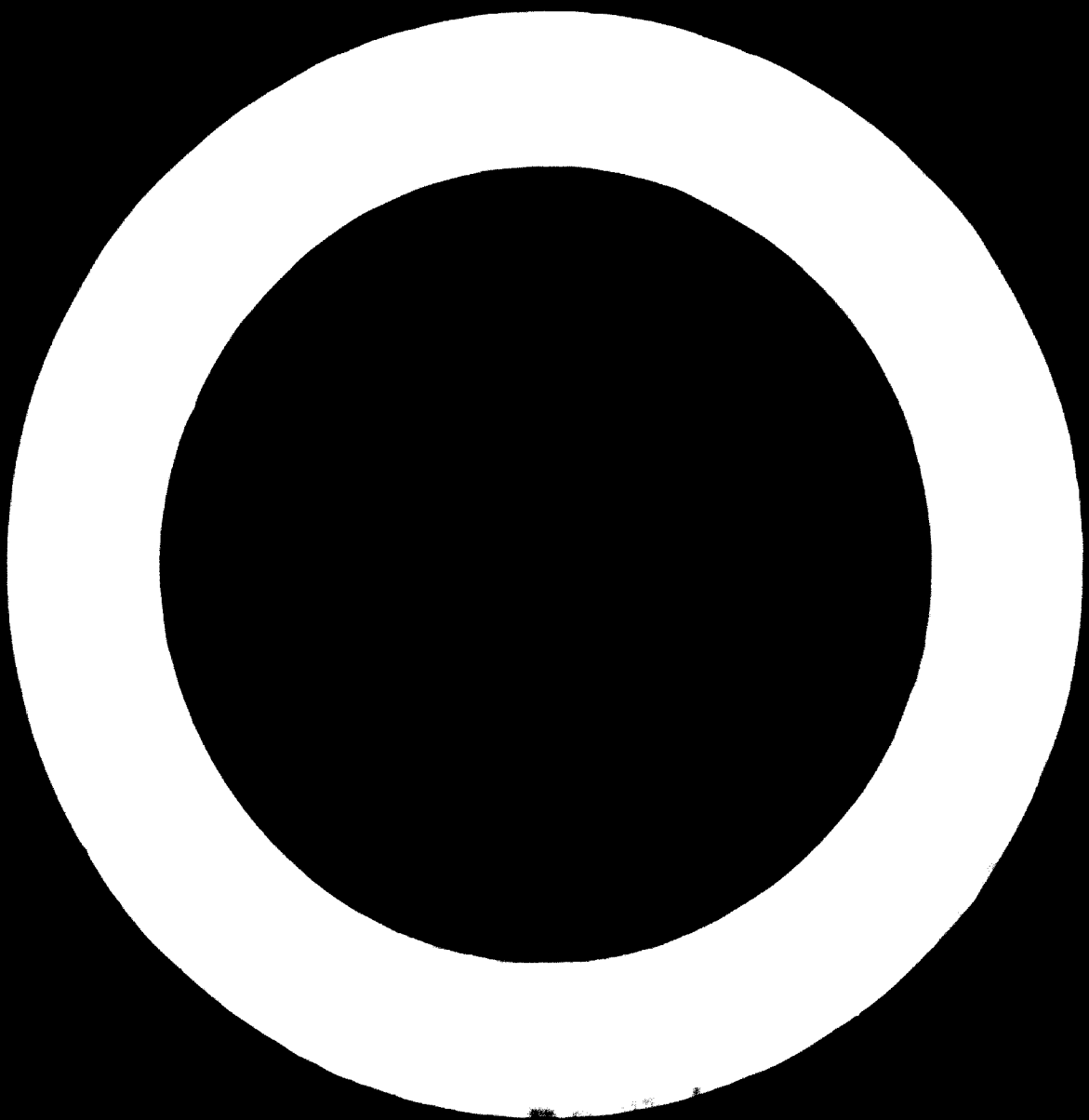
The Nador pellets could be transported to Northern France only in small amounts (150 - 250 thousand tons), to take the place of Peru, Sweden or Algeria. In 1975 a new steel plant would start production near Marseille (Fos) and it would be of great advantage to deliver the substantial shares of the Nador pellets to the new plant because of only a short distance between Melilla and Fos.

The distances in km between Melilla and some importing countries are as follows: United States 6385, United Kingdom (Cardiff) 2150, Rotterdam 2570, South of France and Italy (Marseille and Genua) 2015, Adriatic (Fiume) 1200, Gibraltar 1500 and Japan (via Suez) 18800 km.

In case of shipment for fos the freight will be lower and the f.o.b. price could be kept higher (S US 11 in 1975 and S US 10,5 in 1980) so that the c.i.f. price rises over S US 11 in both periods.

b) Belgium and Luxembourg

The total amount of imported ore from countries not included in the EEC was 12,491 thousand tons - S US 9,70 per ton, of which Sweden (3,090 - 8,00), Mauretania (1,[illegible] - 10,10), Liberia (1,100 - 9,10), Brazil (562 - 9,10), India (100 - 10,40), Algeria (372 - 9,20), Canada (162 - 11,20) and Sierra Leone (127 - 9,70) have exported. Assuming the same prices c.i.f. as for Rotterdam it seems possible to deliver maximally 100 - 200 thousand tons of Nador pellets per year for Belgium.



c) Netherlands:

Imported iron ores (18,141 thousand tons in 1965 - $ US 8,90 c.i.f. [illegible]) were divided between Liberia (8,206 - 7,10), Brazil (711 - 11,10), Sierra Leone (938 - 9,90), Canada (112 - 9,10), Sweden (459 - 9,10) and India (214 - 7,00). Several projects for expanding the steel industry (Hoogovens Ijmuiden and Hoesch, Europoort Rotterdam, etc.) were taken in consideration in the last three years period. The port of Rotterdam can receive ships up to 100,000 dwt, which enables ore transport from long overseas distances. The most of the iron ore going to Western Germany pass port Rotterdam.

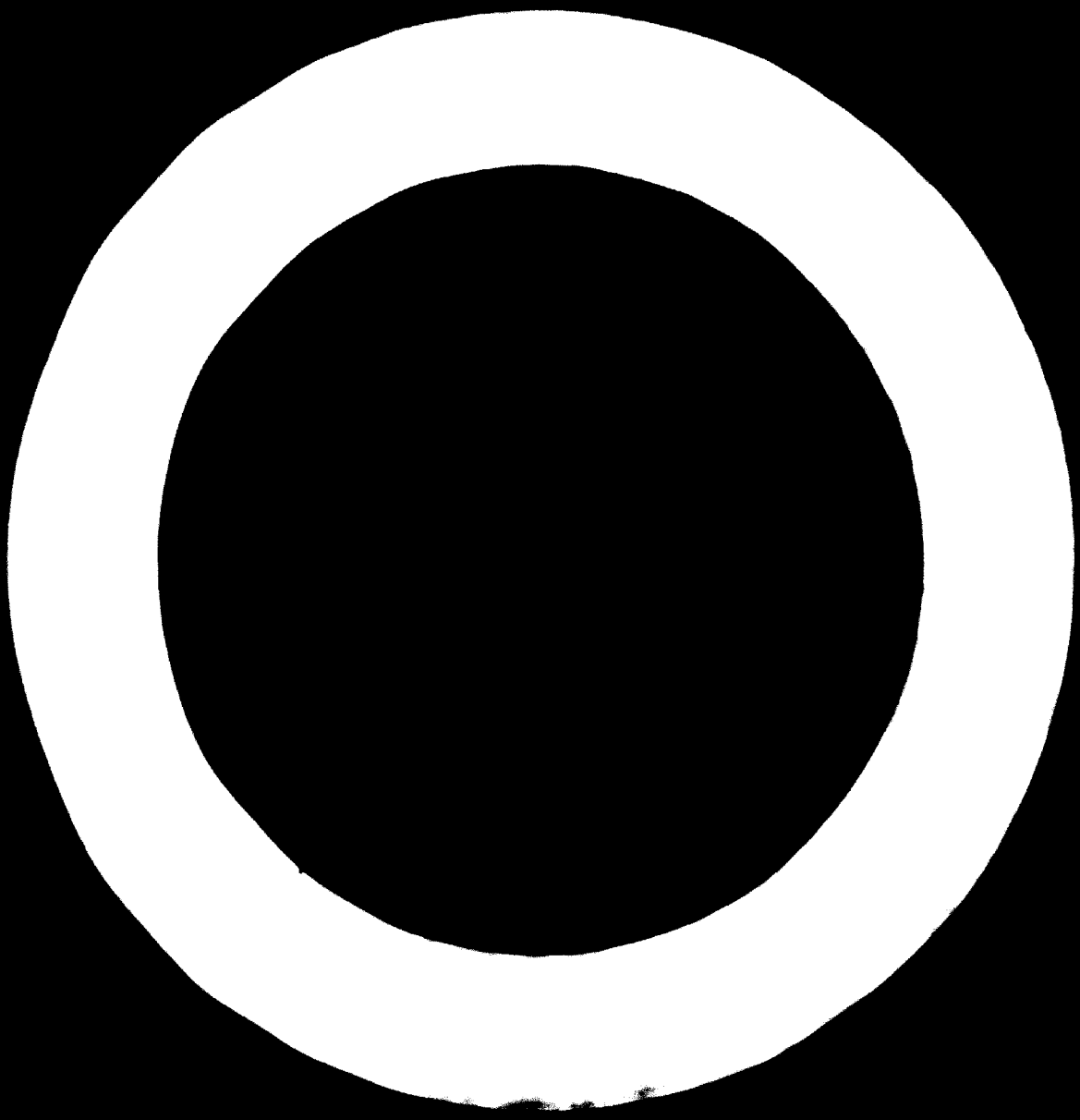
It is therefore most probable that the whole production of the Nador pellet plant could be sold in this area, passing the port of Rotterdam. The c.i.f. prices in 1972 may be $ US 12,80 - 13,00, in 1975 $ US 11 - 11,10 and in 1980 $ US 10,10 - 11,30 per ton of pellets.

d) Western Germany:

The steel plants received in 1966 in total 35,115 thousand tons of iron ore from countries except EEC and the average price was $ US 9,70 per ton. These amounts were divided between Sweden (1 , 90 - ,10), Liberia (5,970 - 9,30), Brazil (1,710 - 10,90), Canada (2,108 - 13,50), Venezuela (1,804 - 9,00), Surinam (1,105 - 11,50) and Sierra Leone (982 - 7,70). The imports of iron ore are so high for the future that it is no doubt possible to sell the whole pellet production of Nador which may replace the Indian and some Liberian ore. Forecasts in prices are the same as for Rotterdam although a small increase in Ruhr region must be taken into consideration to be competitive to other ports (see annex IV).

e) Italy

The total imported iron ore was in 1965 to the rate of 10,059 thousand tons with an average c.i.f. price of $ US 9,90. The main exporters were Liberia (2,184 - 9,20),



Brazil (1,248 - 9,80), Canada (1,272 - 13,00), Algeria (1,155 - 7,80), Venezuela (986 - 8,00) and Sweden (424 - 11,00)

All the biggest Italian steel plants are situated at the seashore (Genoa, Piombino, Napoli, Trieste, Taranto) which is very favourable for the possible import of Nador pellets. These pellets could compensate the iron ore deliveries from the distant resources as for example Brazil, Canada, India, etc. The total production could be sold without difficulties. Assessments of c.i.f. prices (Taranto, Napoli) are $ US 13,0 for 1972, $ US 13,1 for 1975 and $ US 13,2 for 1980 for one ton of Nador pellets.

5.3 - Iron ore imports into other Western European countries.

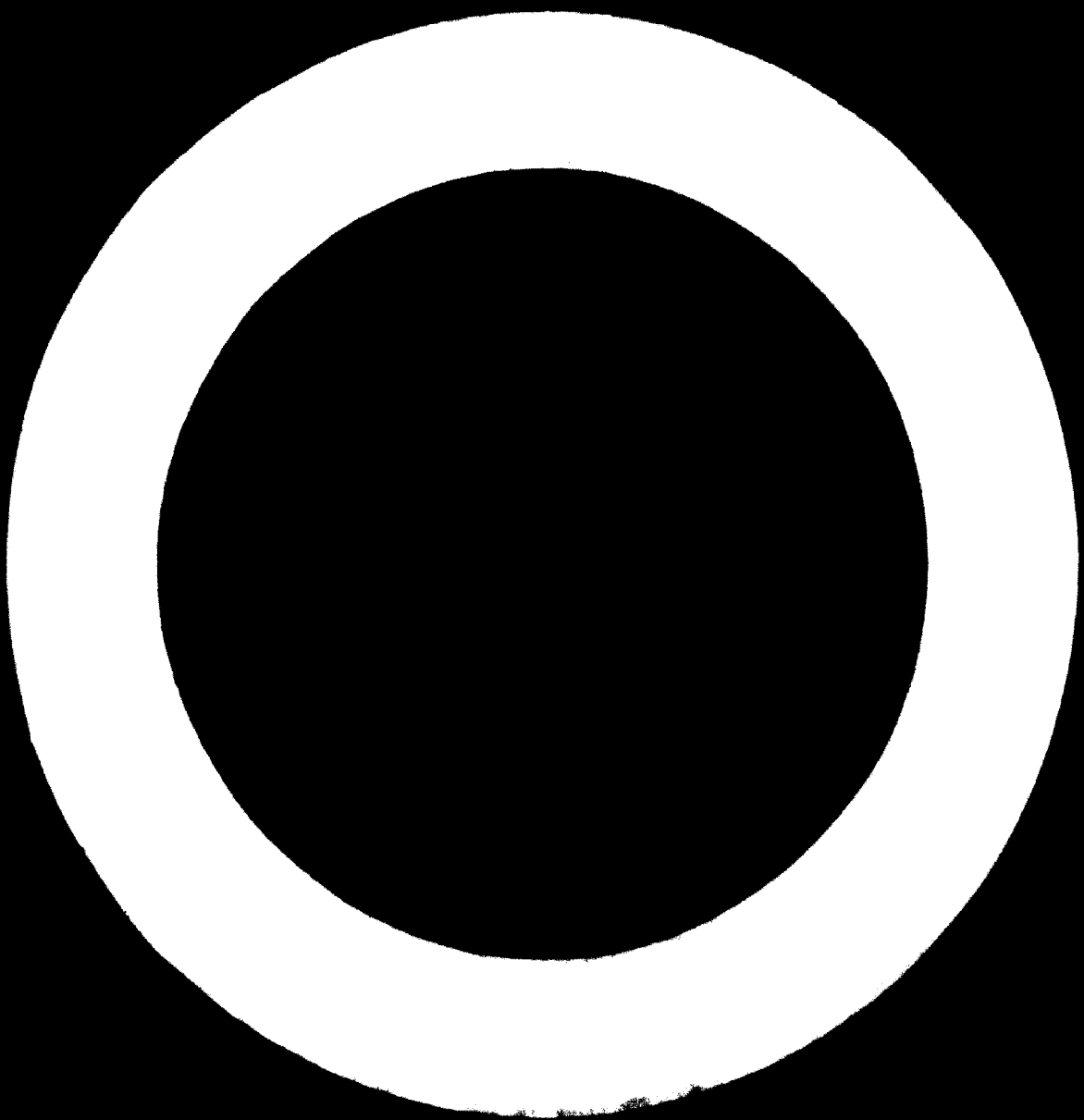
a) United Kingdom:

The iron ore consumption in 1968 was 14,3 million tons (Fe) and the domestic production of iron ore was in the rate of 11,94 million tons of iron ore. A great amount of imported ore came from Sweden, Brazil, Canada, Venezuela and Western Africa.

The twelve importing ports are equipped with berths which can take ships mainly of up to 10 - 15 thousand dwt. Only three berths take boats of up to 21,000 dwt and one, boats of up to 33,000 dwt. In the future three ports will be equipped for taking ships of up to 65,000 dwt. (Port Talbot, Newport and Middlesbrough). Transport to the small ports by using only 10,000 dwt. ships is very favourable for the Moroccan pellets and it may be assumed that 200 - 300 thousand tons of Nador pellets could be sold every year to the United Kingdom. The c.i.f. prices in 1972 may be about $ US 13,2, in 1975 $ US 13,4 and in 1980 $ US 13,5 for one ton of pellets.

b) Spain:

The iron ore production in 1968 was about 5,7 million



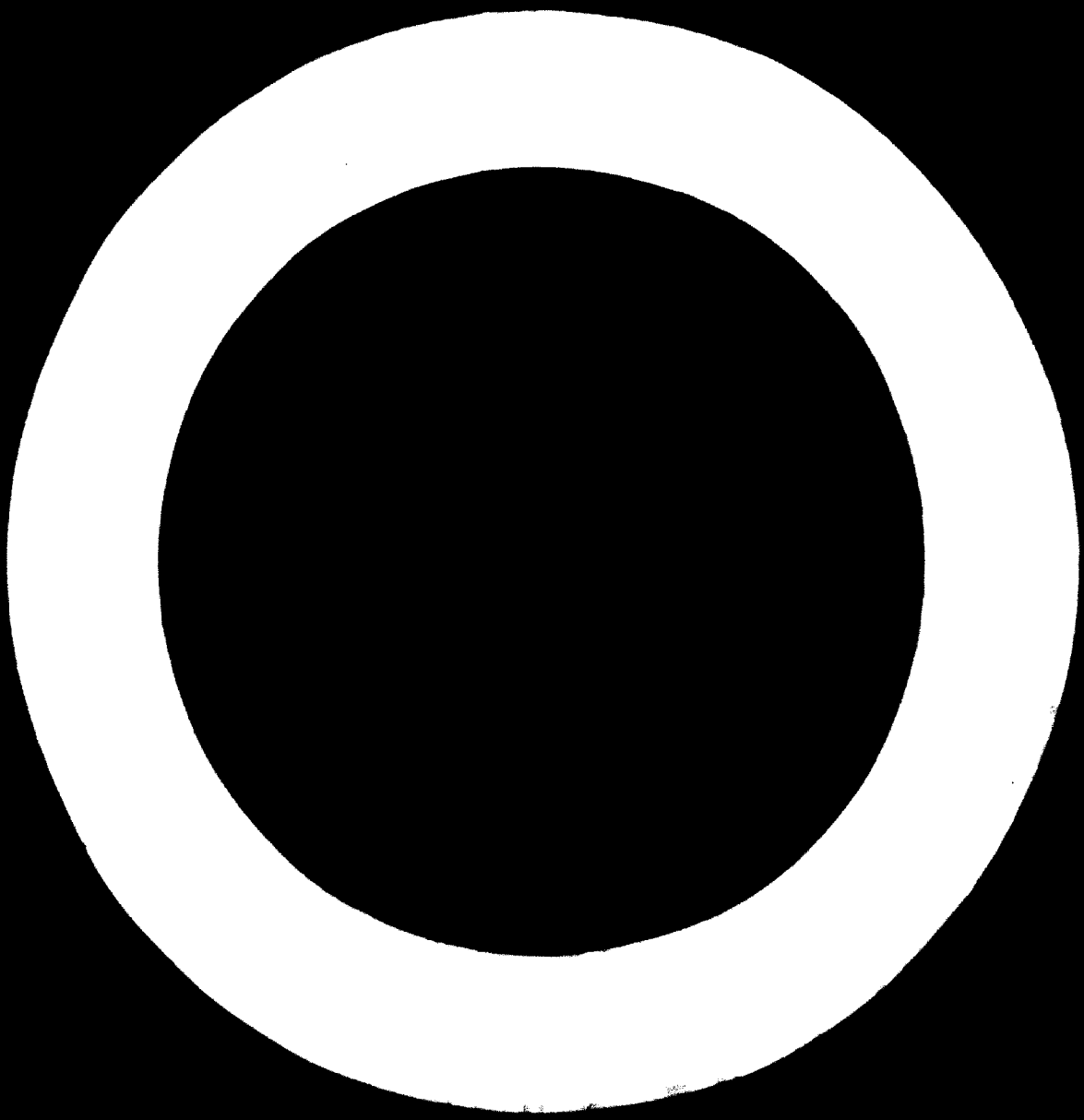
tons and a certain part of this amount was exported mainly to the United Kingdom. The second plan of the development of the Spanish mines calculate with some new mines, for example at Bilbao with 1.5 million tons capacity (58 - 59 % Fe), at northwestern Spain with 2 million tons capacity (62 % Fe). A new pellet plant should be build later for an output of 1.5 million tons of pellets per year. All these new investments cannot satisfy the demands of the domestic iron and steel industry so that at leamt 2 million tons of iron ore should be imported in 1972 and 3 - 4 million tons in 1975. The imports are coming mainly from Brazil, Mauretania, Morocco and India.

The consumption of steel should be doubled from 1968 (6.6 million tons) to 1975 (12.8 million tons). The steel plant Uninsa will be the pillar of the Spanish steel industry after finishing the third stage of the new plant at Veriñal. The Ensidesa company has a production of 2 million tons of steel and the "Altos Hornos de Vizcaya" has an output of 1.45 million tons at Vizcaya and 520,000 tons in Sagunto near Valencia.

The second mentioned plant is in a favourable position to Melilla. It should be expanded in the next few years. The harbour is similar to the Melilla port and a drop in freights could be achieved so that the f.o.b. prices may be about $ US 11.2 - 11.5 per ton of pellets in 1972 and $ US 11.1 - 11.7 per ton in 1980. These savings in freights are important although Spain is a steering country and some political events may occur between Spain and Morocco.

c) Portugal:

Recent exploration has shown that the Moncorvo deposits, about 30 km from the Spanish frontier, north of the river Douro, can give a satisfactory concentrate. The development of this deposit was studied for an annual production of 1 million tons of pellets, which could



be very competitive to the Nador pellets. Due to the necessity of deepening the port, and heavy investments this project has now been postponed. For the small domestic requirements Portugal has a big mine in Angola.

d) Yugoslavia:

This country has three major areas with iron ore deposits, from which the Lubija mines should be developed for the supply of the neighbouring steelworks. Only in case of building a new big steel plant at the Adriatic shore (most probably at Split) it will be possible to sell 100 - 200 thousand tons of the Nador pellets. Provided Yugoslavia will remain a clearing country, a market for Yugoslav goods have to be found in Morocco.

e) Austria, Greek, etc.:

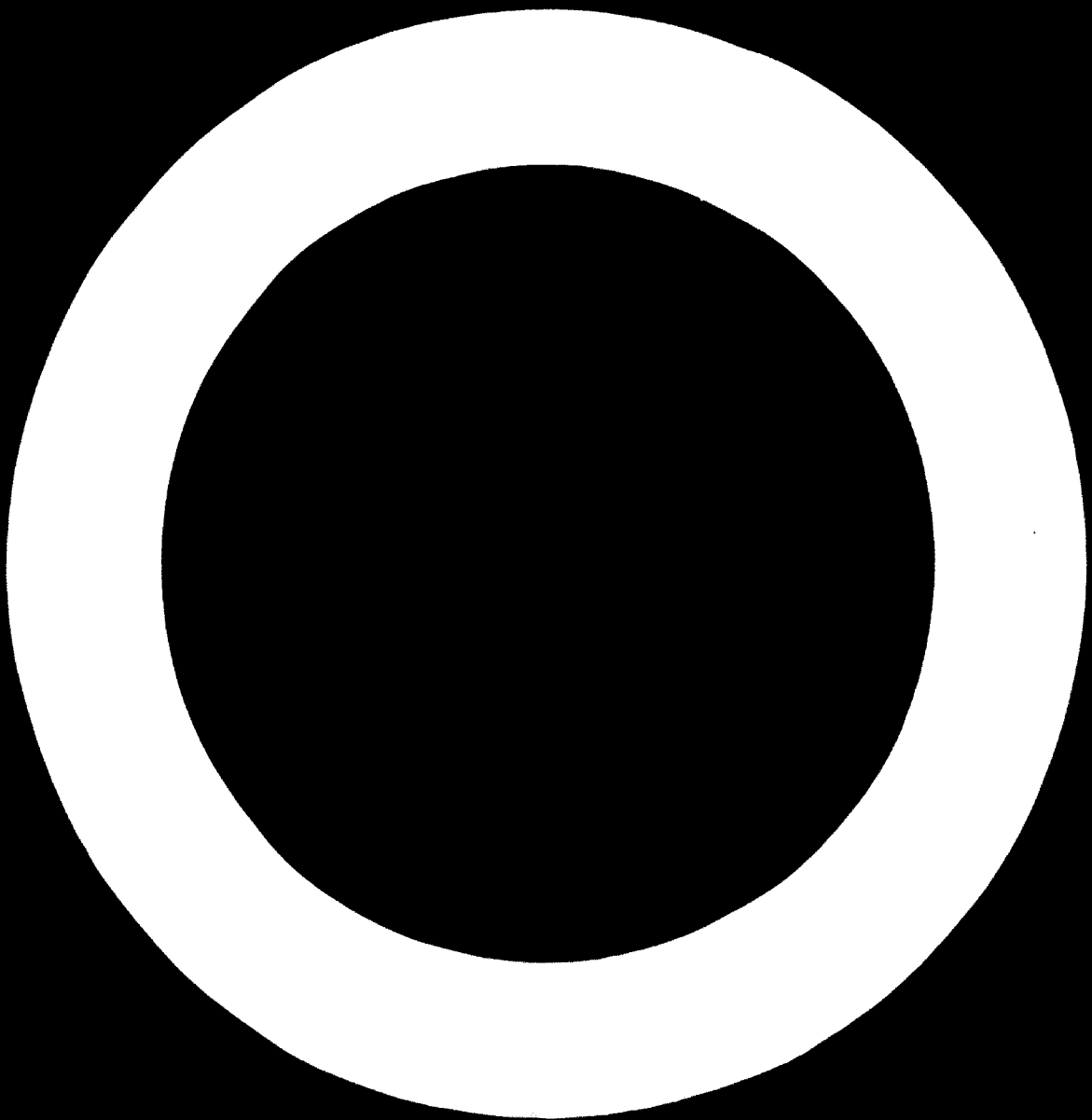
The Austrian steel industry has found in Brasil (CVRD-Tubarao) the source of pellet deliveries and it is hardly possible to change this source. The Greece's position as an exporter of iron ore dropped down during the last 10 years. Plans have been prepared for building a pellet plant with an initial annual output of 100,000 tons of pellets. A new steel plant will be build and it is hardly possible to export some pellets from Nador to Greece.

5.4 - Iron ore exports to Eastern Europe.

Only three countries can be taken in consideration for import of the Nador pellets: Czechoslovakia, Poland and Romania. The other four countries could be avoided because of the special conditions of the iron ore market or political situation (Eastern Germany, Hungary, Albania and Bulgaria).

a) Czechoslovakia:

This country was in the past and is at present one of the biggest buyers of the Moroccan iron ore and it



can be assumed that some 150 - 200 thousand tons of pellets could be imported annually by this country. It depends mainly on the mutual trade between Morocco and Czechoslovakia because of clearing payments. A higher import could be only possible in the case of higher export of Czechoslovakian products (machinery, etc.) to Morocco or a participation on the deliveries of equipment for the Nador plant or for other investments in Morocco (phosphate mines, harbour facilities, chemical equipment, etc.).

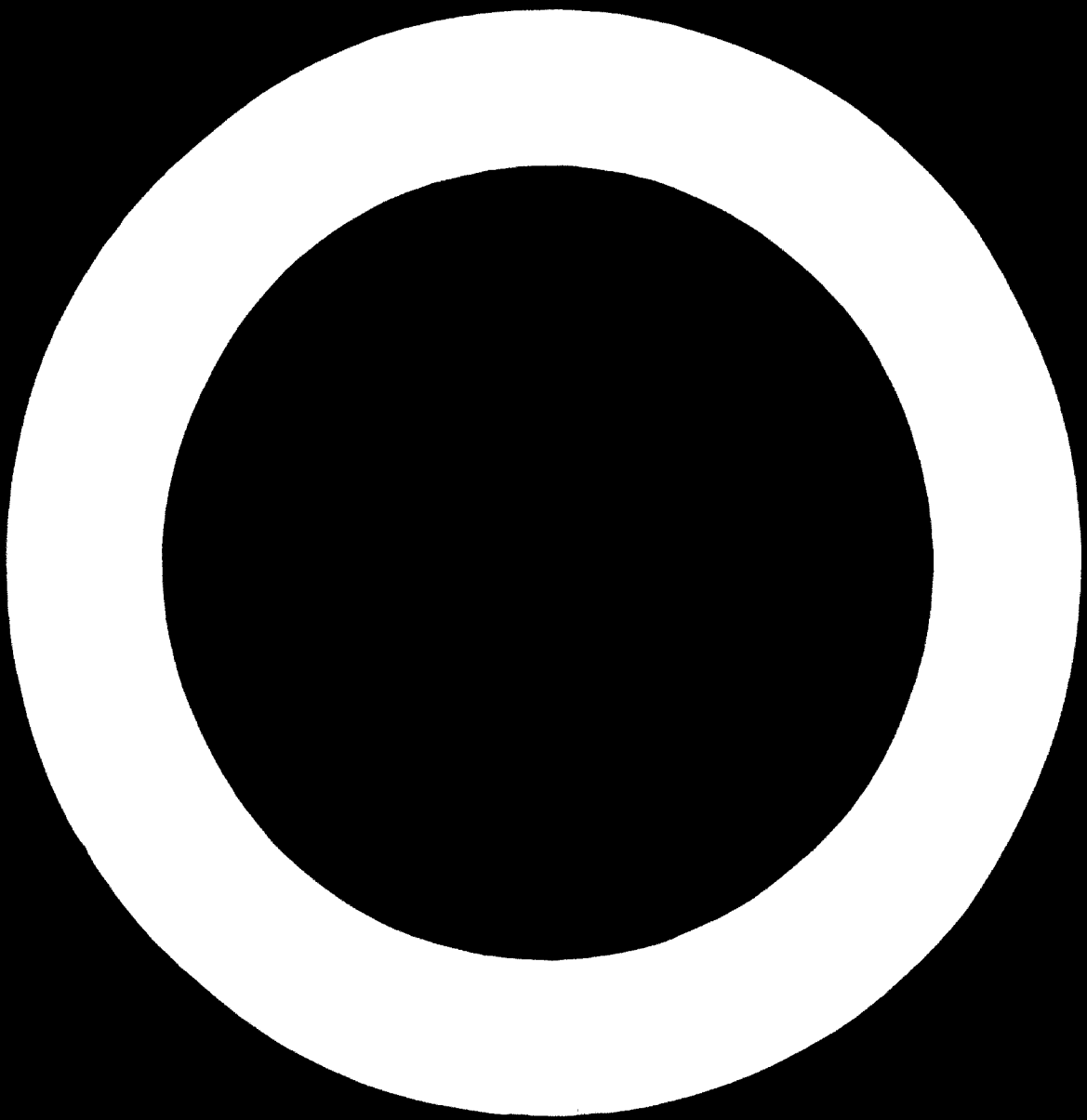
The participation is important also for Poland and Rumania, both being clearing countries. Pellets could be unloaded for Czechoslovakia at Nador near Rjeka or in one of the Baltic ports, Gdynia or Szczecin. The prices may be favourable for both countries.

b) Poland:

Only small amounts of iron ore are at present bought from overseas. The substantial quantity comes from the USSR. Imports from Nador, therefore, are only supposed in smaller amounts or in case of some deliveries from Poland.

c) Rumania:

The Rumanian steel production will increase substantially, due to the government's plans. A big steel plant in Galac is being built and the domestic iron ore production will not be sufficient to cover all the requirements. Rumania, therefore, has signed a long-term contract with some Indian mines for delivery of the Indian iron ore of 25 millions tons. A part of this ore is covered by reexport of the Rumanian equipment. Because of closing the Suez channel the freights are very high and it should be, therefore, possible to sell annually some 150 - 200 thousand tons of Nador pellets to Rumania. The freights will not exceed those for Gdynia and will be only a little higher than freights for Rjeka or Rotterdam.



6.-FORECAST OF C.I.F. IRON-ORE AND PELLET PRICES

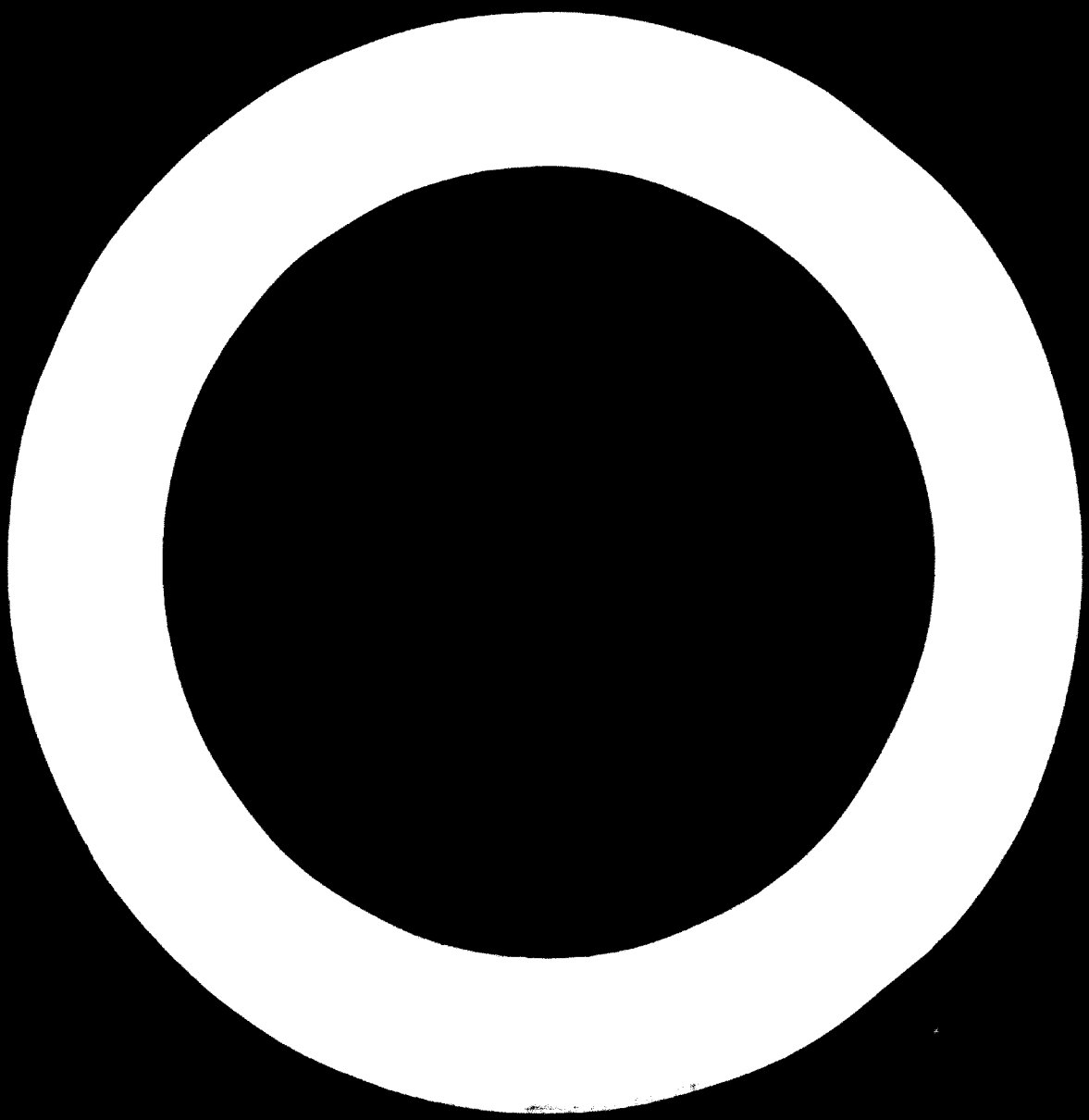
In order to be competitive and to realise a reasonable level of profit the costs of iron ore and pellets must be kept below the price level determined by the c.i.f. prices obtainable for these materials in certain regions.The producer controls mainly the f.o.b. costs which are for him of paramount importance.They consist of mining costs and beneficiation costs,land transport and loading cost at port and of taxation and royalties.

The assessment of f.o.b. prices considered in the economics of the future Nador plant is $ US 10.) f.o.b. Melilla. Provided that the production and transport costs including a certain profit could be held on the same level for the whole plant life time,only the cost of sea transport can be taken into consideration as the substantial factor effecting the c.i.f. prices.Some details regarding costs of sea transport are given in chapter 7.It is not the task of this report to count and control the f.o.b. price of the Nador pellets,which seems to be reasonable under the present-day conditions.

The c.i.f. prices consist of the f.o.b. prices,with a deduction of sea or ocean freights and insurance.Changes in c.i.f. prices closely follow changes in freight rates,although improvements in loading have reduced the proportion of freight in c.i.f. costs.Since 1957/58 iron ore prices have fallen owing to the opening-up of new mines with large capacities and because shipping facilities have been improved.The changes can be seen in annex).for ports in various countries.

Sometimes the prices are not comparable because of special conditions in case with only a single purchaser of a certain ore.Long-term contracts,covering the whole output of a mine and ore prices from "captive" mines give the various factors which have to be taken into account in deciding the price of ore or pellets.

In chapter 9.there are mentioned some c.i.f. prices which could be achieved by selling the Nador pellets to certain



countries in Europe. In the present chapter only the c.i.f. prices development for iron ore is given as a forecast for the following 5 and 10 years. In general the freights for United Kingdom are over $ US 1.20 higher than West German freights and so are the c.i.f. prices. It is due to the advantages of the modern port of Rotterdam which is equipped to receive large ore-carriers.

A trend toward higher uniformity of prices for delivered iron ore is noticeable with lessening of the spread between the average annual prices for different countries between 1955 and 1968 with estimated prices for 1975 and 1980. This is illustrated in table No.10.

Table 10- Average c.i.f. prices of imported ore in FRG and U.K.

/ Dollars per metric ton/

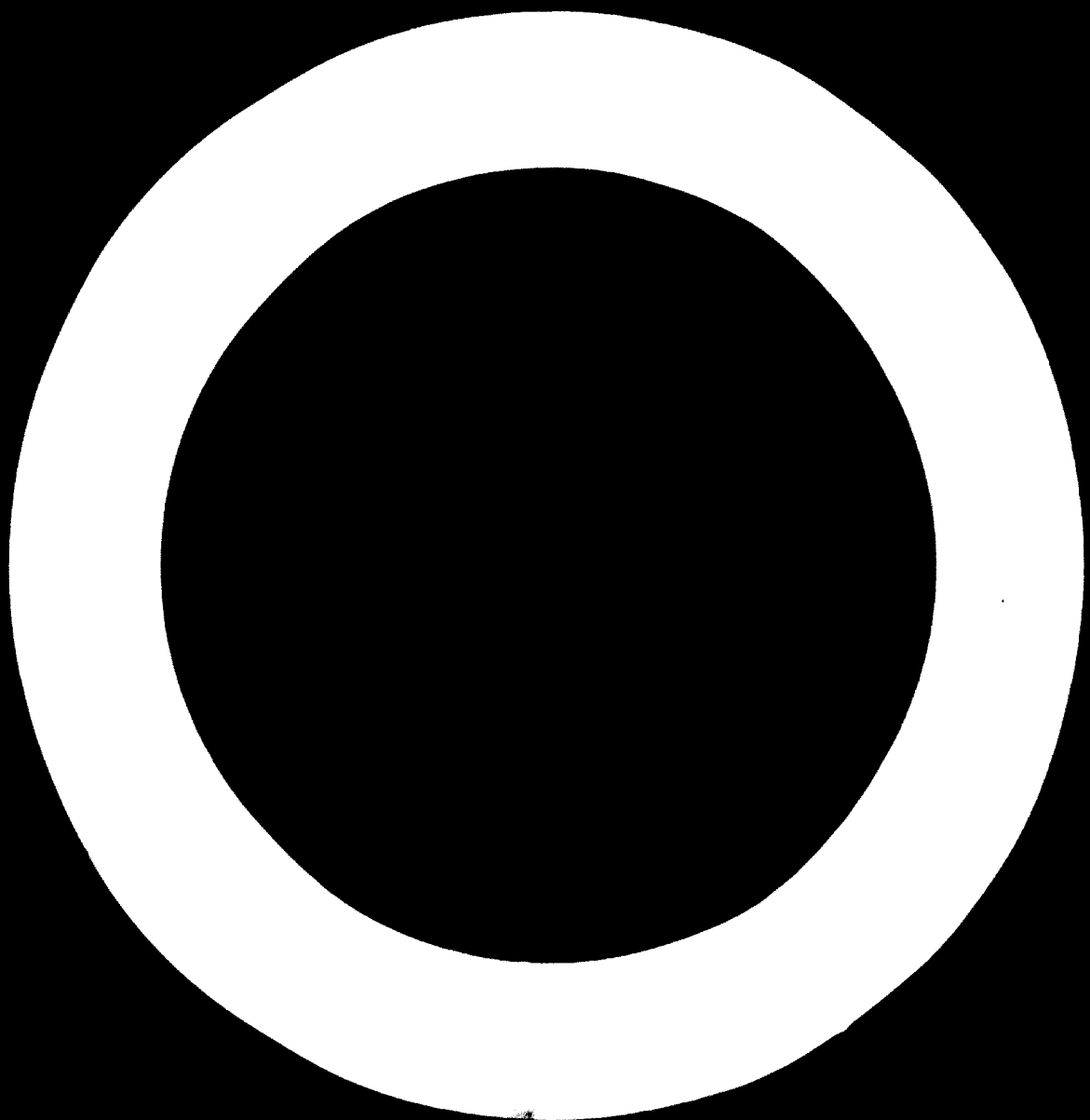
Year	Western Germany	Belgium Luxemb.	France	Italy	Nether-lands	United Kingdom
1955	13.74	11.93	15.43	14.81	14.65	14.97
1957	16.97	13.61	18.57	19.59	17.43	17.00
1961	13.56	11.41	13.14	11.89	12.06	13.50
1963	11.72	9.66	10.78	10.95	9.07	12.60
1965	11.10	9.91	11.24	9.48	10.11	12.40
1966	10.93	9.96	11.17	9.96	9.32	12.20
1968	10.70	9.90	11.05	9.80	9.25	12.10
/1970/	11.10	10.30	11.10	10.20	9.80	12.60
/1975/	11.50	10.70	11.50	10.60	10.00	12.80
/1980/	11.60	10.80	11.60	10.70	10.10	12.90

Major factors that have contributed to this more uniform price trend are as follows:

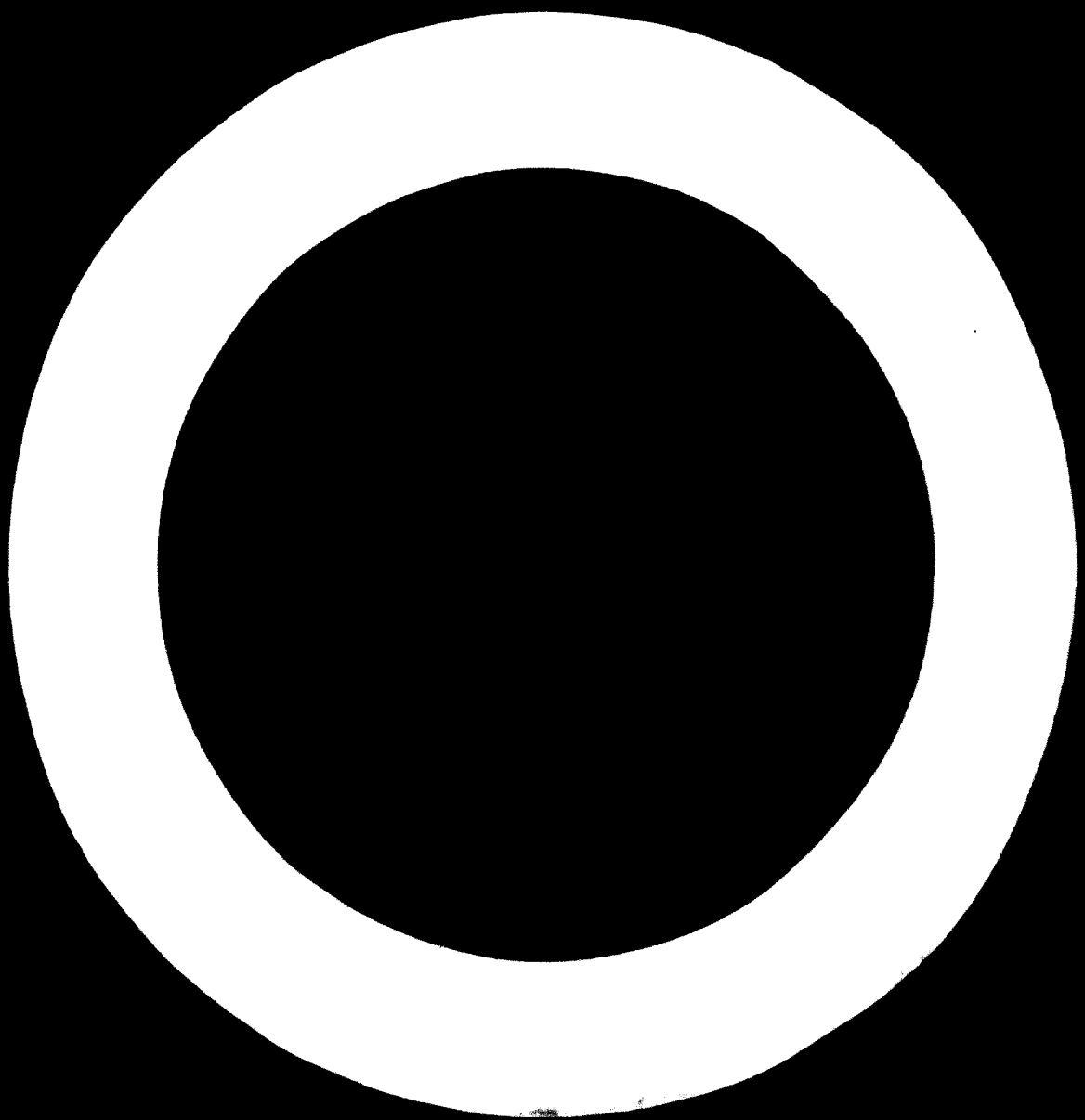
/1/ Abundance of supplies of ore in the years between 1955 and 1969 which led to lowering almost all prices to be competitive on the world market.

/2/ Increasing number of important sources of ore made economically available from increasing distances by vessels of much larger size- the bulk supercarriers.

/3/ Improvements in harbour facilities, dredging, increasing the stockyards capacity, and the hourly output of the shiploaders and ship unloaders.



/4/ Increasing in steel demand in certain countries,last but not least caused by some warfare in the Middle East,Vietnam.
/5/ This decreasing of c.i.f. prices continued till 1969 and reached the minimum rates in the beginning of 1970.Heavy and long-term strikes in Sweden and Canada have led to lowering the ore supply from these two countries of about 10 million tons.The prices of iron ore and pellets began to rise even though the differences are not yet very high.
/6/ The unexpected growth of the Japanese steel production which can to be realized up to 100 million tons in 1970 and 160 million tons in 1975 have caused a higher competition in the Atlantic Ocean area.Both long-term and short-term contracts between Japan and some countries in South America,Middle Africa and even in Europe /last contracts with Sweden and USSR/ show that it will be more difficult fot the EEC countries to hold the current prices.
/7/ The increasing of ship freights in some cases in the rate of 25 to 90 % in the last year was almost unexpected and was caused by higher salary and wages demands and also by an unsufficient number of large ore-carriers for transporting the iron ore from overseas.The distances especially to Japan was longer.The necessity of going around Southern Africa took another part of the shipping capacity.
/8/ Assumed that demands for higher wages in the mines,pellet plants and for the ship crews will last we can consider the prices for iron ore in the following five and ten years,as can be seen in the last three lines in table 10.The prices in 1980 are approximately by 10 % higher than those of 1970.
/9/ The shortage of iron ore will surely lead to higher investments in mining development,opening new mines or to building new beneficiation plants for not yet exploited resources. The new mines need new and often long distance railway connections and a certain number of years /usually seven/ from the date of starting the project to the full production.It can be therefore expected that the c.i.f. prices for Kudos pellets could be obtained at least till 1978 or 1980.



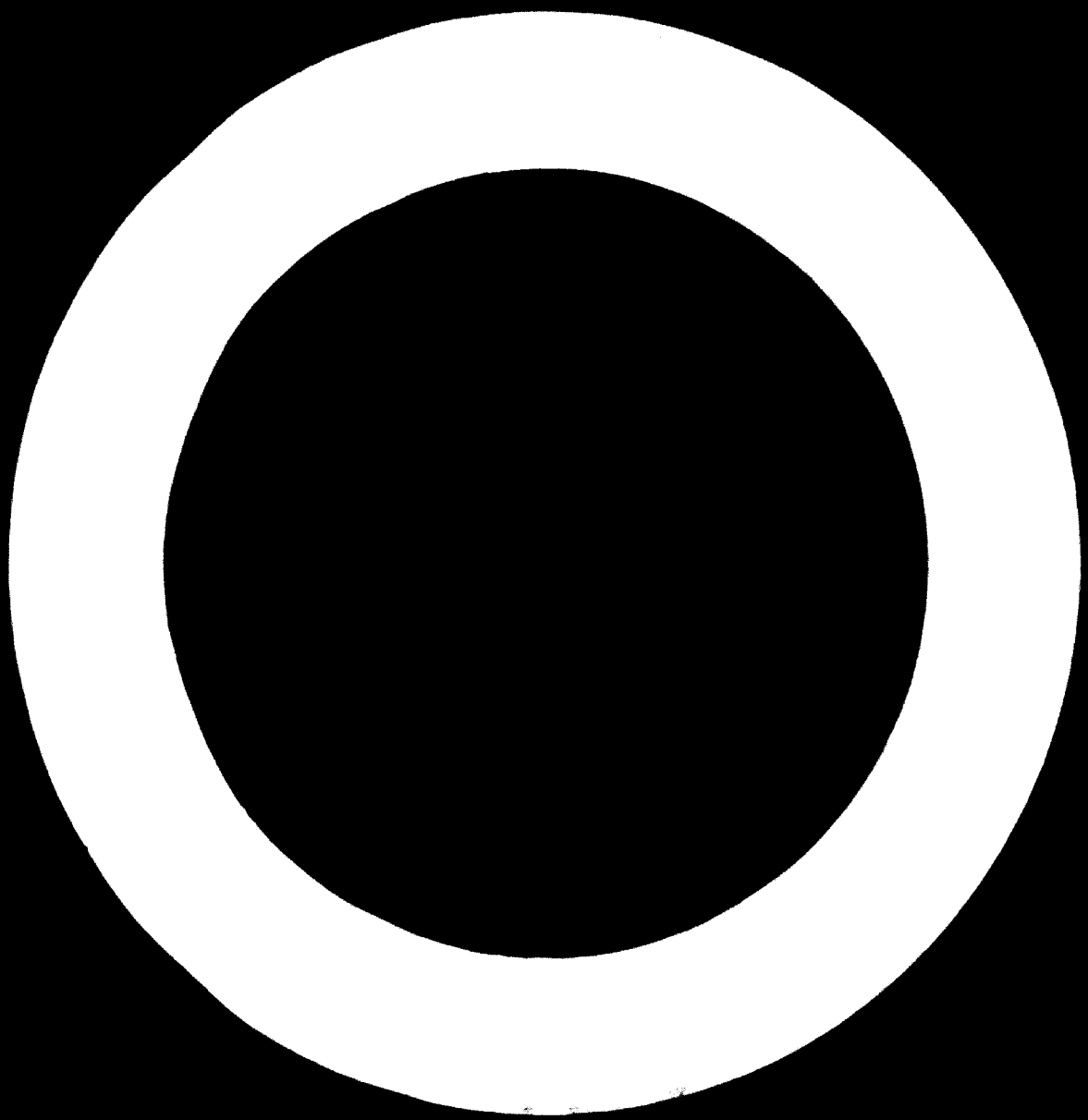
It is of course of great importance to have some reserves in f.o.b. price for unexpected changes which may be caused by another factors as for example the lower increase of the Japanese steel production, the discovery of some new large ore deposits near to the purchasers etc. Under present conditions we can assume that the minimal rate of f.o.b. price for Moroccan pellets should be 15 cents per iron unit which gives the f.o.b. Melilla price of $ US 9.75 per metric ton of pellets with an average 65 % Fe content or $ US 9.90 for 66 % Fe.

It is therefore not easy to forecast the supply situation for Europe after 1979-1980, both because of the number of countries involved and because Europe does not enter in long-term contracts to the same extent as Japan. It was known, that usually the ten-years period of abundance in iron ore supply is relieved by another ten years period of iron ore shortage. It means that after 1978 the Moroccan pellets will meet a higher competition in Europe.

The competition will include the new pellet plants in Italy /1.4 mil.tons/, Spain /3.5 mil.tons/, Portugal /1/, Sweden, Algeria, Australia, Liberia, Norway, Brazil, Venezuela, Peru and Canada. All these countries will build new pellet plants or increase the output of their existing plants. In the United States the production of new pellet plants is hoped to rise to 40 mil. tons per year during this period, which gives a total pellet production of 73 million tons of pellets per year with an iron content of over 62 %. That is nearly 30 % of the total United States pellet production. About 20 million tons of pellets from Canada must be therefore sold to other countries then to the USA, which will buy only some 10 million tons of pellets from Canada.

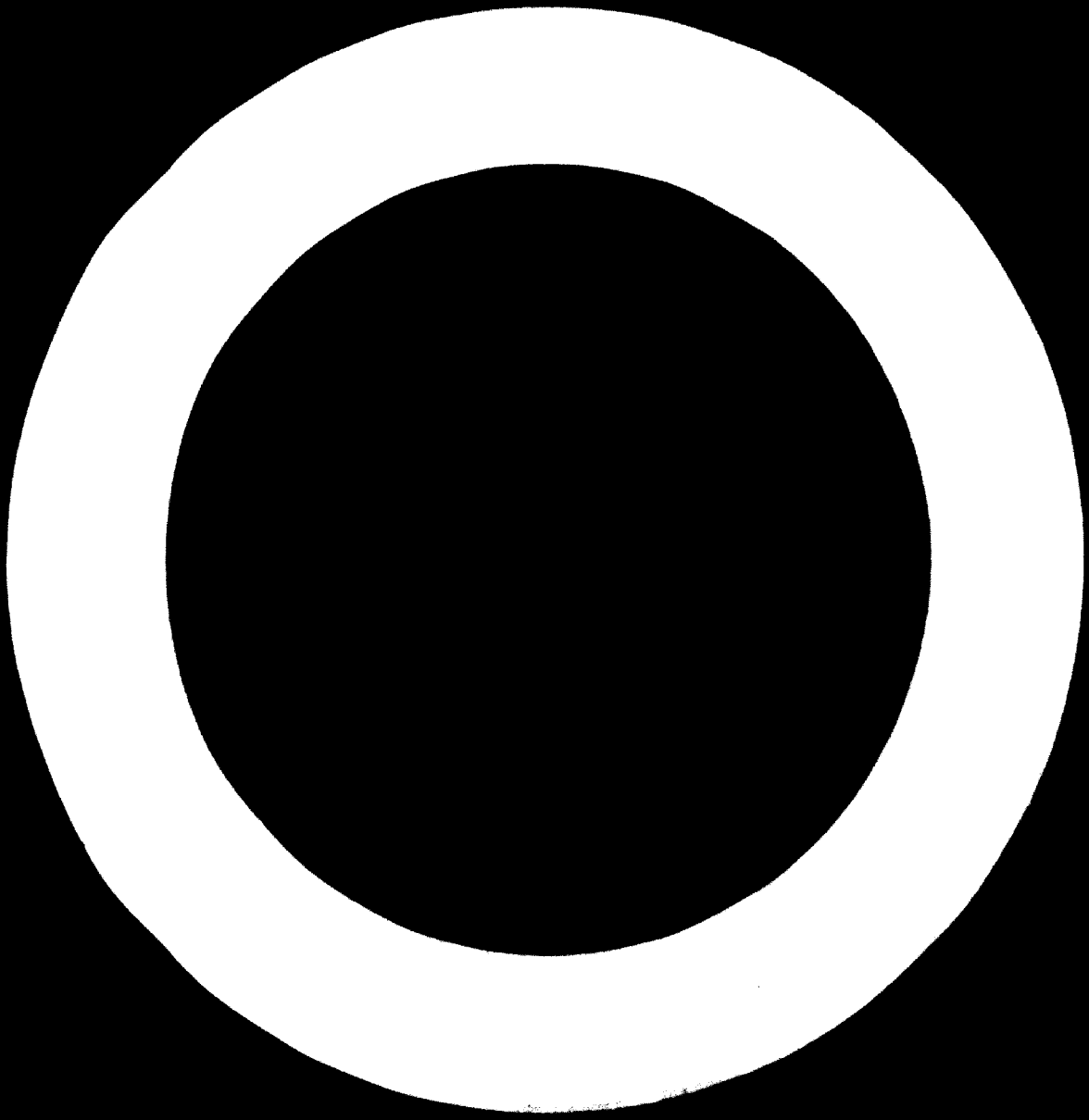
The present position of the Major pellets can be seen in the following figures which give some pellet prices achieved in contracts this year /in US cents per iron unit in pellets/:

- Long-term contract between Japan and Peru for pellets with 65 % Fe and 22 cents c.i.f.



-Pellets from Canada and USA to Europe,26 cents c.i.f.
- Sweden and Japan have recently contracted 500,000 tons of pellets with 63 % Fe for 19,2 cents f.o.b.
- Rohstoff handel Western Germany and Canada,contract for Carol Lake-Seven Island pellets with 21 cents f.o.b. Costs for freights are $ US 1.5 for long-term contracts and $ US 1.73 - 2.0 for short-term contracts.
- Rohstoffhandel Western Germany have bought in Sweden pellets with 64 % Fe for 22.2 cents c.i.f. Rotterdam.
- Rohstoffhandel-have bought pebble with 64 % Fe in Australia for 21 cents c.i.f. Rotterdam with freights in rates of $ US 3.80 or $ US 2.50 for chartered ships.
- The average prices of taconite-pellets from Lake Superior area / Port Lake Erie / were in the rate of $ US 13.25 per long ton during the period 1964-June 1969.
- The average prices of the Sweden pellets containing minimally 65 % Fe were $ US 14.00 per long ton f.o.b. Narvik since 1964 up to June 1969
- Carol Lake pellets sold to Western Germany in 1969,have had a c.i.f. price of 21.2 cents in Rotterdam.
- Lance Nimba pellets were sold for 21.1 cents c.i.f. Rotterdam last year.
- Kiruna pellets from Sweden were sold with a price of 20.9 cents per iron unit c.i.f. Rotterdam for Western Germany last year.

It has to be mentioned that a small increasing of this prices appeared during the last half of year,due to the fact that an increasing in freights and strikes in Sweden and Canada have made the position of the buyers more difficult.



7. Shiploading and cost of ore transport.

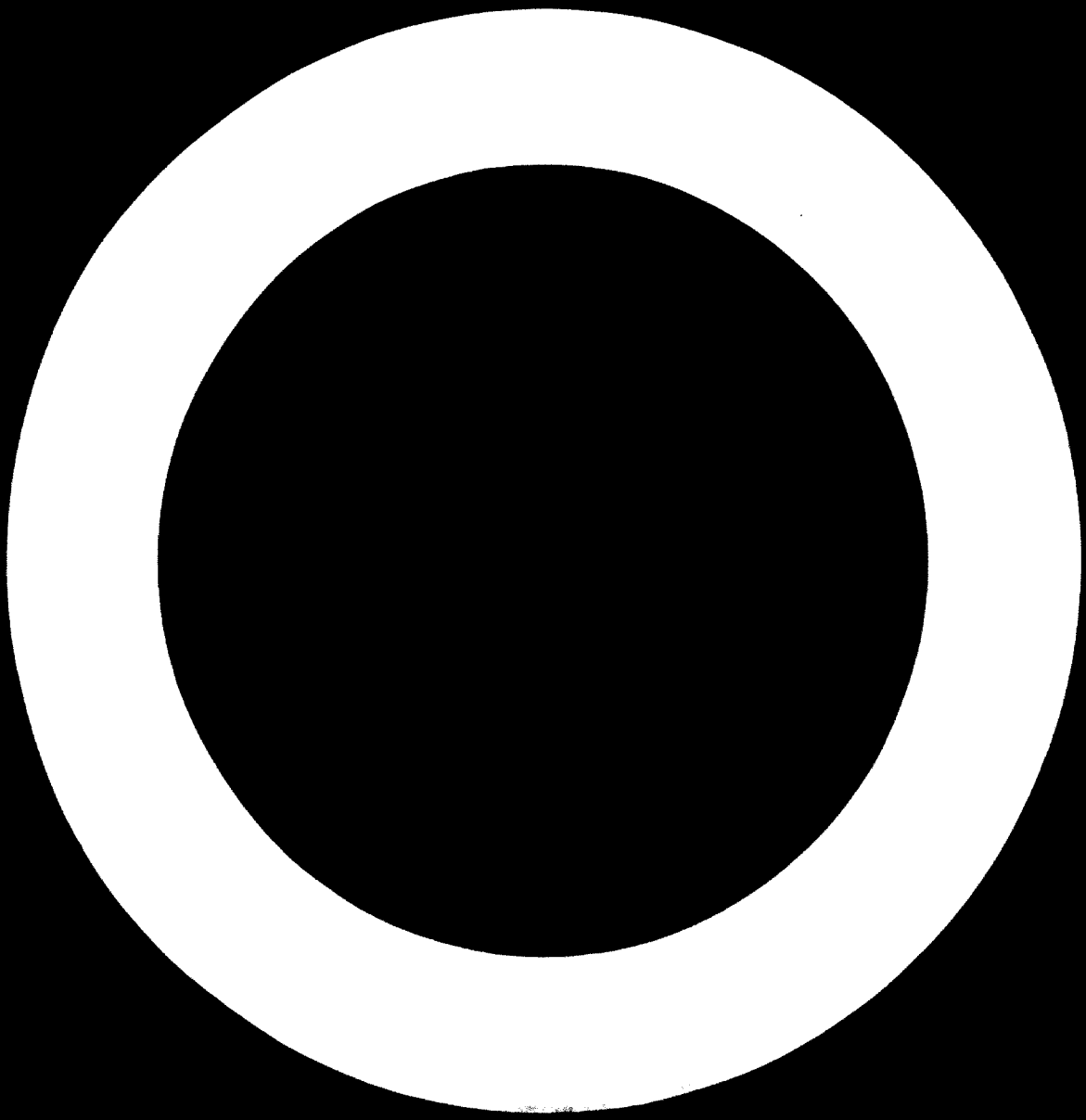
7.1 Shiploading.

The competitive position of an individual iron ore is dependent to a great extent on its costs of production and delivery to a given customer. The price of iron ore or pellets is determined by " the metallurgical value " and by the topical market conditions. There is a considerable freight advantage in large ships. Existing shipping ports are being deepened and modernised so far as conditons permit. It is no doubt that a pellet plant, which is not equipped with a sufficiently deep port and high capacity shiploader is handicapped.

The loading equipment at the Melilla port consists of two shiploaders with a theoretical output of 1,000 tons per hour each. Practically 1,200 - 1,500 tons per hour might be realized for loading larger vessels. This capacity is sufficient for pellet loading, but the shiploaders must be modernised because off their age of more than 30 years. The belt conveyor system and feeder must be renewed too, and it should not be difficult to increase the speed of the belt conveyors so that to achieve a much higher output, approximately up to 2,500 tons per hour. It would enable to load larger ships of up to 20 - 25 thousand d.w.t. The cost of modernizing the harbour facilities should be, of course, included into the cost of investments and it would appear by this way in the f.o.b. prices .

7.2 Vessels for iron ore transport.

During the 1950's large number of special ore-carriers were built, mainly between 15,000 and 20,000 d.w.t. (deadweight tonnage, which is the cargo tonnage plus the weight of fuel and stores carried). Later the carriers for 50,000 up to 100,000 d.w.t. were developed so that the fgures are below the most economic size for today.



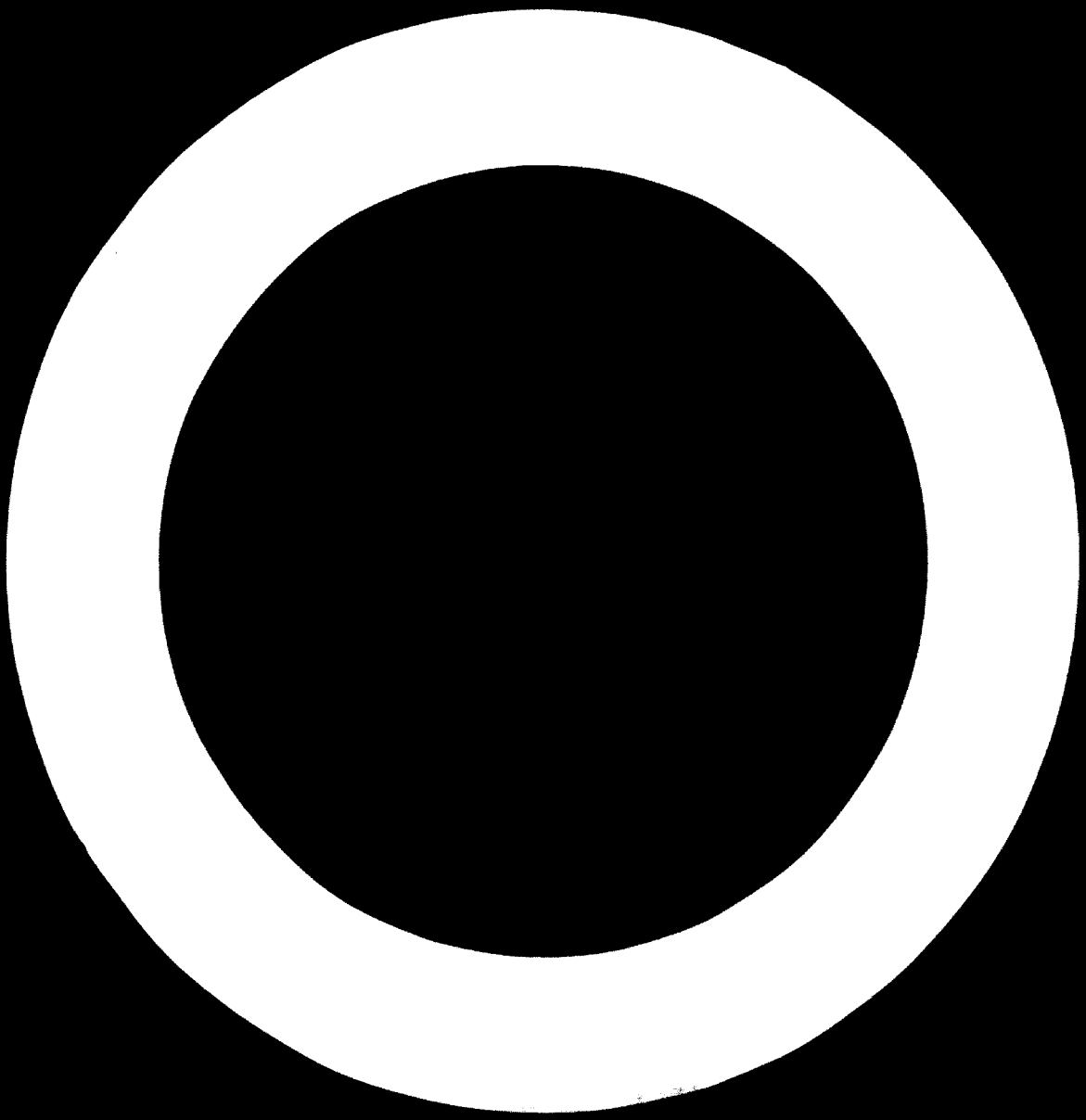
For v[illegible] is [illegible] capacity in the 15,000 to 20,000 dwt. class the [illegible] other considerable size range of vessels available for the iron ore trade.

Berth size could be used with great advantage at Melilla, provided depth in the port can be increased. (See next chapter.) There are no limitations on the length of a ship, to allow the ship to turn in the dock and also the available depth of water (9 m) which determine the maximum size of ship up to 18,000 dwt. If there is not lack of tugs at the port and ship need not turn near to the loading berth it may be possible to load 12,000 - 14,000 ton pellets into a 15,000 - 15,000 tonner which is not fully loaded. It is, however, only a small increase of the loading possibilities.

Considering the depth of bulk-carriers is usually 1.3 or 1.4 times the designed draft, an upper limit of length 14 times this depth and the beam up to three times of the draft, we can fix the maximum size of ships which can be loaded in the port of Melilla today and which could enter the dock in the future after improvements of the loading berth are finished.

The depth of the dock at Melilla is at present approximately 9.20 m, the designed draft can be between 7.2 and 7.5 and the ships depth is usually 10 - 11.5 m. This gives the maximum beam dimension about 21 - 23 m and the upper limit of length is 14 x 11.5 = 156.5 m.
Provided, that the dock at Melilla will be in the future 10 m deep or another jetty will be built, vessels with 20,000 dwt. could be loaded. Their dimensions are: depth 12.6 - 13.6 m, beam 27 m and length 190.4 m.

The most of the ships of the United Kingdom, Spain, France, Italy and Eastern Europe fleets are in the 10,000 to 30,000 ton range, because of the lack of deep water in ore ports in these countries. The remaining major importer of ore, Western Germany, again operates both ore-carriers and bulk-carriers, the former of 10,000 - 25,000 ton size and the latter mainly below 15,000 tons.



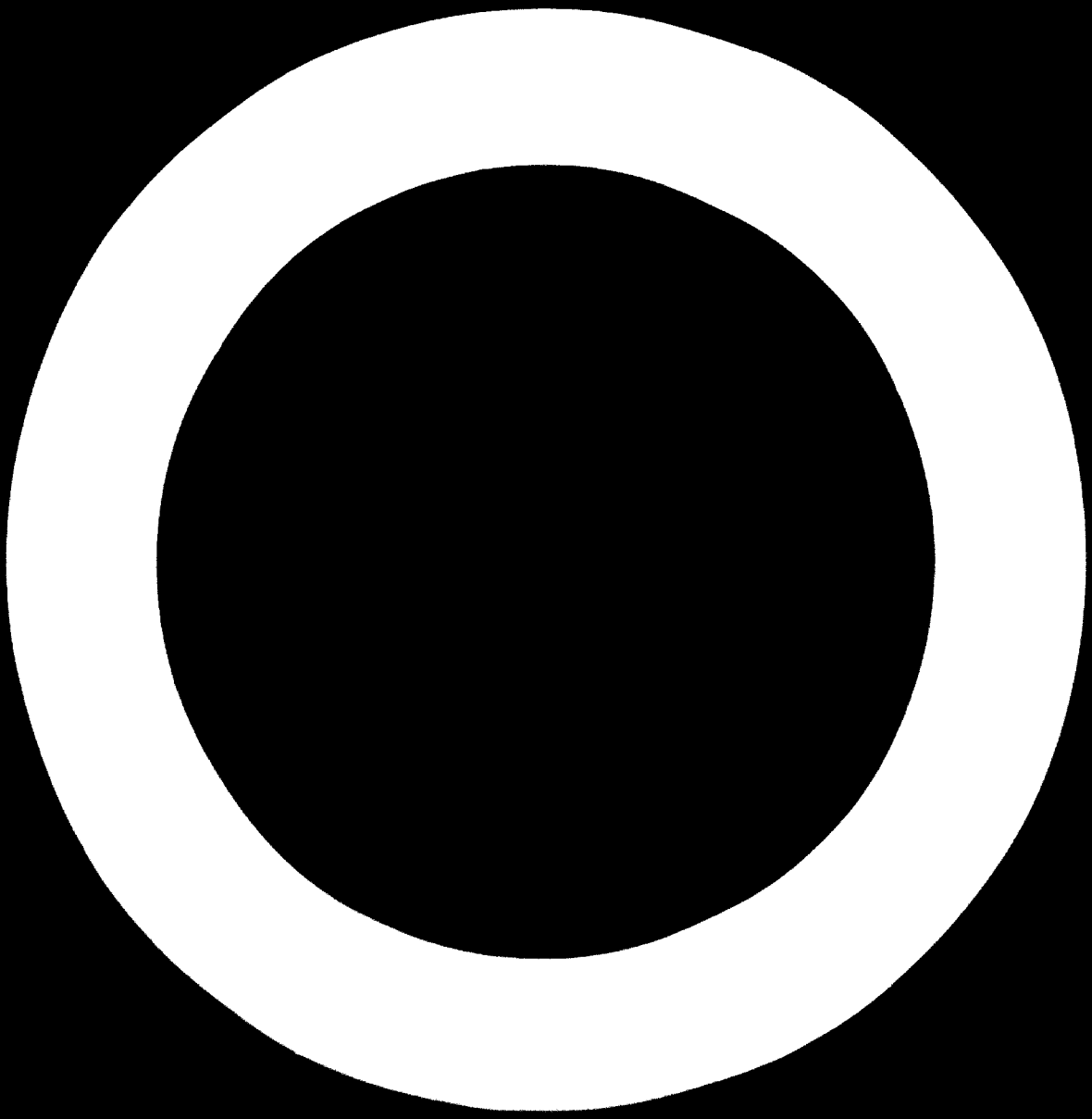
/.3 shipping costs.

For the Malaga potash market, using larger vessels is of great importance because of reduction in c.i.f. prices. Not only the capital costs of ore-carriers are falling from a figure of $ US 300 per d.w.t. for 10,000 tonners to $ US 200 per ton for ships of 20,000 tons, but also the crew's wages and victualling, stores, maintenance costs and fuel costs are per d.w.t. lower by using large vessels. Operating costs of some sizes of ships are given in table No 11. (Costs in US dollars per day.)

Table 11. Operating costs and daily costs of ships.

Item	d.w.t. 9,000	15,000	25,000
Crew and victualling	390	450	475
Deck stores and radio	42	50	58
Engine stores, lubrication oil	56	70	87
Repairs, maintenance and survey	115	150	200
Sundries	56	70	77
Total operating costs	659	790	897
Capital charges	732	1015	1195
Insurance 1,5%	104	141	166
Fuel costs at sea	255	380	549
in port	25	36	50
Total daily costs at sea	1751	2325	2809
in port	1421	1964	2308

Total daily cost at sea may increase from $ US 1647 for a 10,000 d.w.t. ship to $ US 2625 for a 20,000 tonner. The daily cost in port increases from $ US 1396 to $ US 2140 for the same size of vessel. Assuming the distance between Melilla and Rotterdam (or Ajoka) 2370 km (or 3200 km) and only 6 days spent in port per voyage, the number of round trips per year is 23 to Rotterdam and 20 to Ajoka. At an average speed of 14.5 knots a ship will cover 649 km

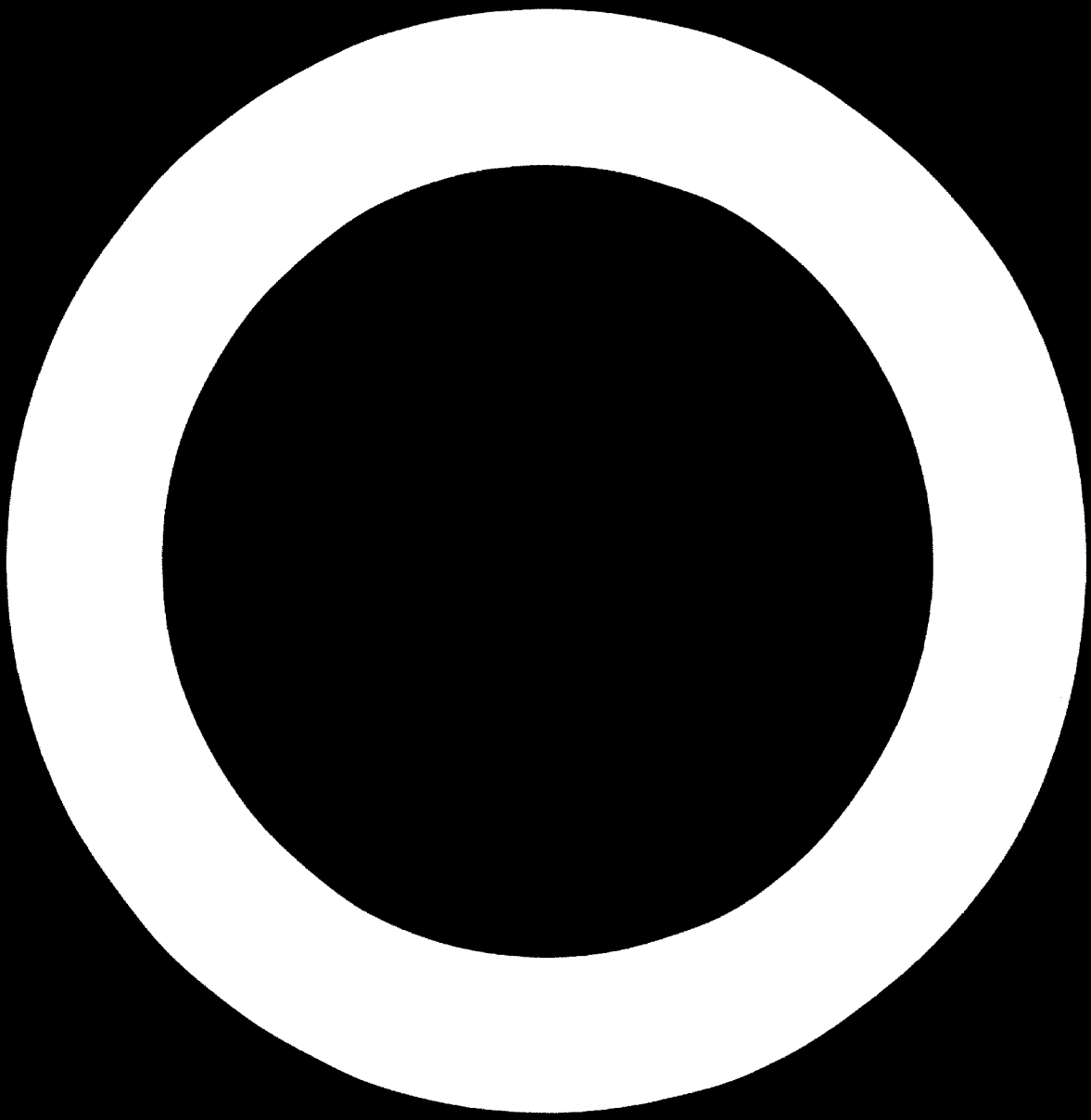


show the economic advantages of loading larger vessels. Even though the harbour authorities or the conditions would not allow dredging and/or providing a new berth, the existing jetty should have an output of at least 1,000 tons per hour to enable loading of 9,000 - 10,000 tons of pellets in one day. No large investments have to be done. The speed of the belt conveyors should be higher anyhow in the harbour at the occasion of renewal of the whole transport system.

There is another possibility how to enable loading of ships up to 25,000 dwt. Provided the new bottom of the berth, the berth depth could be considered larger without any or with a small additional dredging. For this purpose a new berth has to be build in a certain distance "L" which depends on the shape and inclination of the bottom of the sea ground. This method has been used in Europe, for example in Zeila or in Aqaba where the width "L" is longer than 1,000 m.

It can be assumed (and some investigations and measurements should show the best alternative), that only the distance "L" of 100 to 150 m has to be ensured. This length may be formed by a stone and/or concrete wall which can protect the harbour basin from the storm or from silting down the mud and sands. When the distance "L" is longer or no protection of the harbour basin is required a cheaper solution could be taken into consideration namely the construction of a certain number of pillars at the distance of about 25 m, carrying the belt conveyor bridge.

At the end of the wall or at the bridge a new jetty should be provided, consisting of a few pillars for fixing the ship while loading. A new shiploader with an output of 1,200 tons per hour (practically) must ensure the loading boom, which must be at least 15 m long. The frame of the shiploader must allow turning the boom on both sides from the normal axis with a wide range.



Along the new berth or in the new bridge only one belt conveyor is situated. Pellets are transported either by the left or by the right existing conveyor and pass through the tripper cars to short cross belt conveyors and further fall on the new long conveyor. The whole equipment is shown in annex 8.

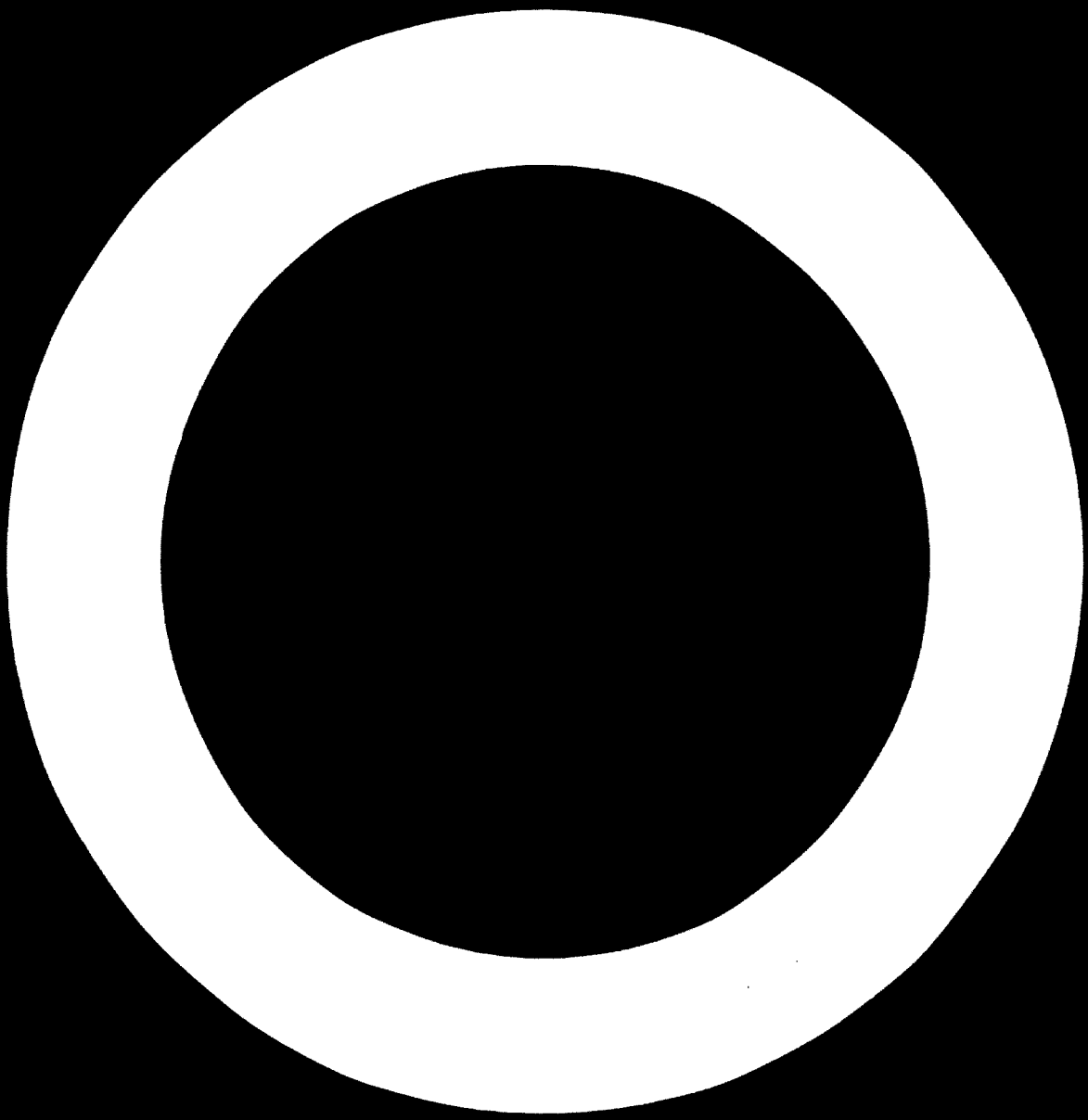
The cost for the new shiploader and conveyors is assessed to be $ US 1.6 million not including the requested reconstruction costs of the existing belt conveyors. Altogether the costs may rise up to $ US 2 million. Supposed that about 22 million tons of pellets should be exported during the mining period, the share of this additional costs is not greater than 9 cents per ton of pellets. Even though an extra payment for dredging had to be counted, the total cost will not exceed 20 cents per one ton of pellets.

By taking into account the considerable savings, which can be achieved by loading into bulk-carriers up to 20,000 dwt. and considering the extra costs for the improvement of the harbour facilities, it is clear that at least 60 to 70 cents per ton of pellets can serve as a reserve for a future competition on the European iron ore market. Even if one third of the loaded ships will be in range of 15,000 dwt. savings of 45 to 57 cents per ton of pellets can be achieved. It is recommended to calculate the investment costs together with the Spanish port authorities, because the port is situated in a Spanish area.

9. Pellets from pyrrhotine ashes

9.1 The pellet quality.

Kotters pyrrhotine is at present mined by underground mining and the ore is crushed and sent by rail to the Huron Chemie Plant at Safi. The pyrrhotine, which is a modification of pyrite, includes about 58 % Fe and 30 % sulphur. The latter is used in the Safi Chemical Complex for the production of tripple phosphate fertilizers. After their



sulphur value has been exploited, the pyrrhotine ashes are being stocked. There is a quantity of approximately 1.5 million tons of ashes at the stockyard and every year this amount increases by 400,000 tons.

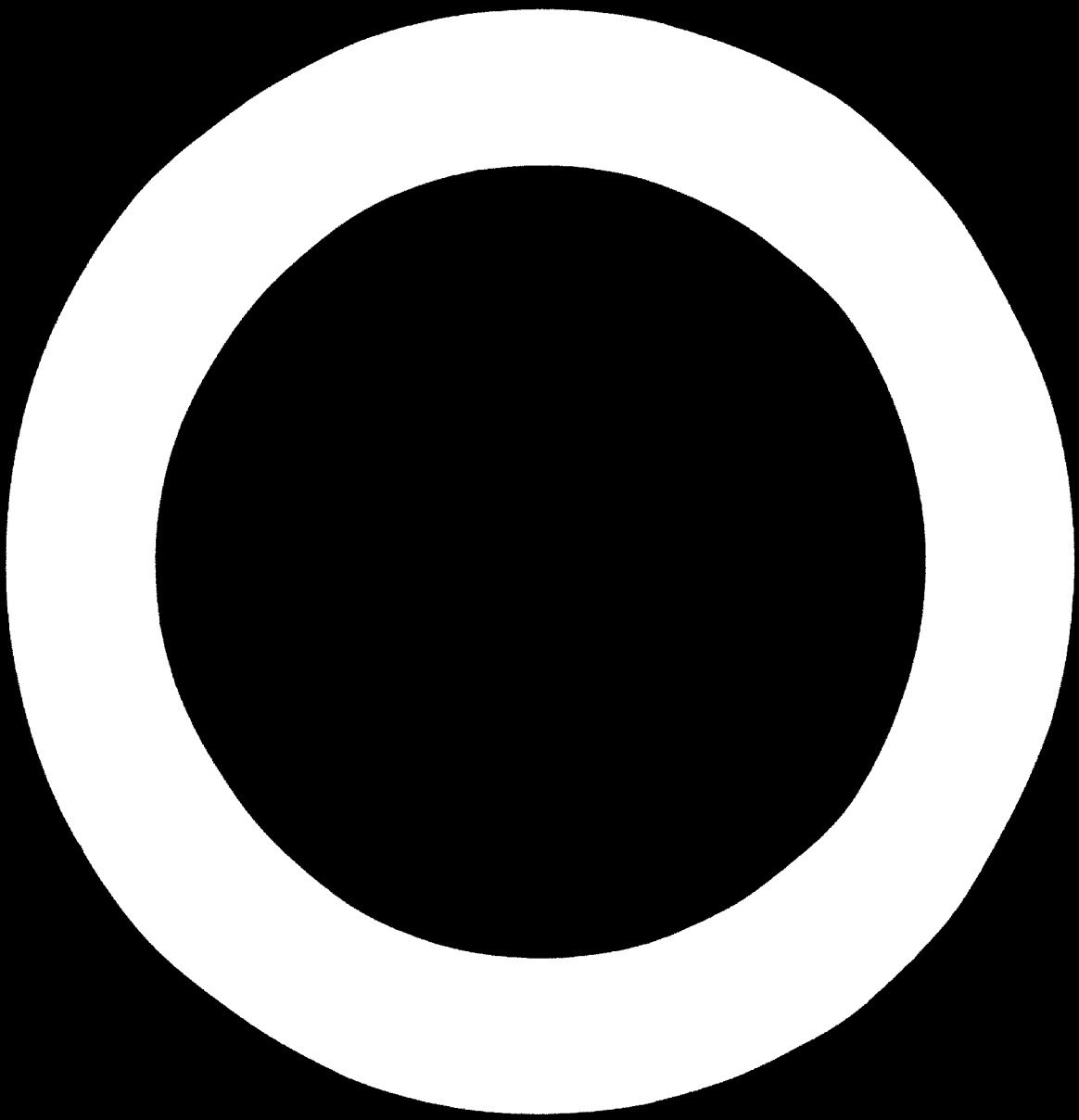
A new shaft is being built at Kottara with all necessary equipment for crushing, screening, separation in jigs, flotation, stockyards and transport. The output of the new plant, which should start in 1972 is calculated for 1.2 million tons of ore per year. This fact will cause an increasing of the iron ore residue (ashes), twice the present rate. It is therefore of utmost importance to utilise the value in order to upgrade the overall economics of the project.

The integrated project for the treatment of pyrrhotine ashes includes the recovery of copper and pelletising of the iron ore residue. The pellets should be exported or utilised for home smelting of pig iron or sponge iron units, using anthracite in low shaft furnaces or direct reduction. A great number of attempts and laboratory scale work has been carried out in overseas laboratories, aiming at the required elimination of SiO_2 from the pyrrhotine and recovering the copper content. Some pellet test series have been made with fairly good results.

The present chemical analysis of the pyrrhotine ashes and the future analysis of the pellets is shown in table 12. Estimated pellet quality after treatment, the pyrrhotine in the new preparation plant at Kottara is given as " pellets future ".

Table 12. Analysis of the pyrrhotine ashes and pellets.

	% Fe	S	Cu	Zn	Pb	As	Co	SiO_2
pyrrhotine ashes	55,5	2,15	0,67	0,2	0,1	0,04	0,06	11,2
pellets from	55,0	0,015	0,02	0,05	0,01	0,02	0,04	9,0
to	60,0	0,020						12,0



pellets	66,2	0,013	0,0	0,13	0,01	0,02	0,04	4,0	
fines	63,0	0,02	0					6,0	

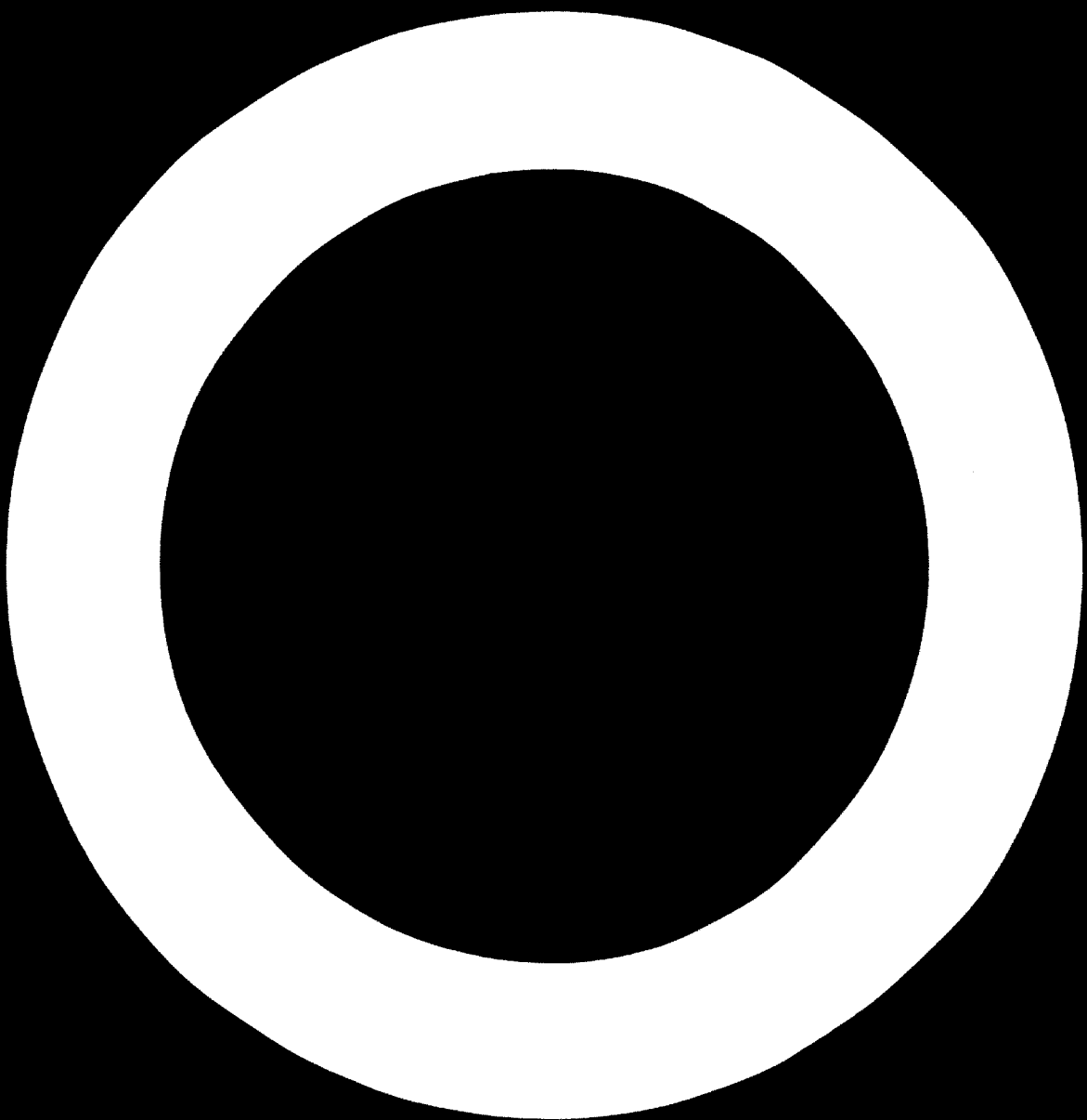
The moisture of the pyrrhotine ashes at the stockyard is estimated at 1,5 - 2 %.

A great variability in the strength of the pellets has been achieved, almost between 90 and 450 kg per pellet with normal pellet size 11 to 16,7 mm. Only one part of the results in strength is sufficient because of the minimal compression strength which should be at least 150 kg per pellet. The burning of the pellets was comparatively busted which can increase the reductibility of the pellets but causes a lowering in strength and worse Tumbler Test results.

3. Cost of the said pellets.

Provided the chemical analysis of the produced pellets will be in the range of 65 - 70 % Fe and 3 - 6 % SiO_2, which is assumed to produce in the first stage of exploitation, the market possibility will be inconvenient. It would be hardly possible to sell these pellets for a c.i.f. price higher than 6 US $ per ton by using ships with 15,000 to 20,000 dwt. It means the price of 20 cents per iron unit x % Fe. The handling and improvements of the existing installations in the present Five Year Plan of the Moroccan government and are destinated for phosphate loading.

It would be better to upgrade the present stocked ashes by a low magnetic separation in spite of the increasing of the investments costs. The simple treatment could increase the considerably their silica content. In this case the c.i.f. prices for pellets with 68 - 70 % Fe and 4 - 6 % SiO_2 should not exceed 8 US $ in 1973. The average pellet strength has to be about 200 kg per pellet with the lower range of 150 kg.

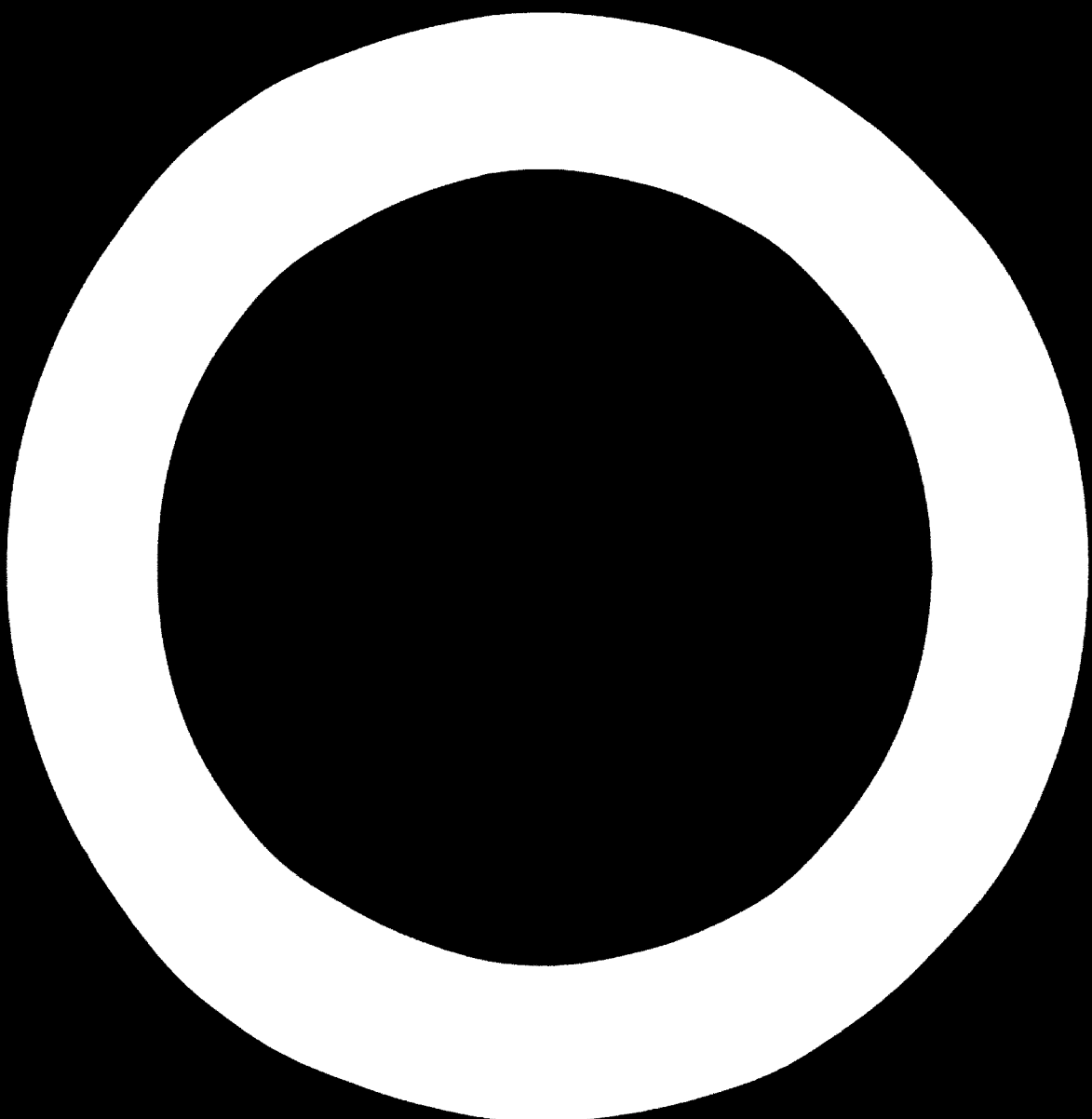


The possibility of transporting one part of the pyrrhotine ashes to Melilla and Nador for train before pelletizing seems to be inconvenient. Although the Cu content of the pellets produced from a mixture would not increase very much, the marketing possibility for Nador pellets would be more complicated apart from the fact that more expenses have to be brought in. Ship unloaders and considerable changes of stockyard equipment in Melilla port etc., transport by rail to Safi port, by ship to Melilla and by train to Nador have to be arranged with higher expenditure at least of $ US 2.- for each ton of ashes.

The assumed yearly production of 400 - 450 thousand tons of pellets seems to be high for supplying the domestic pig iron smelting industry. It would be, therefore, very advantageous to build at Safi, Casablanca or in another suitable area a special direct reduction plant using the pellets from Maroc-Chemie. A sufficient resource of reduction fuel (natural gas, anthracite lumps, oil, etc.) must be available in the surroundings.

Provided that a great share of the future pellet production should be exported, the same condition in marketing may be expected as would be achieved with Nador pellets. Taking into consideration that Italy is building two pelletizing plants for pyrrhotine-ashes, one near Terni with a total capacity of 1 million tons of pellets per year, the other in the Torino region with an output of 400,000 tons of pellets per year, the competition for Safi pellets will increase.

It is to be said that in case of participation of foreign capital in the Kettara Pyrrhotine Project investments a "captive" plant coul be built. It might enable the earlier starting of the new plant and change the costs, prices in great extent, depending on the conditions of participation.



10. - CONCLUSIONS

International trade in iron ore will continue to grow in response to the increasing requirements of the iron and steel industry. The production of pellets, which represented only 6 % of world production of marketable ores in 1961, may attain 30 % by 1980. Demand for iron ore fines is likely to remain high, since many of the iron ore importing countries have considerable sintering capacity which will also increase.

If the forecast is taken into account, it will be seen that a deficit in iron ore supply will occur in the next ten years. New development of mining capacity in overseas will cause large investments which have to expand the production capacity. Only after 1980 a surplus of iron ore will occur and satisfy the requirements for iron ore. The rate of increasing the iron ore capacity depends to a great extent on the growth of the Japanese steel production.

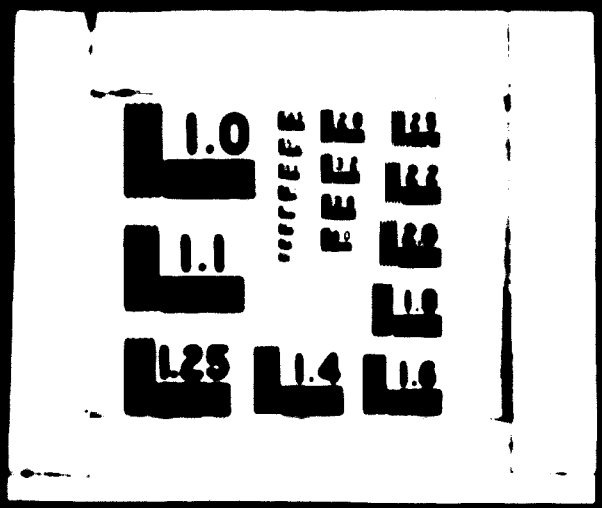
The relatively low price level on the world market for iron ore was characterised by an excess of potential supply over demand. In this year a slow increase in f.o.b. prices can be seen, due to the fact that higher salary and wages requirements are settled by the companies and an increase of investment costs (steel) and production costs occured. Another changes were made in the ship transports where the prices for freights rose in some cases by 20 - 30 %.

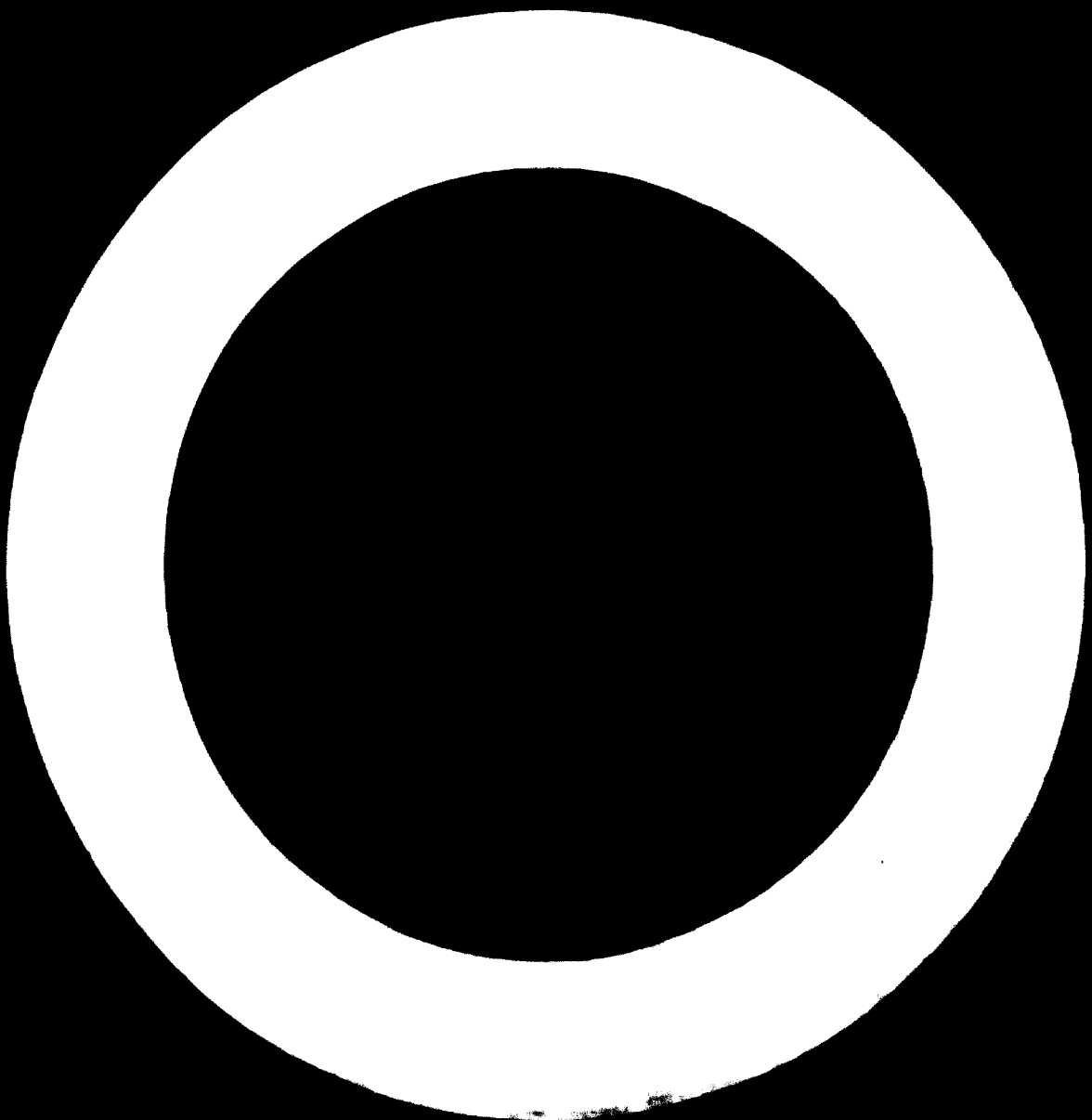
These factors together with the future forecasts in the world iron ore and pellet market have led to assessments of rising the common prices by 5 - 10 % up to 1980, taking into consideration the growing trend in salary and wages demands and production costs. In this point of view is the new Kudos pellet plant, which should start production in 1972, not a risk of wasting capital resources.

76.05.04

2 OF 2

OG935





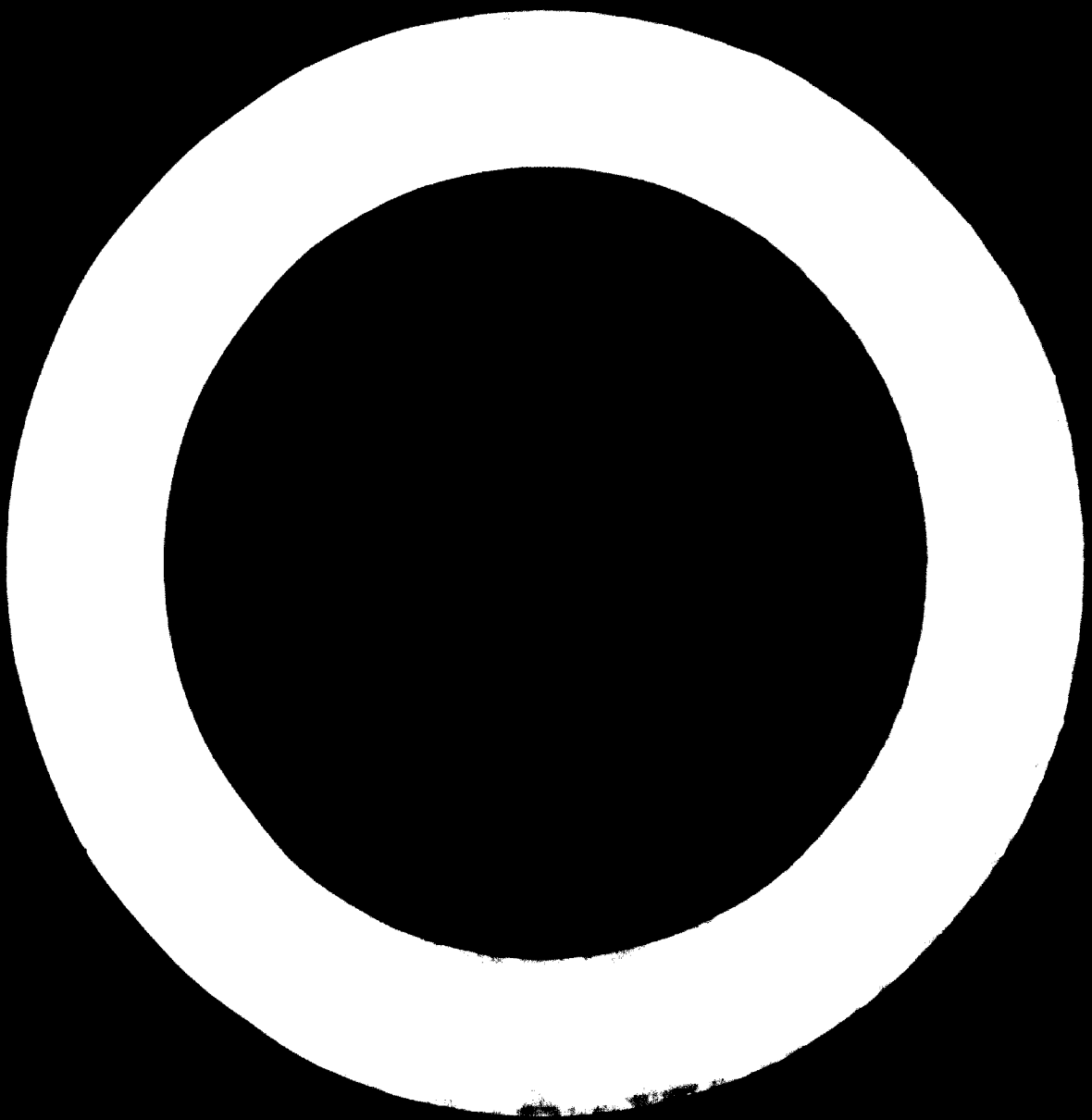
The prices considered by SEFERIF (£ US 10,30 f.o.b. Melilla and £ US 13,00 c.i.f. Rotterdam) are very reasonable under these conditions, provided that the 65 % Fe content, silica content less 3 %, and a minimal strength of 180 - 200 kg can be expected and kept over the life time of the plant.

Some reserves in the Fe and silica content and also in the production costs and transport costs to Melilla and technology improvements can be considered for the future possible dropping of the f.o.b. prices. Another small investments in the stockyard at Melilla, in the old loading equipment and increasing its capacity per hour and especially the construction of a new berth with the third shiploader for loading ships up to 20,000 dwt. could be very profitable for the export possibilities and could rise the position of the Nador pellets against the growing competition on the European market.

It must be remembered that these relatively favourable market conditions have appeared only in the last 6 - 9 months. One or two years ago the conditions were not so satisfactory. A great dropping of the Japanese steel production or a development of new deposits with better iron ore or sand with better position to the Western Europe can change to a certain extent the forecasted situation, which also doesn't calculate with political events as warfare, etc.

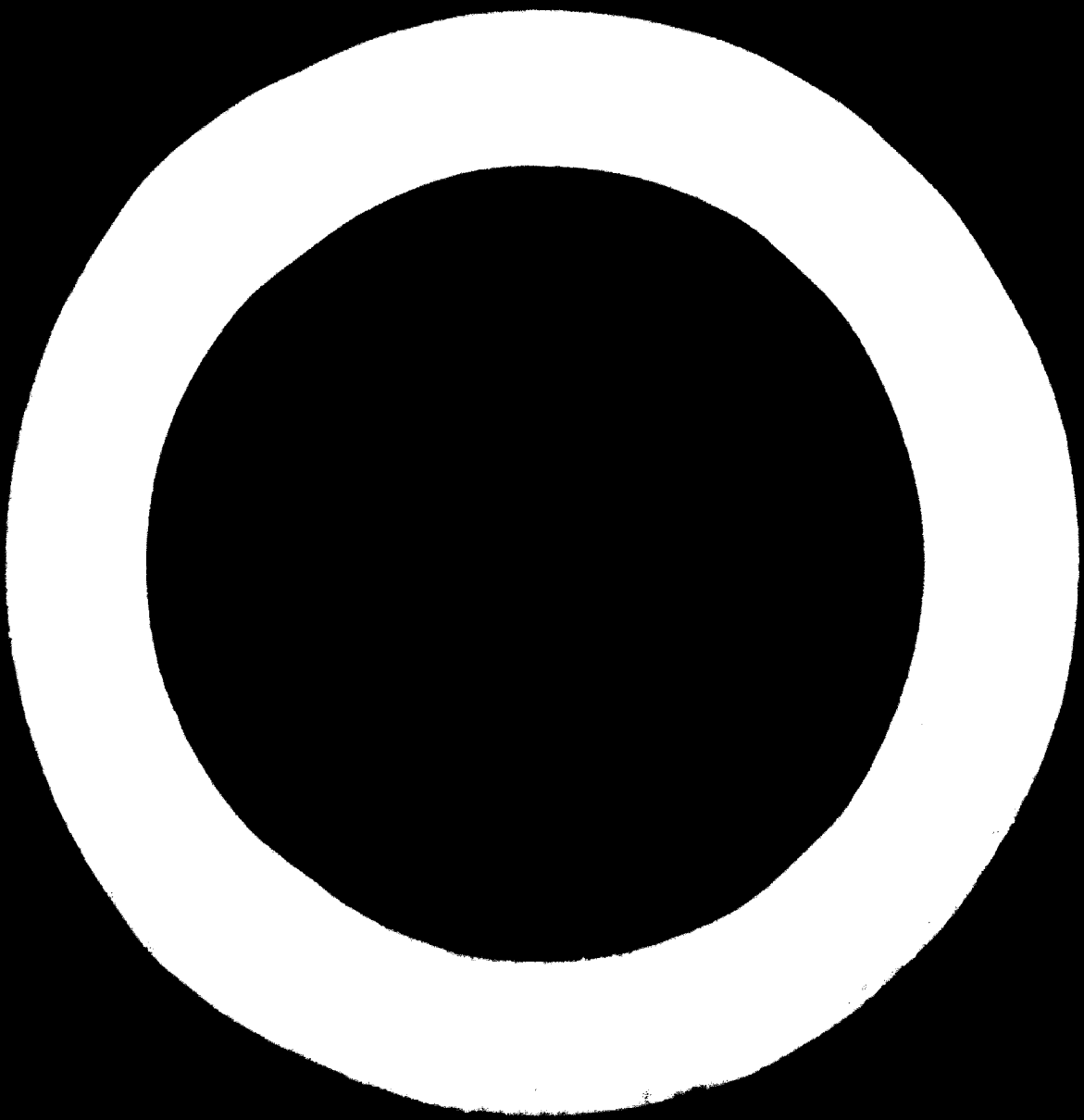
At the end of the seventies the iron ore demands should be covered by both, quality and amount. It is difficult to forecast with a certain probability the world market conditions for the period over 1980. Supposed the trends in steel production will last, the Nador pellets will meet higher competition and some precautions against this competition have to be taken in the future.

Considering the countries which can import the Na-



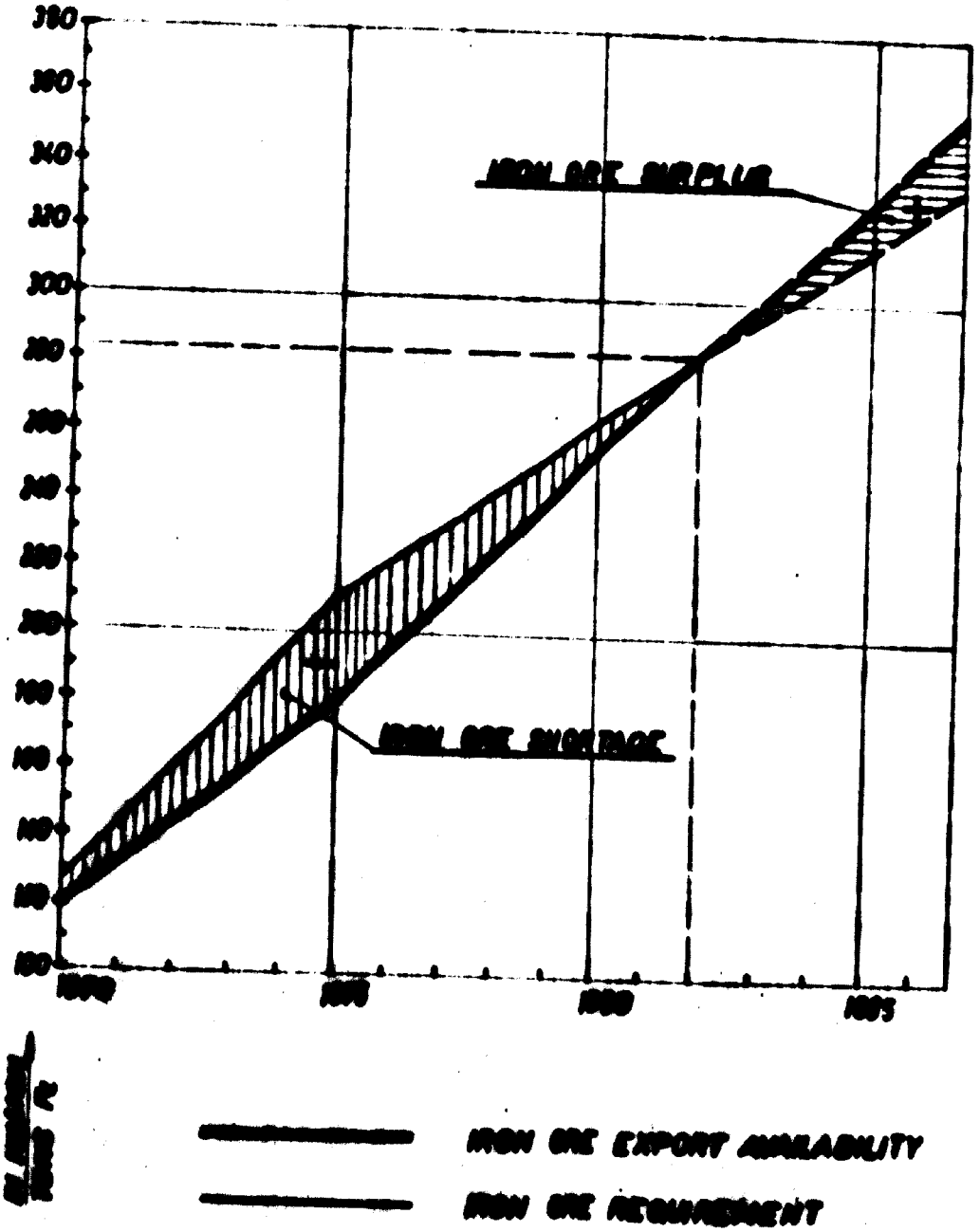
der pellets, the most favourable in distance are Spain (Sagunto), France (Fos) and Italy (southern part). Taking into account the clearing payment conditions etc., the best buyers could be France, Western Germany (via Rotterdam) and the United Kingdom. The question of exports to the East European countries (mainly to Czechoslovakia) must be considered in continuity with clearing payments and therefore with the necessity of having the market for some imported products from these countries to Morocco.

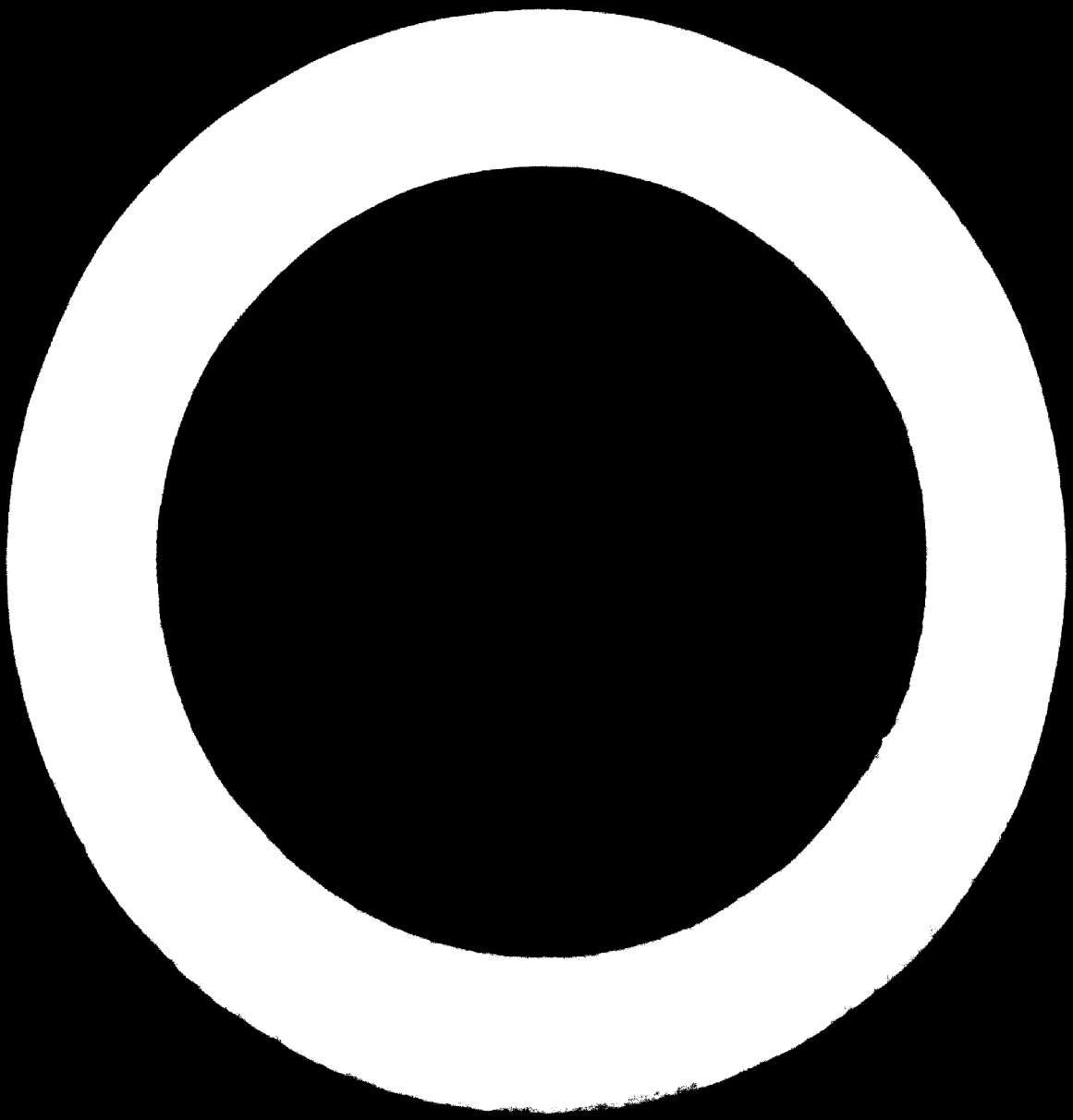
At the end of this marketing report the author hopes that the given information and data will help the Moroccan authorities with the marketing of the new product which should represent an important contribution to the Moroccab economy. Thanks are due to all the techniciens who have rendered their help in the consultations and also to Mr.Moerman, UNDP official at Rabat.



ANNEX I

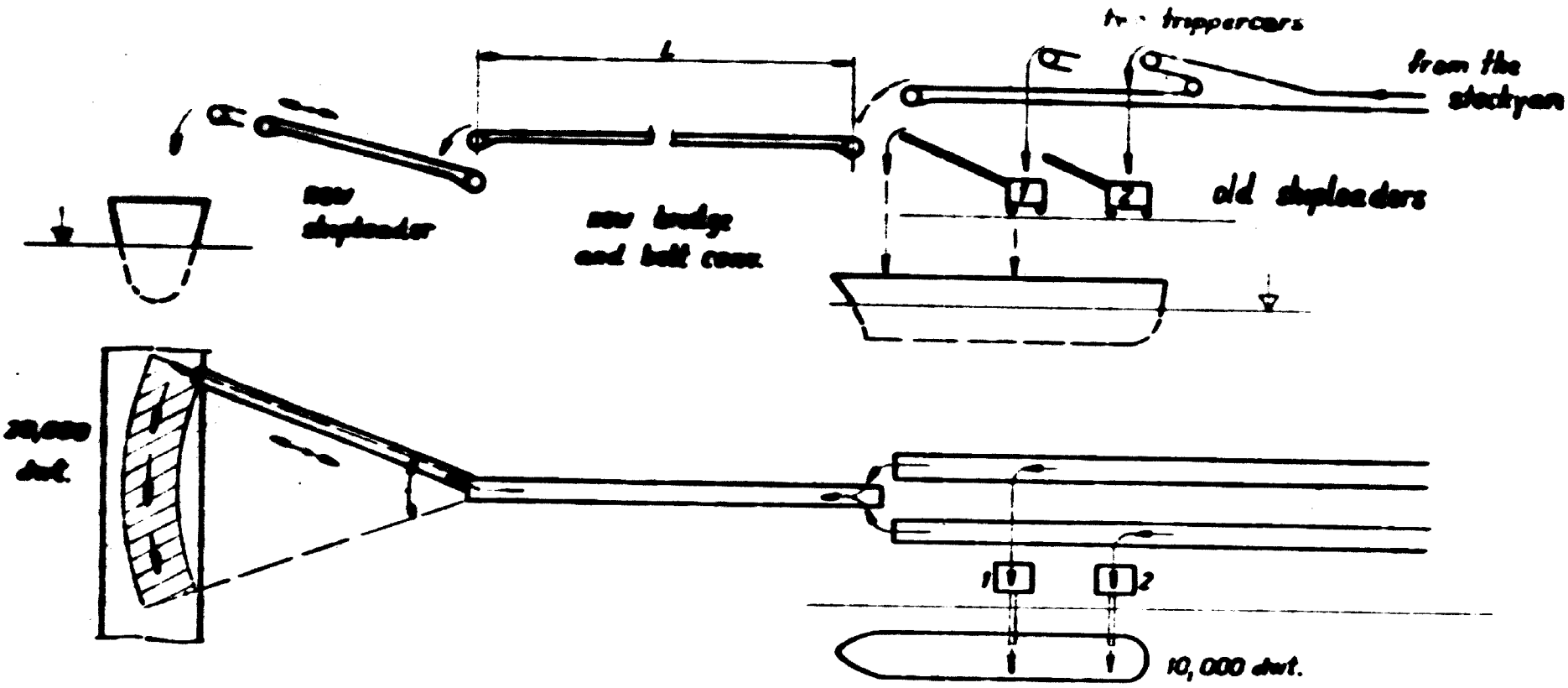
GRAPH OF THE TREND OF IRON ORE SURPLUS OR SHORTAGE IN THE WORLD FROM 1970 TO 1985

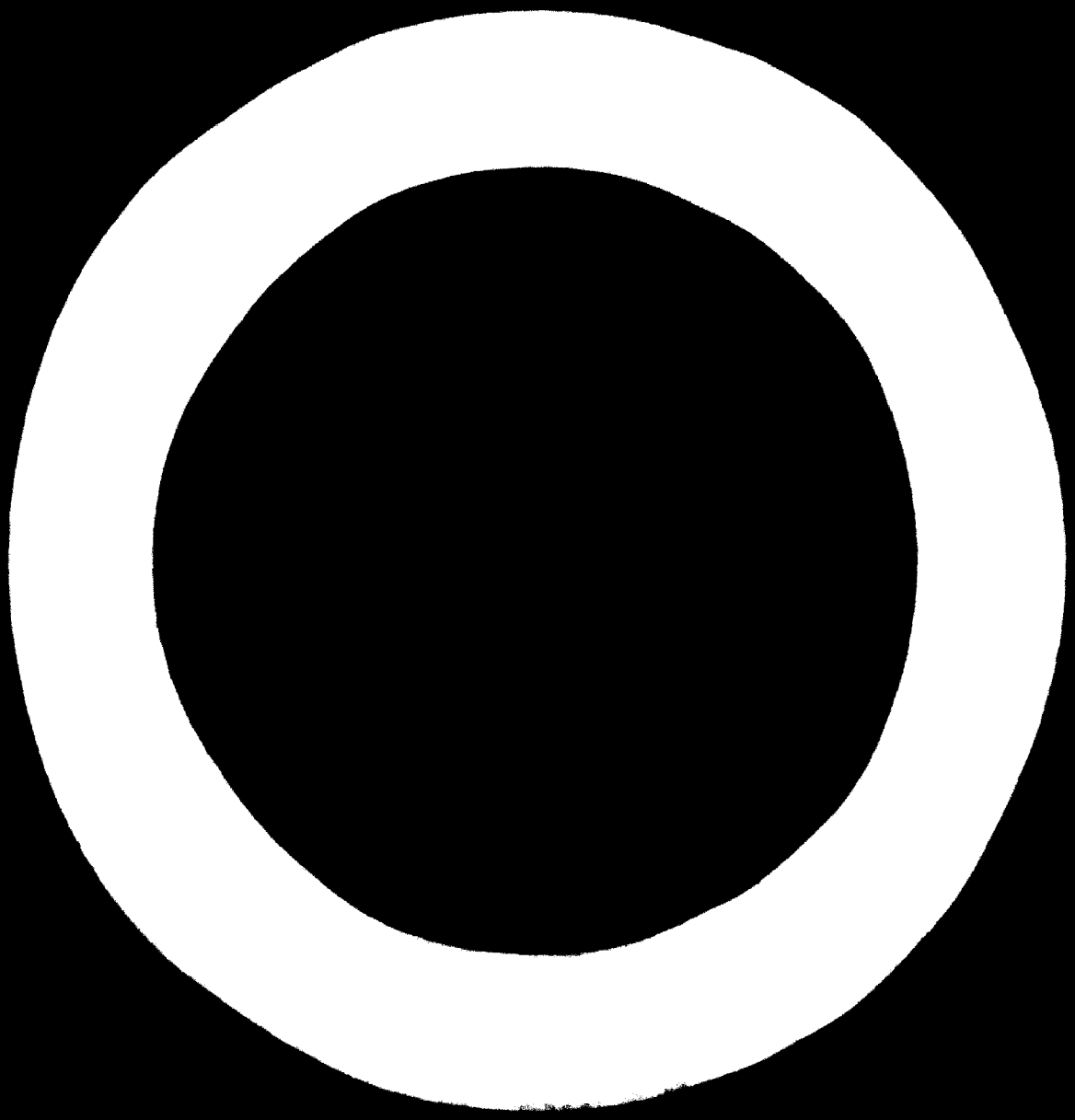




ANNEX I

EQUIPMENT FOR LOADING VESSELS OF UP TO 20,000 dwt. AT MELILLA

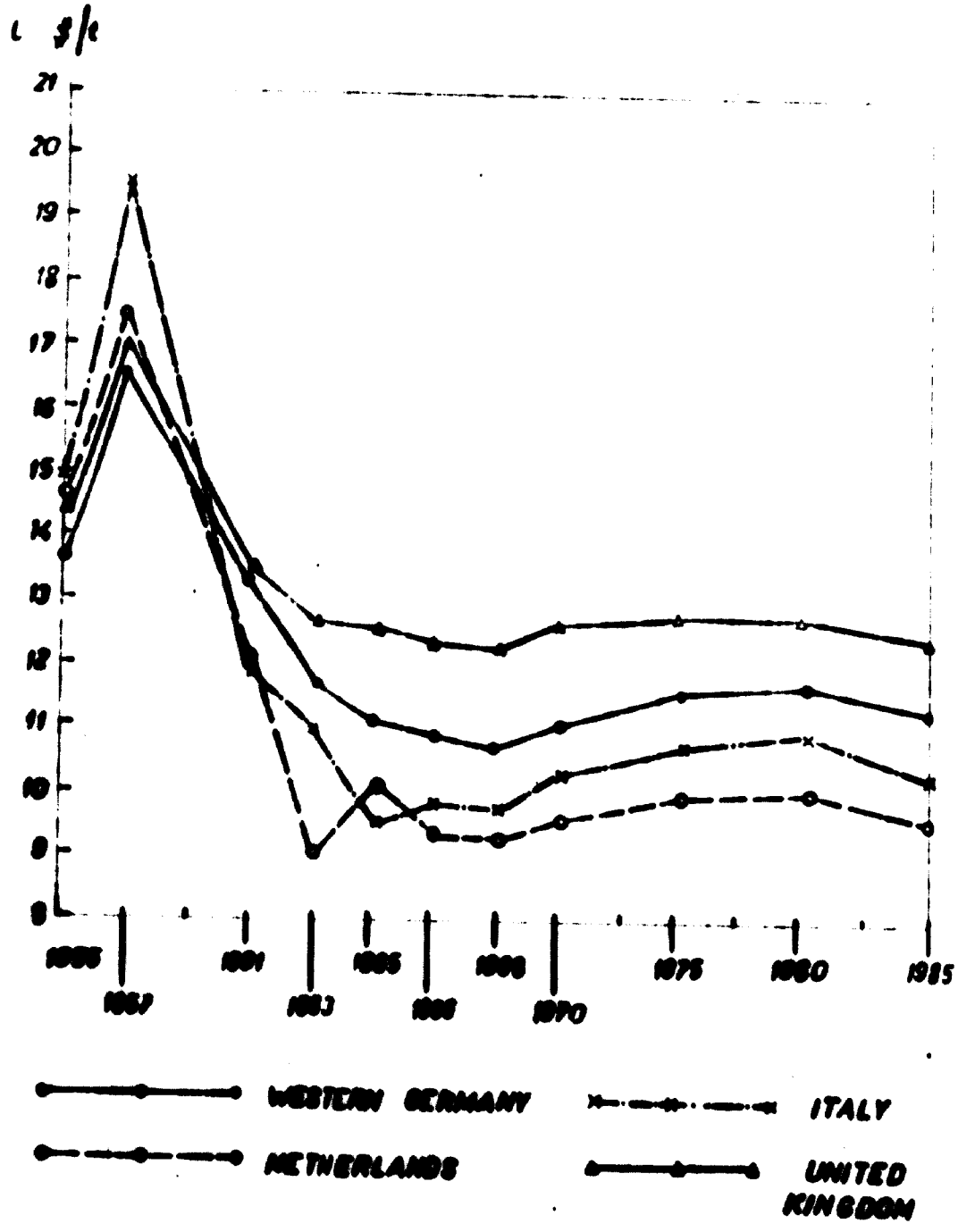


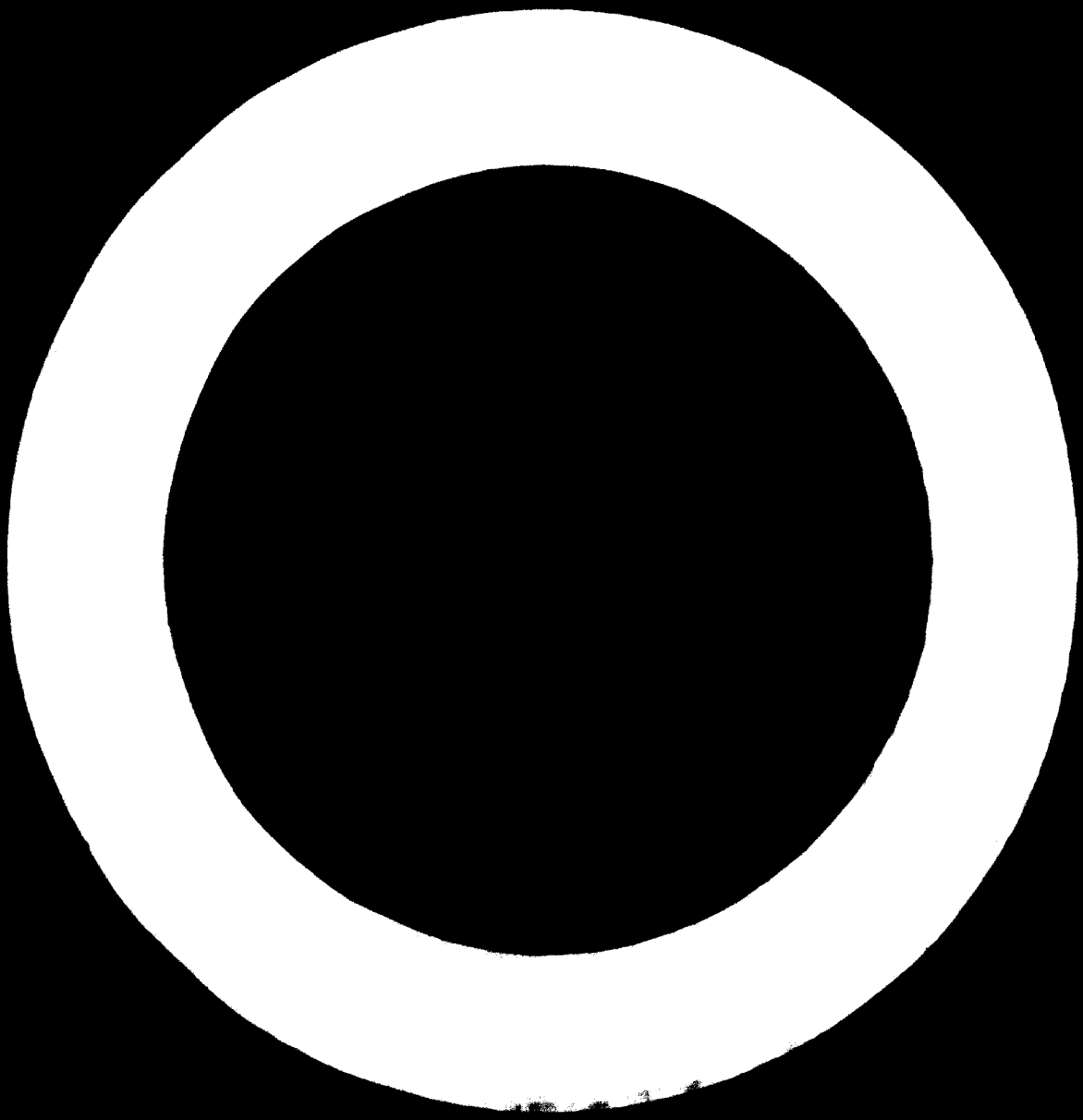


ANNEX III.

DEVELOPMENT OF AVERAGE C.I.F. PRICES OF IRON ORE IN E.E.C. AND U.K. (1955 - 1985)

(DOLLARS PER METRIC TON)





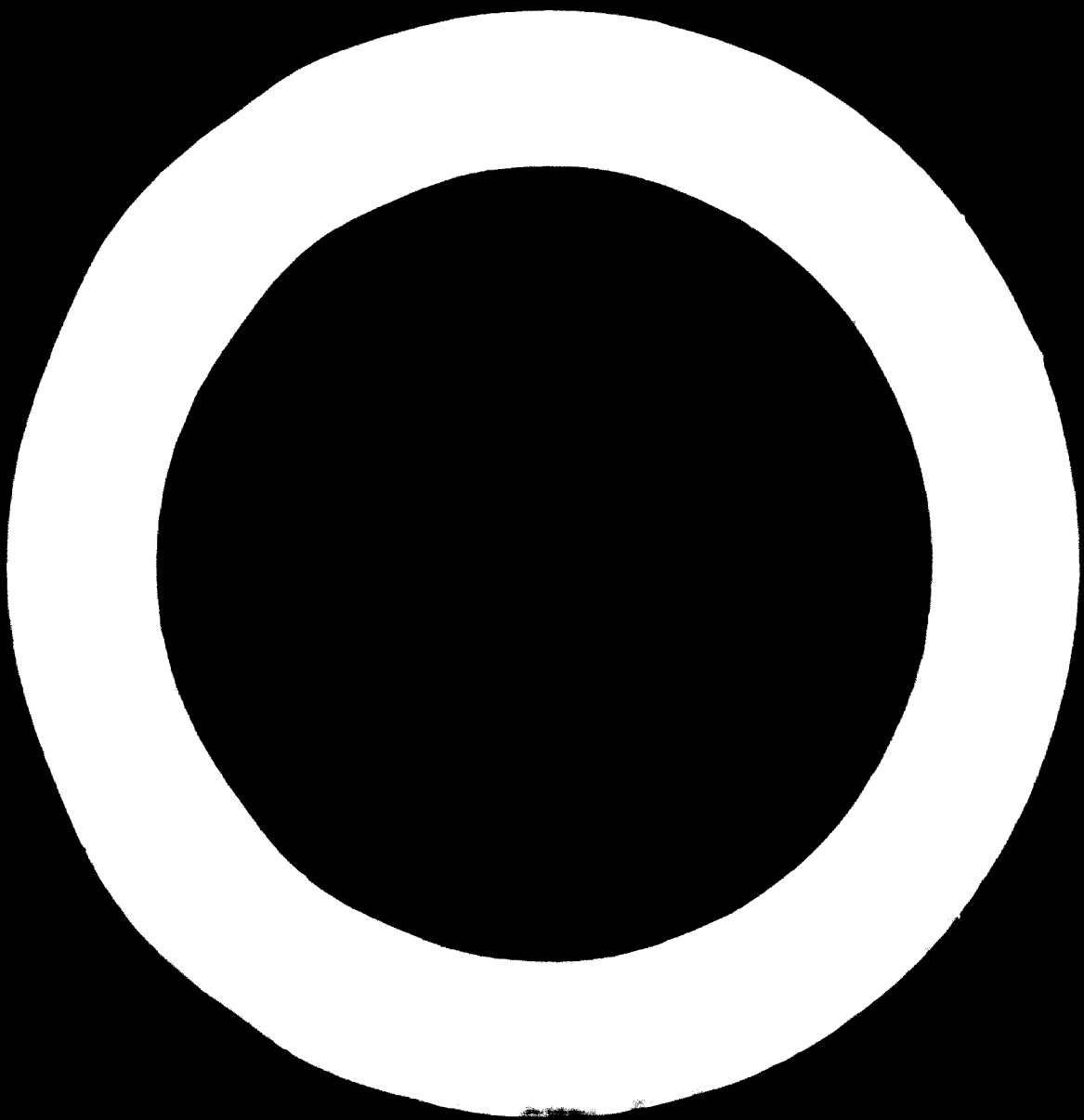
ANNEX IV

MARKETING IN WESTERN EUROPE

The Moroccan authorities have requested during the first discussions to visit all the possible customers in Western Europe in order to get some more information about the possibility of exporting the Nador pellets. It was not possible for me to go to all the countries and after approval by UNIDO only some of them were chosen. The first visit was made to Spain. The next one should bring new experience and data of iron ore market from the United Nations Headquarter for Europe at Geneva - the Economic Commission for Steel. Another visit was made to the European Economic Community's headquarter at Brussels, where some important data about iron ore demands in the whole EEC have been given. After spending one day at The Hague-Netherlands dealing with W^m.H.Muller's company, I went to Düsseldorf to discuss the matter with the Rohstoffhandel. Only the first and the last visit is described in this annex, while the data from the other mentioned countries are included in the report.

a) Results of the visit to Spain.
Following companies or offices were visited from the 9th to 11th June 1970:

- Direccion General de Industrias Siderometalurgicas. Dealt with Mr Aguilio and Mr Irisarri.
- Direccion General Minas y Combustibles: Mr Herrero, Mr Jaime Navarro Benenech (chief of the Nador mines for 15 years).
- UNESID (Unión de Empresas y Entidades Siderúrgicas): Mr Eduardo Lavilla Calvo.
- ENSIDESA (Unión de Siderúrgicas Asturianas, S.A.): Mr Allende.



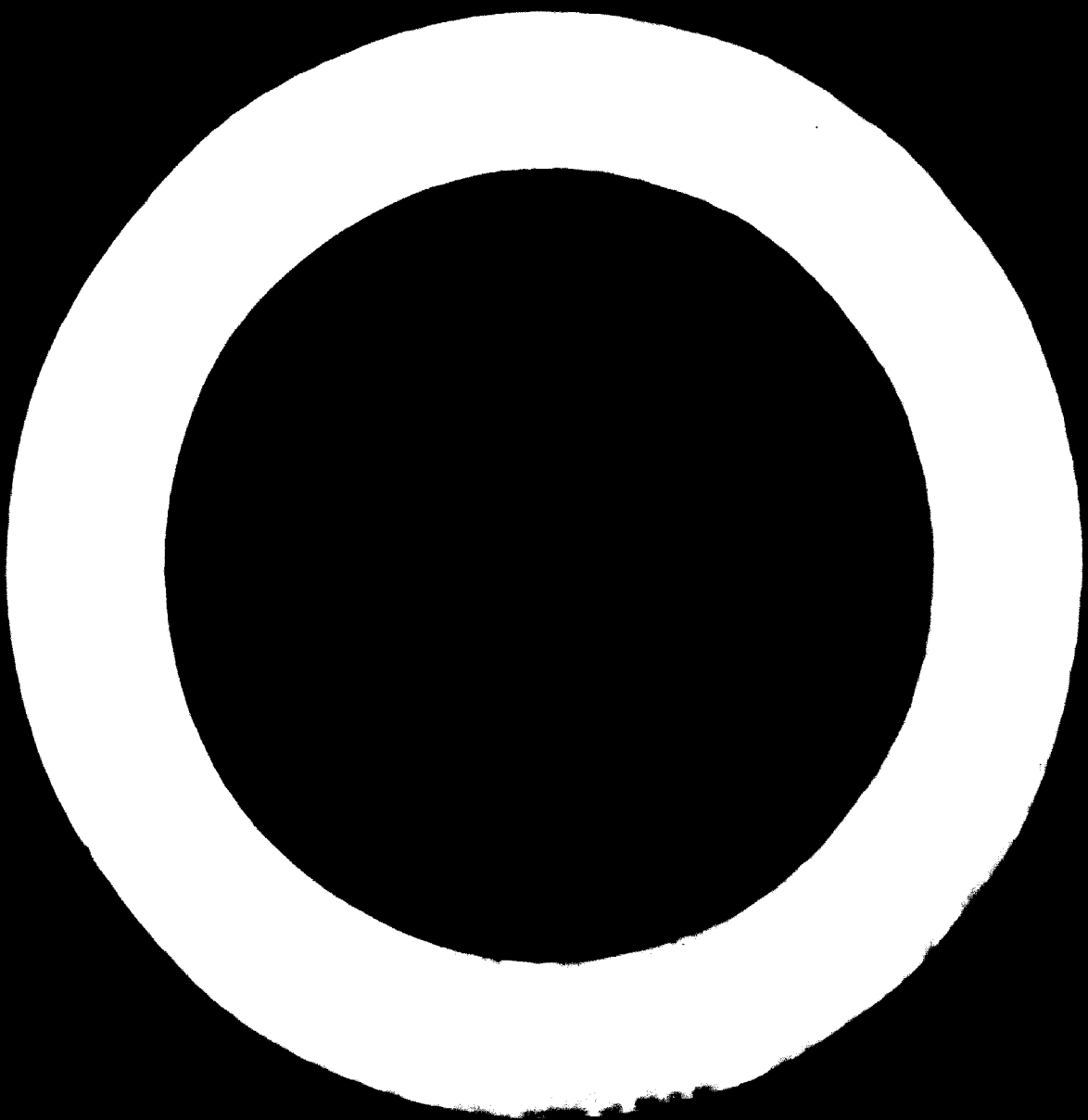
- ENSIDESA (Empresa Nacional Siderúrgica, S.A.): Mr Humberto Moeremans Murtede (subdirector de Compras), Mr José Manuel Corcuo Albarracín (jefe del Servicio de Compras de Primeras Materias).
- Altos Hornos de Vizcaya, S.A.: Mr José Mir.

The members of the ministry and the steel plants were very interested in buying the Kudor pellets which seem to be not much expensive. Some details about the future expanding of the Spain steel industry were discussed. All the three steelplants officials were willing to signe contracts for the Kudor pellets immediately.

Altos Hornos de Vizcaya want to buy some 150,000 tons of these pellets for the first time in a three-years contract. Only f.o.b. prices are requested. I have spoken about the minimal prices of US $ 18.00 per metric ton f.o.b. Bolilla since 1972 for 65 % Fe content.

ENSIDESA is interested in buying at least 200,000 tons of Kudor pellets in long term contracts for 10 years. They want some pellet samples for testing their quality before-hand. I have spoken about c.i.f. prices of more than US $ 13.00 per ton of pellets, which can be favourable for SEFERIF because of a short distance between Spain and Bolilla. The f.o.b. prices could be, therefore, higher approximately at a rate of US $ 10.00 - 11.00 per ton of pellets. If the pellet quality is as forecast, a higher annual import up to 300 - 350 thousand tons can be realised.

UNINSA: The officials dealing with primary materials reside in Gijon and it was not possible due to a short time stay to arrange a visit at the plant. The authorities of the ministry told me that Spain would need some 2 - 3 million tons of iron ore or pellets in the next years, although a higher investment in their own iron ore industry should be expected.

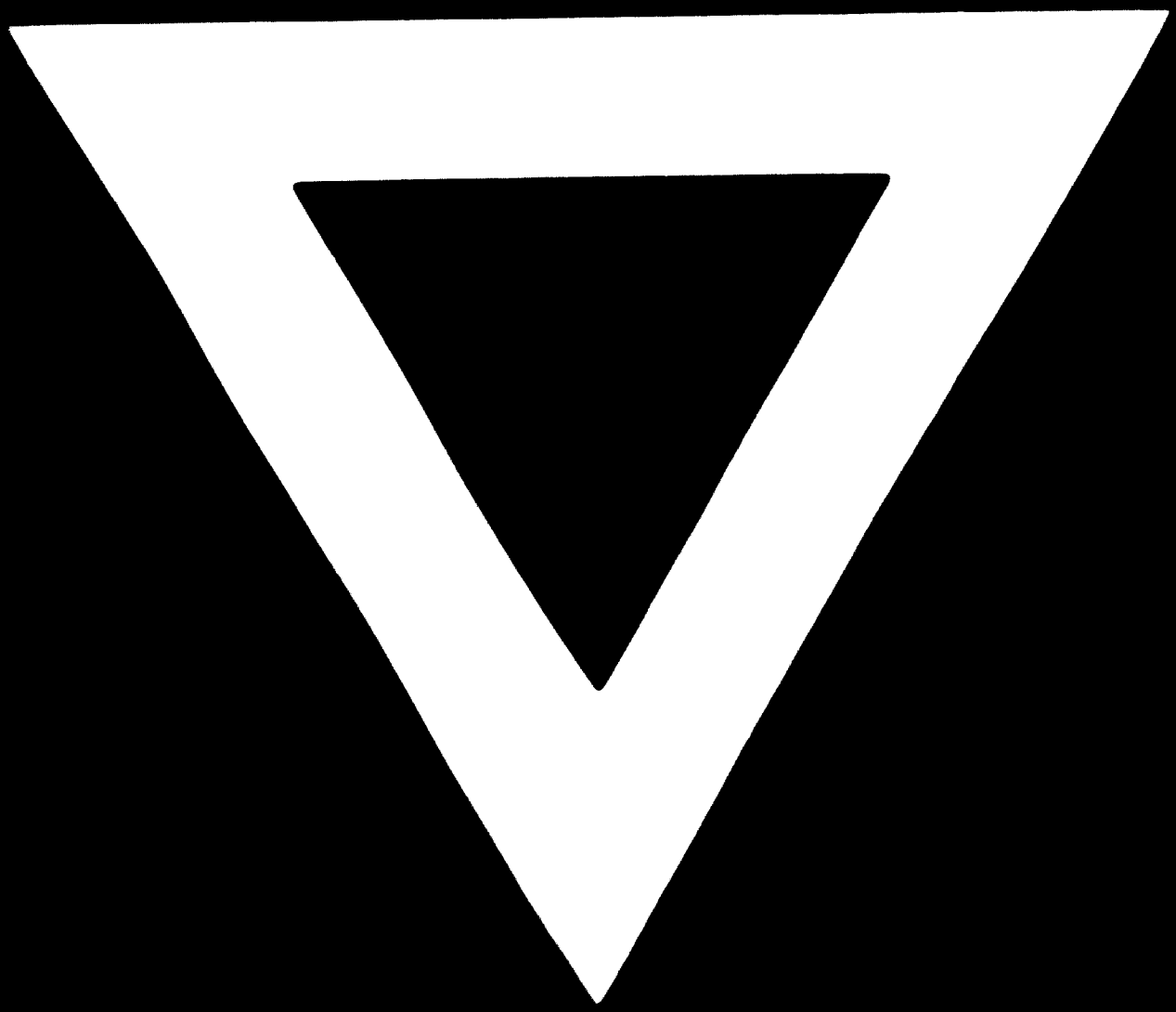


b) Visit to W^m.H.Mueller Co., The Hague, Netherlands. I have met Mr D.A. de Witte and Mr A.M. Kusse from the ore division, while Mr Ungerer was not present in The Hague. Discussions over the possibility of selling some pellets to Czechoslovakia, Eastern Germany, Poland and Romania were held. It seems that Czechoslovakia could buy in clearing an annual amount of 120 - 200 thousand tons and Romania 150 - 250 thousand tons of Nador pellets at given prices $ US 10.30 f.o.b.

Another Dutch iron ore import company, the N.V.Noord-Europeesche in Amsterdam was not possible to visit (only one day stay in Netherlands) but as I under - stood from the telephone call to Mr Bloch, a member of this company, they are interested in getting more details about the whole intention.

c) Visit to Mr Plenkert, manager of the Rohstoffhandel G.m.b.H. at Düsseldorf, Western Germany has shown that the whole production of Nador pellets could be bought by this company if the quality is as presumed and prices are not higher than $ US 13.00 c.i.f. Rotterdam. A sample of the pellets has to be sent to Othfresen for testing. No long-term contracts are likely to be realized.

[redacted]



76.05.04