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THE PULP AND PAPER INDUSTRY IN EGYPT

Background Paper

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THE PULP AND PAPER INDUSTRY IN EGYPT

by

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HISTORICAL DEVELOPMENT :

The ancient Egyptians were the first people who used writing.
They wrote on papyrus paper. They used it for record-ing their sciences and different branches of knowledge, as far back as 4300 B.C. The word " PAPER " comes from papyrus, the first material used for making paper. Papyrus paper is composed of layers or strips out from the papyrus stem and pressed together.

The first industrial paper mill started at the beginning of this century in Alexandria, north Egypt. It is claimed to have been the first mechanized paper mill in the Middle East. The operation started with one machine.

Its output was approximately 10 Tons per day of light weight solid board for small boxes. In 1922, a new machine of slightly larger capacity was added followed by another in 1935. Since then no expansion has taken place in this mill.

There are no plans to modernize the existing equipment but at some future date it may be replaced by a new install-ation.

The next development was the foundation of the National paper Company. This mill is located at Tabia east of Alexandria. Reasons for selecting this location are the proximity of rice growing areas and the port of Alexandria as well as the possibility of discharging effluent to the sea. Two paper machines and a straw pulp plant started up in I940. New paper machines were added in I945, I96I and I968. in I965 and I970, reconditioning and rebuilding of some of the machines took place. A sixth machine was added in I977. This machine was originally built in another mill at Suez.

In I945, the Société Industrielle du Moyen Orient " SIMO" was founded north of Cairo. This mill started with three paper machines producing wrapping paper. It was complemented by two small plants for air dried grey and coloured boxboord.

A sixth machine is now under construction. It is intended that this machine will produce 50 t/d duplex folding board.

In the early sixties there was an important jump in production capacity in the country. At about the same time, in I96I, the sack kraft paper mill in Suez and writing and printing paper mill " Rakta " near Alexandria, started.

The Suez mill used imported kraft pulp and was supposed to use a part of the unbleached bagasse pulp from the mill in Edfu which would start a few years later. In I967, it was decided to dismantle the Suez mill in order to protect the equipment from military action in the critical Canal Zone.

The machine was reerected in the National paper mill as previously stated.

The Rakta mill started in I96I with a bleached rice straw pulp mill and two paper machines for woodfree writ--ing and printing papers. In I967, a 30 t/d mechanochem--ical rice straw pulp line and a waste paper pulping line were added to supply furnish for the 50 t/d multilayer board machine installed in the same year.

One year later, in I968, a third machine for writing and printing (60 t/d) was added.
I970 saw the start-up of a new bleaching plant for 100 t/d of bagasse pulp. It was designed to work in parallel with the existing rice straw line. In 1976, the two oldest paper machines were modernized to produce 60t/d writing and printing paper each.

A new additional rice straw pulp mill with 90 t/d capacity is now under construction. The bagasse bleaching plant will be modified to handle this quantity of rice straw pulp.

The last new enterprise in the pulp and paper field was the Edfu bagasse mill. It started operations in 1965 and was designed to produce 60 t/d of unbleached bagasse pulp.

From a review of the preceding paragraph it can be concluded that the bulk of the pulp and paper now produced in Egypt is made with relatively modern equipment.

EXISTING PRODUCTION AND CONSUMPTION OF PAPER :

The existing paper industry produces about one half of the papers currently consumed in Egypt.

The papers produced are printing and writing papers, wrapping papers and boards. No newsprint is produced. The raw materials used are rice straw, bagasse, waste paper and imported long fibre pulp.

There are fifteen paper mills and one market pulp mill in Egypt . Nine of the paper mills are small, primitive, privately owned mills with productions ranging from less than 1 T/D to 15 T/D. The combined production is only 57 T/D . They produce the lowest grades of course wrapping paper and chipboard and are marginally profitable.

The production of the six goverment owned paper mills is 440 T/D or close to 90 % of the total production of paper in Egypt.

The current total paper consumption in Egypt is 300,000 T/Y or 7 kg. per capita.

The consumption should increase to 590,000 T/Y by 1985.

The principal row materials available for the production of pulp in Egypt are bagasse and rice straw. These short fibre raw materials produce pulps similar to hardwood pulps and consequently these are limitations as to the types

of papers that can be produced using a high proportion of local raw materials. Long fibre softwood pulp must be imported to blend with the locally produced short fibre pulps for the production of most types of paper.

RAW MATERIALS FOR PULP AND PAPER :

At present rice straw and bagasse are used as raw materials for the domestic pulp industry.

These two fibrous raw materials are available in much larger quantities than used today.

As a matter of fact, bagasse can be considered as a very attractive raw material owing to the low price of fuel oil which would serve as replacement fuel.

Theoretically, certain other raw materials show some potential as fibrous raw materials for the pulping industry. However, either availability is very limited or their cost is so high that they are of little or no economic interest.

All fibrous raw materials available at present in Egypt are of short fibre type. The Egyptian paper industry therefore is forced to rely on imports for long fibre pulp.

The cost of fibrous raw materials available in Egypt is low compared to other countries.

Following is a brief discussion of the main raw materials used in Egypt for pulping.

RICE STRAW :

Egypt is a major producer and exporter of rice. The area planted with rice amounts to about 1 million feddans (420.000 ha), see Table 3.

Rice cultivation is concentrated in the Nile Delta .

Production amounts to approximately 270'000 Tons of white rice . The corresponding quantity of rice straw reaches approximately 1,000,000 tons.

Table (3) shows the areas of crops under cultivation which, in principle, could be consid--ered potential sources of paper making fiber.

Rice straw has been used for a considerable time in semi-industrial installations for manufactur--ing coarse board and wrapping paper. Since 1923, it is being used in Indonesia for bleached printing and writing paper.

The mill at RAKTA, established 1960, is probably the world's largest and leading rice straw pulp mill. Rice straw is also used by the National paper Co. and by Sinc.

Total consumption of rice straw for pulping is at present about 100'000 to 110'000 t/year. Another 10'000 t/year of rice straw is being used by the soft board plant in Damietta.
Large quantities of rice straw are used by the farmers as fuel and even as fodder, despite the high silica content.

Rice is planted in May and harvested in October-November. Delivery of rice straw to the mills starts in November and is completed in June. It is purchased through contractors who deliver it to the mills in bales.
In principle, rice straw is in abundant supply. At present only a fraction of the available quantity is being used for pulping or for softboard manufacture.

PULPING OF RICE STRAW

An analysis of rice straw is shown in table(4) Rice straw can be easily pulped. An alkaline cook is considered to be the most suitable. There is no proven process for recovery of the cooking chemical.

This is a severe handicap for rice straw pulping. It means that the black liquor , containing about half of the straw quantity and all of the cooking chemicals, has to be dumped. If chemical recovery were possible, dissolved organic material could be burnt and steam generated. Chemicals could be recycled and pollution would be much lower.

The quality of rice straw pulp can vary considerably, depending on the amount of leaves and sheaths that remain in the straw after cleaning . These parts of the plant contain mainly non-fibrous cellulose. The result is a pulp that drains or dewaters very slowly. To a certain extent this is not undesirable as sheet formation may improve. On the otherhand, it seriously limits paper machine speed. Effective removal of sheaths and leaves would reduce pulp yield. Methods used today at Rakta are rather effective. Hence, yields are still reasonably high but the pulp dewaters very slowly. This problem manifests itself on vacuum filters in the pulping and bleaching operations and on the paper machines.

New high yield varieties of rice tend to be shorter in size.

Further, the plant has more leaves. This is very undesirable for pulp and papermaking operations based entirely on rice straw.

Another limiting factor is the high silica content of rice straw. It is the presence of silica that causes difficulties when attempting to recover pulping chemicals from an alkaline cook. It is responsible for very high black liquor viscosity at the concentrations needed for combustion and for inadequate sludge settling after causticizing.

Better removal of leaves and sheaths before pulping would definitely be a step in the right direction because they contain 3 to 4 times as much silica as the stalks.

Unbleached semi-chemical rice straw pulp made either by soda or by a lime cook yields fibre with good stiffness properties. It could be used to produce corrugating medium of acceptable quality but paper machine speed would be low owing to slow stock drainage.

BAGASSE

Bagasse consists of the remnants of sugar cane stalks from which the sugar containing juices have been extracted by crushing.

For decades it was used exclusively as fuel in the sugar mills. Small and older mills need all of their bagasse for the generation of process steam. Larger and more modern mills have a surplus of bagasse.

As a source of fibre for the production of pulp and paper, bagasse is one of the newer developments. Major installations came into operation after world war 2.

Many processes were tried with varying degrees of success . Success did not come until proper depithing methods were developed and the alkaline cooking process was adopted. The first successful mills were established in Peru (Paramonga) and Other Asia.

Today, bagasse pulping technology is well establish-ed. In many parts of the world it has become accepted practice to use bagasse as raw material for pulping and to replace its calorific value by fuel oil at the sugar mills.

Bagasse is discharged continuously from a sugar mill during the crushing season. A pulp mill is not faced with harvesting problems but it must provide storage to assure a supply of fiber during the many months when the sugar mill is shut down. Cost-wise, it is very advantageous to locate the pulp mill next to the sugar mill. In this way, transportation costs are

avoided.

In Egypt, there are seven sugar mills in operation, these mills and their bagasse outputs are listed in Table (6).

Sugar mills operate only during the sugar cane harvesting season. In Egypt the crushing season lasts 120-140 days, starting around December 20th, every year.

Only one sugar mill, EDFU, has a relatively small bagasse pulp mill attached to it. The actual output of this mill is at present about 40 t/day. The availability of bagasse from the EDFU Sugar Mill would be sufficient for a pulp mill of 100-140 t/d bagasse pulp.

The price of bagasse to be charged to a pulping operation is essentially a direct function of the quantity of oil that is required to replace the depithed bagasse. It is economically advantageous to return pith to the sugar mill for use as fuel.

The EDFU pulp mill bales and stores moist depithed bagasse. Pith is returned to the sugar mill as fuel. The cost of its depithed, baled bagasse is US$ 11 per o.d. ton.

Bagasse would be available in large quantities to the Egyptian pulp and paper industry. The present

sugar cane production, if completely converted to pulp, would yield more than 200'000 t/y of bleached pulp. The cultivation of sugar cane has increased steadily over the years and the government is planning further increases.

PULPING OF BAGASSE

Bagasse is composed of two distinct cellular constit-uents fibre and pith. The fibre fraction consists of long, strong fibre bundles from the rind and from fibrovascular bundles within the cane stalk.

This fibrous fraction is an excellent raw material for the production of pulp and paper. The pith fraction consists of thin walled non-fibrous cells that contained the sugar juices before crushing. These pith cells are of no value for the production of pulp and paper.
In fact, their presence is detrimental to the production of pulp and paper and they must be removed prior to pulping. Further, there is a dense non-fibrous waxy epidermal material which is of no papermaking value. In addition, bagasse contains residual sugars and other water solubles and it invariably contains appreciable quantities of dirt, stones and other foreign material that enters the crushing mill with the cane.

A typical composition of whole bagasse, before depithing is shown in Table (7) Rather significant variations in the composition can occur, due to differences in cane variety, climatic conditions, time of cutting and mill operating conditions.

The first step in a bagasse pulping operation is pith removal. This is usually accomplished today in two stages. In the first stage, moist bagasse in its natural state of approximately 50% moisture is shredded and screened in a rotary mill. The pith along with some fine fibre are rejected and returned to the sugar mill. The accepted fraction contains about 80% fibre and 20% pith. part of this fraction is conveyed to an area where it can be stored several months for use when the sugar mill is not in operat--ion. Most authorities agree today that bagasse should be stored on a slab in bulk. The other part of the accepted fraction is conveyed to a wet depithing operation where the fibre content is raised to 90% . The washed fibre is drained, pressed, impregnated with alkaline cooking liquor, either soda or kraft and fed to a continous digester. From this point on, conventional washing, screening and centri--fugal cleaning equipment is used to produce finished pulp.

by varying the amount of cooking chemical and the digester dwell time, all grades of pulp from semi-chemical to bleachable can easily be produced. A three stage CEH sequence is adequate for an 85° brightness bleached pulp.

USE OF RICE STRAW & BAGASSE FOR PAPER MAKING :

A combination of bagasse pulp and rice straw pulp could offer certain advantages. It would be possible to use a high total amount of short fibre pulp and to maintain a good drainage rate. The formation and sheet properties would be good.

Strength properties cannot be increased, neither dry strength nor initial wet strength. With modern paper machines, problems with low initial strength can be over--come with closed draws from wire and through the press section.

In Table (8) approximative furnish compositions using rice straw and/or bagasse pulp are shown. Furnish composition are given, considering unbleached or bleached grades, rice straw of bagasse pulp and required imported pulp. Rice straw pulp and bagasse pulp can be used alone, up to the given amount or in various combinations together, up to the amount given for one of the components. The Table (8) shows further, that some grades of paper

cannot be easily manufactured only with indigenious raw materials :

- cement sack kraft paper. The best kraft paper, suitable for cement back, is made from softwood pulp. With a Clupack installation, a high bagasse pulp content could be achieved.
- true linerboard needs softwood kraft pulp.
- Newsprint and magazine paper (supercalandered). Particularly newsprint requires groundwood. The only substitute for the true newsprint appears to be the developments for chemi-mechanical bagasse pulp. Again for these paper qualities, opacity, printability, ink absorbency (during highspeed printing) and runability (adequate strength for the printing process) are of prime importance.

USE OF WASTE PAPER

The use of waste paper in Egypt follows standard practice. Problems connected with its use are common all over the word :

- Uniformity of quality
- Presence of dirt, foreign materials and plastics
- Necessity of ink removal for higher grades
- Lower strength compared to wood pulp
- Price

The presence of wet strength paper in waste does not yet create operating problems. This is largely due to the fact that the paper producer themselves use little or no wet strength resins.

Deinking is not yet practiced in Egypt . This could provide a new source of good grade fibre but the economics would require examination.

FUTURE PLANS FOR PULP AND PAPER INDUSTRY IN EGYPT :-

It is seen from table (2) that paper consumation is growing rapidly. This may result in a critical gap between the demand and the capacity of the existing mills.
Accordingly it is very essential to improve and expand the existing mills. However this cannot meet the total domestic demands.

The future demand is sufficient to justify the construction of a number of new mills.

We may classify future plans into three categories :

1 - Modifications and additions to existing mills to optimize their production.
2 - Smaller projects suitable for private owners.
3 - Major new projects.

The first group consists essentially of projects

to overcome the technical and production problems facing the existing mills in order to improve their viability and operations.

These projects are identified as follows :-

1 - For Rakta Pulp and paper mill :

a - Expansion and improvement of PM 3 to a capacity of 120 T/D instead of the existing 60 T/D.

b - Expansion and improvement of the board machine to a capacity of 90 T/D, instead of the existing 45 T/D.

c - Off machine coater.

d - Electrolytic plant to produce chlorine, caustic soda and hypochlorite.

2 - For National paper mill :

a - Modifications of PM 4 producing wrapping and envelope.

b - Modification of PM 5 to produce writing and printing paper.

c - Modification of PM 6 to produce writing and printing paper.

3 - For Simo paper Mill :-

Addition of a complete new 150 T/D multiply board machine.

The second and the third groups are shown in tables (9) and (10)

REFERENCES :

- FAO forestry paper, world pulp and paper demand supply and trade.
- Central Bank of Egypt, Anual report 1977
- Nation - wide study of Egypt's pulp, paper and Board Industry, Studler Hurter limited, CANADA.

TABLE (1)

PRODUCTION OF PAPER IN EGYPT

GRADE	BASIS WEIGHT g/m2	TONS
Writing and printing paper	40 - 100	48000
Manifold	30	2000
Duplicator (stencil)	70	2000
Coating Base	70 - 80	1500
Greaseproof	40	1000
Kraft and kraft Wrapping	40 - 150	15000
Sulphite Wrapping	55 - 60	1800
Corrugating Medium	130	5000
Kraft and Kraft Liner	130- 200	5000
Cover Paper (all grades)	130- 350	15000
Duplex Board	250- 550	14000
Textile Cone Paper	270- 400	10000
Wrappings, (low grade)	110- 240	25000
Heavy boards (low grade)	600- 1000	6000
TOTAL		151300

TABLE (2)

DOMESTIC CONSUMPTION OF PAPER AND BOARDS

Consumption (apparent)	1973	1974	1975	1976	1980	1985
Printing & Writing	46,870	53,700	73,700	*87,700	124,000	170,000
Industrial, (including corrugating, liner, sack, etc.) and Board	122,600	146,600	145,000	156,000	209,000	302,000
Newsprint	25,900	46,700	41,600	49,000	60,000	75,000
Magazine	3,000	incl.	12,000	14,600	15,000	20,000

* Should be 96,250 tons, but due to lost production on RAKTA Nos. 1 & 2 P.M.'2 during speed-up program, the figure fell short to 87,700 tons.

TABLE (3)

AREAS OF CROPS UNDER CULTIVATION

CROP	FEDDANS x 1000	HECTARES
Rice straw	1'053	442'260
Bagasse	145	60'900
Wheat straw	1'394	585'500
Cotton	1'346	565'300
Flax	54	22'680
Corn (Maize)	1'830	768'600

1 Feddan = 0.42 ha

TABLE (4)

CHEMICAL CHARACTERISTICS OF MAJOR EGYPTIAN FIBROUS RAW MATERIALS

Fibrous Material	Alpha Cellulose %	Lignin %	Pentosans %	Ash %	Silica %
Rice Straw	28 - 36	12 - 16	23 - 27	16 - 18	9 - 11
Bagasse	32 - 43	16 - 22	27 - 32	1.5 - 6	0.7-1.5
Flax Tow	50 - 68	10 - 14	6 - 16	2 - 5	0.5-0.7
Cotton Wastes	80 - 85			0.8-1.8	
Softwoods	40 - 45	26 - 34	7 - 14	<1	<0.2
Hardwoods	38 - 49	23 - 30	19 - 26	<1	<0.2

Note :

✡ Bone dry basis.

✡✡ " Depithed " bagasse.

✡✡✡ Not available in Egypt ; data included for comparison to Egyptian raw materials.

TABLE (5)

PHYSICAL CHARACTERISTICS OF MAJOR EGYPTIAN FIBROUS RAW MATERIALS

Fibrous Material	Average Fibre Length in mm	Fibre Length to Diameter Ratio
Rice Straw	1.0 - 1.2	120 - 130
Bagasse	1.4 - 1.5	65 - 75
Flax Tow	10.0 - 30.0	600 - 1300
Cotton Waste	6.0 - 20.0	300 - 1000
Softwoods ***	3.2 - 3.5	90 - 110
Hardwoods ***	1.2 - 1.4	40 - 65

Note :

* Fibre dimensions are subject to considerable variation depending on source and growth conditions. The figures given in this table are however, good order of magnitude figures.

** " Depithed " bagasse .

*** Not available in Egypt; data included for comparision to Egyptian raw materials.

TABLE (6)

BAGASSE OUTPUT OF EGYPT'S SUGAR MILLS

Sugar Mill	Sugar Cane crushed-tons	Bagasse % of cane	Bagasse Moist tons	Moisture content	Bagasse od tons	Residual Sugar in Bagasse
				%		%
Abu Quargas	547'000	33	180'500	54	83'000	4,6
Nag Hamadi	1'364'000	35,3	484'300	54.6	220'300	5,3
Dishna	start-up expected 1975					
Qus	741'000	34,3	254'500	52,6	120'600	5,4
Armant	881'000	30,8	271'500	50,8	133'500	6'1
Edfu	760'000	33,2	252'500	51,1	123'400	5,1
Komombo	1'090'000	34,9	380'700	52,4	181'200	5,2
Total	5'383'000		1'824'000		862'000	

N.B. 1. Figures based on 1976 harvest. some values are estimated.

2. An eighth mill, El Balyana, is in the planning stage.

TABLE (7)

COMPOSITION OF BAGASSE

	MOIST BASIS	O.D.BASIS
	%	%
Water	51	--
Water Solubles	4	8
Dirt and Ash	3	6
Pith	14,7	30
Useful Fibre	27,3	56
TOTAL :	100	100

TABLE (8)

Type of paper	Rice Straw		Bagasse		
	Unbleached	bleached	Unbleached	Bleached	Imported
	%	%	%	%	%
Woodfree printing an writing	--	up to 80	---	up to 90	bleached pulp
Bristol Board				50 - 100	0-50 bleached pulp
Tissue				60 - 90	10-40 woodpulp
Lightweight paper, manifold		up to 60			wood pulp
Glassine, greaseproof	30-90	30 - 90	30 - 90	30 - 90	10-70 sulphite pulp
Groundwood printing and writing		20 - 50		20 - 50	20-40 wood pulp
					10-60 ground-wood
Newsprint			mechanical	70 - 80	20-30 bleached kraft pulp
Duplex and Triplex	30-80	30 - 80	30 - 80	30 - 80	20-70 woodpulp
Wrapping and bag paper	up to 60		up to 85		waste paper and/ or wood-pulp
cement sack Kraft paper			up to 70		kraft pulp
Corrugating medium	up to 100		up to 100		waste paper or pulp
Coarse board	up to 80		up to 100		wood pulp
Testliner			50 - 80		20-50 kraft pulp

TABLE (9)

PROJECTS FOR THE PRIVATE OWNERS

Projects	Product	Capacity	Raw Materials
1. Tissue Paper	Toilet tissue, facial tissue, sanitary napkin tissue, napkins and tissue, napkins and towelling	20-25 T/D	Imported bleached pulp, and imported waste paper (Later, bleached bagasse pulp, imported bleached pulp and imported waste paper)
2. Super-fine paper Mill	Cigarette papers, security papers, bond and document papers, permanent record papers, super-fine writing papers	10-15 T/D	flax tow and flax waste, cotton and linen textile wastes
3. Mill Board Plant	Automobile boards, suitcase boards, shoe boards, insulating boards (electrical)	10-15 T/D	Imported pulp and waste paper
4. Moulded pulp Mill	Egg crates, fruit and vegetable baskets, flower pots, etc.	15 T/D	Waste paper

TABLE (10)
NEW MAJOR PROJECTS

Project	Product	Capacity	Raw Materials
1. Expansion of Edfu pulp Mill			
Stage 1 - Increase in pulp production	Unbleached bagasse market pulp	65 - 70 T/D	Bagasse
Stage II - Addition of bleached pulp mill and writing and printing paper mill	wood-free writing and printing papers	150 T/D	Bagasse and imported Bleached pulp
	Bleached bagasse market pulp	55 - 60 T/D	Bagasse
2. Newsprint Mill at Kous	Newsprint	350 T/D	Bagasse and imported
3. Multiply Board Mill	Multiply boards, grey back, white back and bleached	150 T/D	Mixed waste paper, deinked waste paper, imported bleached pulp bleached bagasse pulp
4. Corrugating Medium Mill in the Delta	Corrugating Medium	150 T/D	Rice straw and waste paper
5. Bagasse Market pulp Mill	Bleached bagasse market pulp	350 T/D	Bagasse

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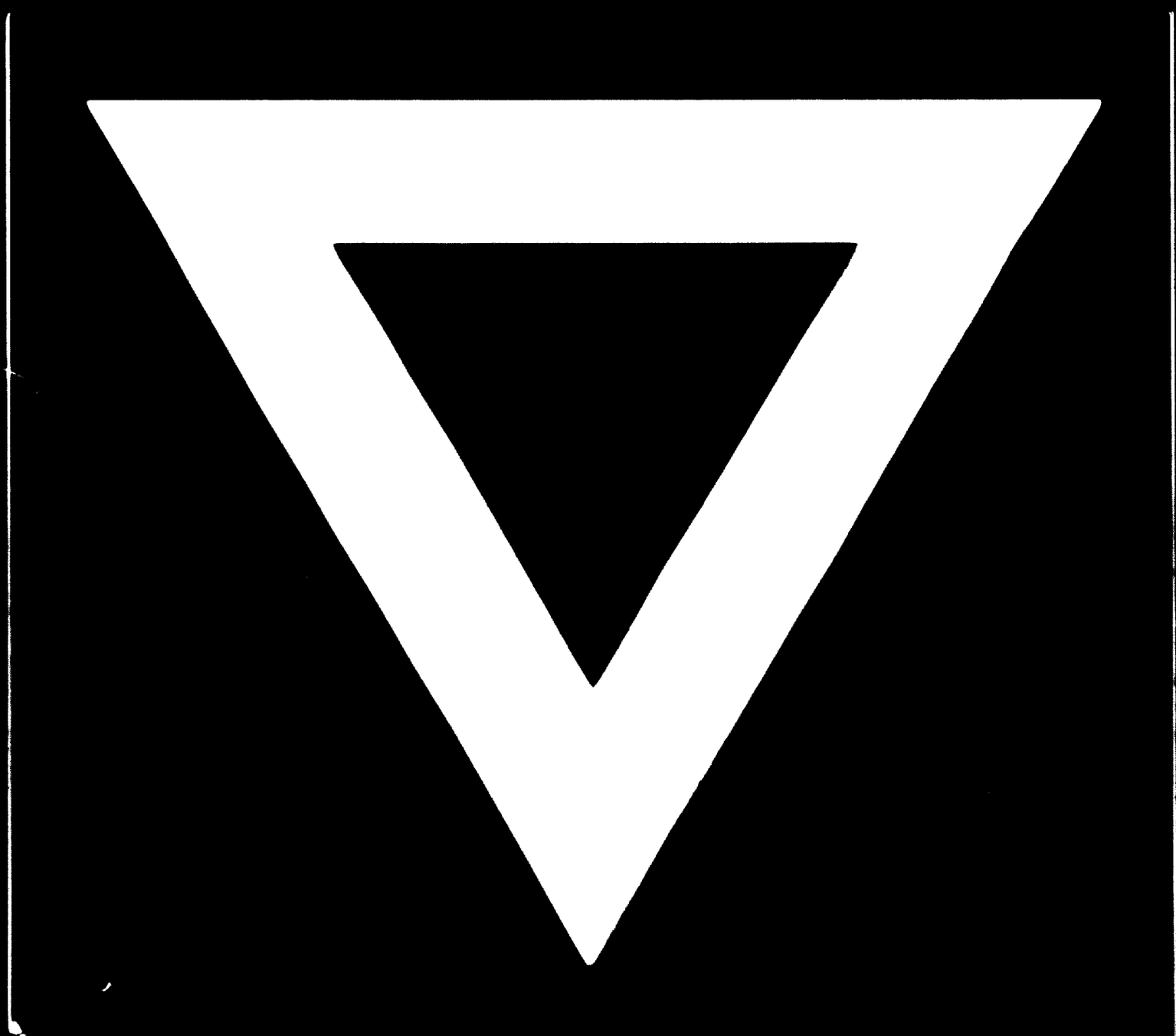

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