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Vienna, Austria, 8 - 12 October 1973

THE MARKETING OF FERMENTATION PROTEINS IN DEVELOPING COUNTRIES1/

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SUMMARY

THE MARKETING OF FERMENTATION PROTEINS IN DEVELOPING COUNTRIES 1/

Jeremy Wells*

The object of the paper is to show Fermentation Proteins (SCPO in their proper perspective as a component in a mixed animal feed. The paper analyses the animal feed industry in the six listed countries and predicts a potential market.

Tha analysis has been divided into two sections. The home market and the internal use of SCP in the feed industry of each country and the export or world market for SCP as a traded commodity.

It concludes with a brief look at the requirements of feed components in terms of protein and amino acid profiles and shows how SCP will fit into this role in a least cost programme.

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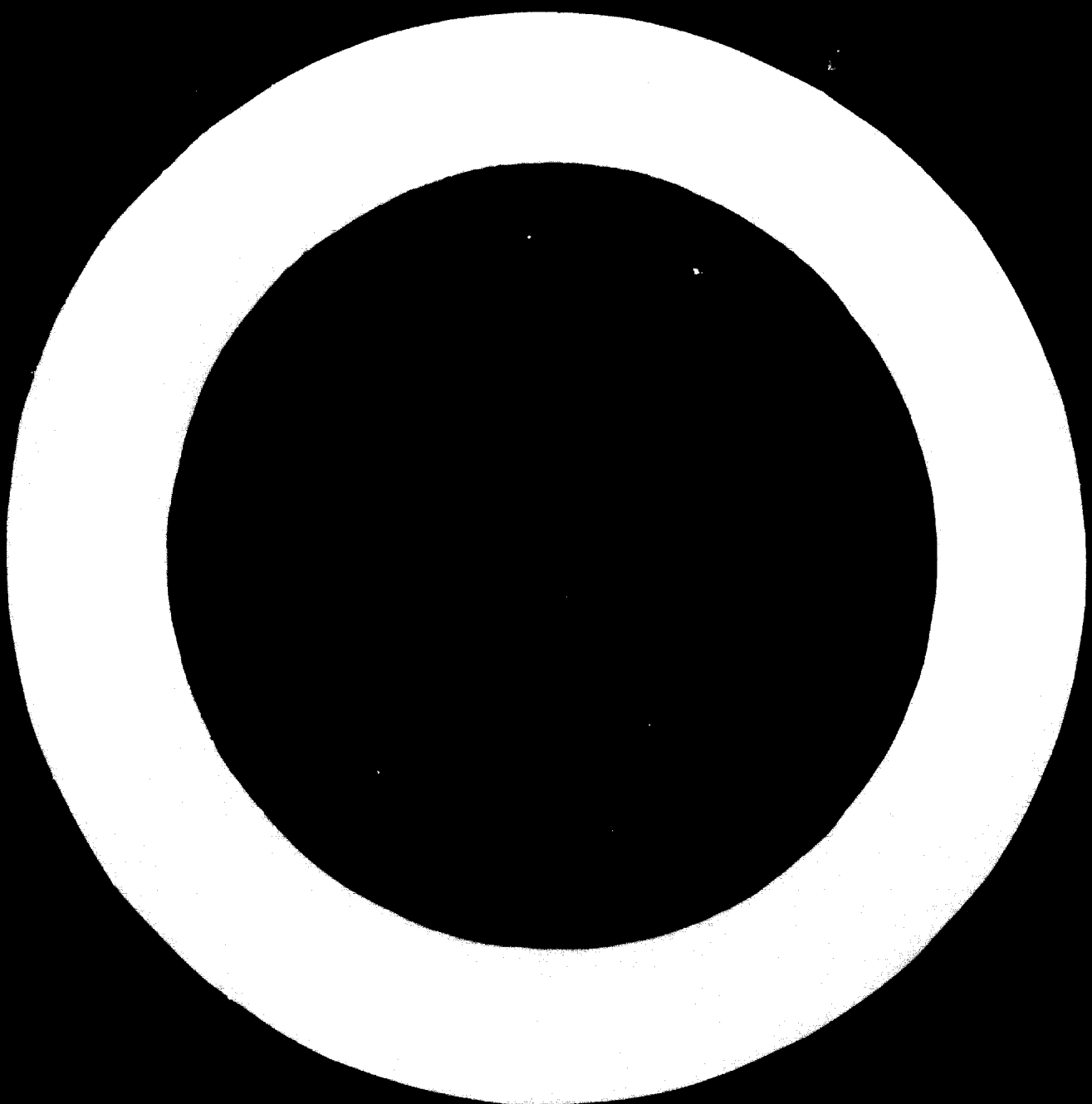

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INTRODUCTION

The objective of this paper is to indicate the potential markets that exist for fermentation proteins (hereinafter called SCP) that may be produced in developing countries. The major emphasis has been put on the marketing to the animal feed industry, since it is felt that direct human consumption of SCP will not be a reality until the nineteen eighties.

It is a further objective of the paper to show SCP in a proper prospective as a major component of a fixed feed. In order to do this the necessary requirements of a mixed feed and its components has been outlined. It is then shown that SCP with proper amino acid supplementation fits the requirements and will take a position very similar to marine protein, but at a lower cost. Since the supply of SCP can be assured and medium to long term prices may be contracted, it is felt that the reliability of SCP supply will guarantee an ever expanding market.

Since the optimal size of a plant will often produce more product than can be consumed in the domestic market, it will be most important to market the SCP on the world market and so secure a valuable source of hard foreign currency.

I MARKETING SCP IN A DOMESTIC MARKET

Experience with other new protein sources in developing countries has shown the enormous difficulties in translating new technologies into actual consumption by the nutritionally deficient. However, the production and marketing of SCP are essential to meet the market demands. World demand for protein is unsatisfied at present prices and will expand rapidly over the next 20 years from projected population increases alone without allowing for any rise in per capita spending which experience has shown to be proportional to a rise in per capita demand for animal protein. Animal protein foods are preferred by most consumers, but they are limited by the ratio of their income to the cost of the animal protein. It is found in developing countries that more than 40% of the disposable income is spent on food while in Europe only 25-30% is required. In order to stabilize the local cost of producing animal protein, a stable livestock and feed industry must be developed and allowed to grow.

The present knowledge of animal nutrition allows balanced feeds to be formulated that meet the nutrition requirements at the minimum cost. It is intended that SCP be used as a protein supplement in the domestic animal feed industries in many developing countries.

Firstly it will provide a local source of proteins which will not require spending valuable foreign currency. Secondly it will allow expansions of the local livestock industry which could reduce importation of animal protein or will allow the export of livestock or meat products and be a foreign currency earner.

A. Current State of Feed Industries

In order to evaluate the domestic market for SCP it is necessary to develop a market analysis of the feed industry in the country concerned. This entails developing a distribution analysis of potential feed customers and potential feed users. It further more requires a knowledge of local feed mixes and some insight into the general trends of livestock development. An analysis is then carried out as to the total amount of SCP any one company was capable of handling.

A distribution analysis is then performed which allows the best location of a production centre as well as the potential market demand. On investigation of the state of the feed industries of the key countries represented it was found that the feed industries are all truing to develop in coordination with an increasing livestock industry. In most cases lack of up to date statistics made accurate evaluation of the potential feed demand difficult.

B. Development of Livestock Industry

The local availability of SCP will give an impetus to the further development of livestock industries which have been started in all of the countries considered and are, in some cases, very well developed. (See table 1).

However, it whould be pointed out that the developing of a livestock and mixed feed industry requires a great deal of expertise and should be handled under the auspices or with guidance from a major consulting group such as an international agency or major feed company or other qualified specialist. It was observed that all of the countries studied (see table 2) are needing animal protein, hence a development of the livestock production would reduce their food balance of payments deficit.

However it is felt necessary to put into prospective the position of SCP. Although it will be a major component in a mixed feed it should not be used in excess of fifteen percent and in general will only constitute up to five percent of the feed. This will be most important and where the livestock or meat products are to be exported many developed countries which could be potential customers for meat, could refuse import permits for animals which have been fed on foods at levels not permitted in their countries.

C. Conclusion

It may be concluded that there is an existing domestic market for SCP in any developing country that has a non rummant feed industry which uses concentrated or mixed feeds. This industry will go through a large period of growth as the live stock industries in each of the countries rapidly expands.

II MARKETING SCP IN A WORLD MARKET

A. General

Since the production of an optimal sized SCP production unit will more than satisfy the domestic needs, a large proportion of the production can then be exported and sold on the world market.

According to FAO estimates, protein requirements will increase from 25 million tons in 1965, to 42 million tons in 1980 and 65 million tons by the year 2000. Shortages of 10 million tons in 1980 and 22 million tons by year 2000, will be likely if all the resources now being utilized were fully exploited. Since SCP can be most economically shipped, its development will greatly help alleviate these potential shortages which are more of a logistic nature than an actual total deficit.

Since it has been demonstrated that there is a total absence of toxicity and carcinogenic properties in SCP and on account of its high nutritional value, SCP has been approved in many countries as an animal feed supplement. Edible food tests and studies are presently being carried out for direct human consumption of SCP. This requires the production of high purity protein concentrates for use as meat extenders, flour protein fortifiers and milk replacers. In addition amino acid concentrates will be used as milk replacers; while the ribonucleic acid which must be removed, is used as flavoring agents.

B. Market Forecast

The main use of SCP to be considered, is as an animal feed supplement. It is felt that due to the reliability of supply it will replace the role of fish meal whose price (Table 3) has risen so sharply as to make it less attractive and whose large scale future availability is unsure. It will also act as a means of keeping the price of soybean meal at an economic level. In this study it was not felt that SCP was competing with the soybean but acting complementary to it. However, since the price of SCP will be in the region of $450 metric ton, it can be seen that if soybean prices were to rise dramatically, then SCP would come into direct competition as a replacer for soybean meal.

It can be seen from Table 4 that although the price of fish meal has increased, there still exists a very substantial market in Europe for meal and it is felt that if the price of SCP was right, then much of this market could be exploited by SCP.

Table 5 shows the diversified market in the United States for feed concentrates which although dominated by the soybean, offers large market potential to any other commercially viable concentrate. After a careful study of the European market it was felt that a present market for SCP in excess of 1.000.000 tons per annum exists. Table 6 shows an analysis of imports of oil seeds to the major eight importing countries, namely Japan, West Germany, Holland, France, Italy, Denmark, Spain, and the United Kingdom. These countries account for about 70% of the total oil seed and meals traded.

However, a number of other countries are beginning to expand their livestock and poultry operations, so increasing meal consumption per animal unit. These latter countries are expected to become increasingly important in terms of their proportion of total world demand for high protein feed in the future.

C. Conclusion

A definite world market already exists for SCP which will double by 1980. Provided the development of the SCP industry is handled in manner which culminates in the final product receiving the formal government regulatory approval where it is to be marketed, then a vaste market for SCP exists. Any developing country having an economic source of substrate can develop a commercially viable SCP or Formentation Protein Industry. However, it is recommended that before embarking on such a course the country acquires a marketing study and economic evaluation tailored to their particular situation.

III REQUIREMENTS OF A PROTEIN SUPPLEMENT

A. General

In order to develop a stable live stock industry, an efficient live stock and feeding program must be jointly coordinated and integrated. For the size of operation presently being considered in several developing countries, it is essential that the entire program be coordinated.

A well run program has the following type of format:

- market analysis of potential for animal protein or meat produced
- type of breeding program best suited to particular environment
- development of livestock housing and processing
- animal feed formulation
- management and coordination of program.

Most of the above sections are well known and expert advice can easily be obtained through major international agencies.

The scope of this paper requires a discussion on animal feed formulation and in particular the requirements of a protein supplement and how SCP fits this role.

B. General Requirements of Protein Supplements

The efficiency of an animal feed is judged by the amount of weight gained by an animal per unit of feed. Hence to achieve maximum efficiency, an animal should only be fed the exact amount of proteins required. Poultry for example are unable to use the surplus of certain amino acids for protein, and use these for energy and excrete the nitrogen.

The margins employed by the farmer are such that only the most efficient survive. Thus we constantly strive to remove costly ingredients from rations, while at the same time use ingredients which supply the needed nutrients at a more economical price.

Amino Acids

It is well known that the apparent protein requirement in nutrition is actually a requirement for specific amino acids necessary for protein synthesis and for maintenance and replacement of endogenous losses. A supplement should contain the eight amino acids essential for growth and maintenance of the human adult as well as those required for reproduction and lactation. Hence, the nutritional value of animal feeds are governed by the amino acid composition of the protein and the pattern of the amino acids required by the particular animal.

Secondly, the nutritional value of a protein is determined primarily by its amino acid balance. Most protein supplement is deficient in the sulphur containing amino acid methionine which

has to be added. Availability of amino acids in the protein to the animal is most important and the efficiency of the protein is the measure of the amino acid compo ition and their availability to the animal.

Protein

Meeting energy and protein nutrition requirement constitutes the major influence on the economics of animal production and is related to the other nutritional needs.

Nutritional research has well established the energy protein relationship. Usual feed arrangements allow animals free access to feed so that the rate of feed consumption is controlled by the animal itself. Hence the feed consumption is determined by the energy needs of the animal. Hence the rate of feed consumption of the animal is proportional to the energy level of the feed. Hence the efficiency of production is directly proportional to energy concentration. Hence a high energy supplement is greatly desired.

C. Qualification of SCP as a Protein Supplement

SCP is a high purity protein containing between 50-65% protein. As can be seen from table 7 it has an extremely good profile with availability of the most important amino acid lysine to a larger extent than both soymeal and fishmeal. The only amino acid showing

a deficit being methionine which is added at very little cost. Also the metabolized energy of the normal paraffins feedstock is significantly higher than other supplements.

The table 8 compares the water soluble vitamins contained in several common foods with that of SCP. The table shown that SCP possess all vitamins in addition to the essential amino acids to make it suitable for both consumption as a human food as well as animal feed.

Finally all extensive animal feeding trials carried out to date, indicate a complete absence of toxicity or carcinogenic effects.

TABLE 1. LIVE STOCK INDUSTRY IN SELECTED COUNTRIES - 1970/1971

(Thousand Metric Tons)

	EGYPT	GREECE	IRAN	LIBYA	SAUDI ARABIA	VENEZUELA
CATTLE	2120	985	5100	109	320	8499
PIGS	4	380	35			1671
SHEEP	1950	7650	500	2200	330	104
HORSES	65	250	380			427
MULES	12	175	138			
ASSES	1330	355	2000			500
POULTRY	75	68	5800	2	8	80

SOURCE UN Statistics Year Book 1972

TABLE 2. PROJECTED MEAT DEMAND IN SELECTED COUNTRIES

(In Thousand Metric Tons)

	1970	ESTIMATED 1975	ESTIMATED 1980
EGYPT	418	523	636
GREECE	420	502	589
IRAN	411	522	745
LIBYA	52	70	86
SAUDI ARABIA	79	102	131
VENEZUELA	418	514	625

SOURCE Agricultural Commodity Projections 1970-1980

TABLE 3. PRICE OF FISH MEAL 1/

Year	Price US $/Metric Ton
1960	130
1961	146
1962	160
1963	160
1964	160
1965	185
1966	226
1967	185
1968	185
1969	185
1970	197
*1971	167
1972	239
1973	550 +

1/ Average price calculated by Commodity Division FAO for 65% protein from Peru FOB Hamburg.

TABLE 4. FISH MEAL SUPPLY IN WEST EUROPE 1/
(Thousands Metric Tons)

	1967	1968	1969	1970
West Germany	480.6	532.6	544.2	504.9
France	94.9	103.2	103.3	50.2
Netherlands	145.0	171.6	164.2	96.5
Spain	106.7	113.5	141.4	117.2
Italy	102.6	114.4	114.7	113.7

1/ USDA Foreign Agriculture Circular FFO 8-72 May 1972

TABLE 5. PROTEIN CONCENTRATE FEEDSTUFF USED IN US 1/

(Thousands Short Tons)

Year	Soybean Meal	Other Plant Proteins	Meat Meal	Fish Meal	Dried Milk
1934	267	1887	558	186	125
1944	3627	3449	792	210	105
1954	5426	4097	1073	319	170
1959	8449	3969	1664	444	153
1964	9236	4485	1932	619	236
1968	11250	3950	2050	950	660
1971 2/	14000	4000	2000	510	400

1/ Feedstuffs 41 (36) Sept. 6, 1969 p. 2/3

2/ Feedstuffs 44 (5) Jan. 31, 1972 p. 18

TABLE 6. OIL SEED AND MEAT NET IMPORTS IN MAJOR MARKETS 1/

(Thousands Metric Tons)

				(% of Total)		
	1969	1970	1971	1969	1970	1971
Soybeans and meal	7983	10269	11032	53.5	60.8	63.8
Fishmeal	2344	1977	1686	15.7	11.7	9.7
Peanuts and meal	1368	1355	1167	9.2	8.0	6.7
Cotton seed and meal	934	885	732	4.3	5.2	4.2
Flax seed and meal	599	683	760	4.0	4.0	4.4
Rape seed and meal	471	450	684	3.2	2.7	4.0
Sunflower	554	584	450	3.7	3.5	2.6
Other oil seeds	668	702	791	4.4	4.1	4.6
Total	14921	16905	17302	100	100	100

1/ USDA Foreign Agricultural Circular FFO 8-72 May 1972

TABLE 7. COMPOSITION OF PROTEINS FROM DIFFERENT SOURCES
(grams in 16 grams Nitrogen)

	FAO Guideline	Wheat Flour	Beef	Cows Milk	Dry Torula Yeast	SCP Vitamins Concentrate	Fish Meal	Soybean Meal
% Protein		13.2	59.2	33.1	44.1	54.1-66	62.0	50
Essential Amino Acid								
Leucine	4.8	7.0	8.0	11.0	7.6	5.0-6.93	7.3	7.7
Isoleucine	4.2	4.2	6.0	7.8	5.5	5.45-7.8	4.6	5.4
Valine	4.2	4.1	5.5	7.05	6.0	5.43-5.8	5.2	4.0
Threonine	2.8	2.7	5.0	4.7	5.4	4.9-5.0	4.2	4.0
Methionine	4.2	1.5	3.2	3.2	0.8	1.22-1.8	2.6	1.4
Cystine	4.2	1.9	1.2	1.0	1.0	0.9-1.76	1.0	1.4
Lysine	4.2	1.9	10.0	8.7	6.8	7.4-7.8	7.0	6.5
Arginine	-	4.2	7.7	4.2	4.1	4.53-5.1	5.0	7.7
Phenylalanine	2.8	5.5	5.0	5.5	3.9	4.3-4.8	4.0	5.1
Tryptophan	1.4	0.8	1.4	1.5	1.6	1.22-1.4	1.2	1.5
Histidine	-	2.2	3.3	2.6	1.7	2.1-2.22	2.3	2.4

TABLE 8. WATER SOLUBLE VITAMINS

	Thiamine (B1)	Riboflavine (B2)	Nicotinic Acid (PP)	Pantothenic Acid	Pyridoxine (B6)	Cobalamine (B12)
Function	Carbohydrate Metabolism	Oxidative Dehydrogenation	Hydrogen Transfer	Acetylation Synthesis of Fatty Acids	Trans Amination	Purine Synthesis
Effects of Deficiency	Beriberi Neuritis	Arrested Growth	Pellagra	Arrested Growth	Dermatitis	Pernicious Anaemia
Daily Requirements for Adults	2	3	15	3	2	0.01
Foods (mg/kg)						
Beef	1-3	2	40-100	7-21	1-4	
Beef Liver	5-10	16	75-272	30-60	5	3
Milk	0.3-0.7	1-3	1-5	1-4	1-3	
Cereals	0.5-7	1.0-1.5	10-30	5-20	3-6	
Oil Cake	7-14	3-10	10-250	12-50		
Dry Yeast	2-20	30-60	200-500	30-200	40-50	
SCP-Vitamins Concentrate	3-16	75	180-200	150-152	23	0.011

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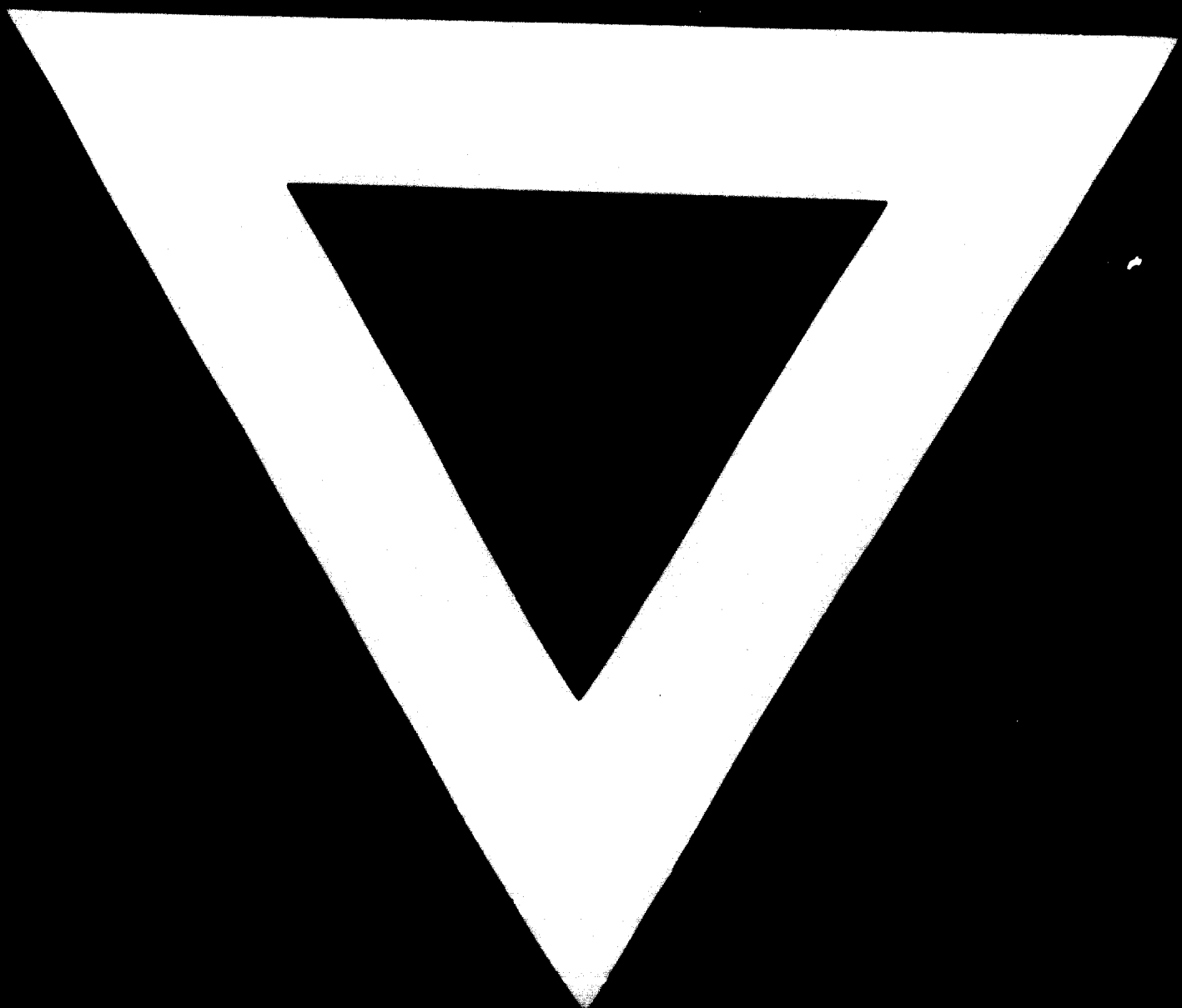

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