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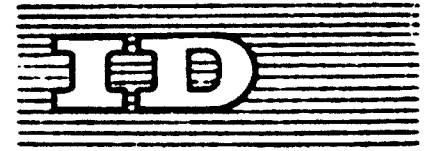
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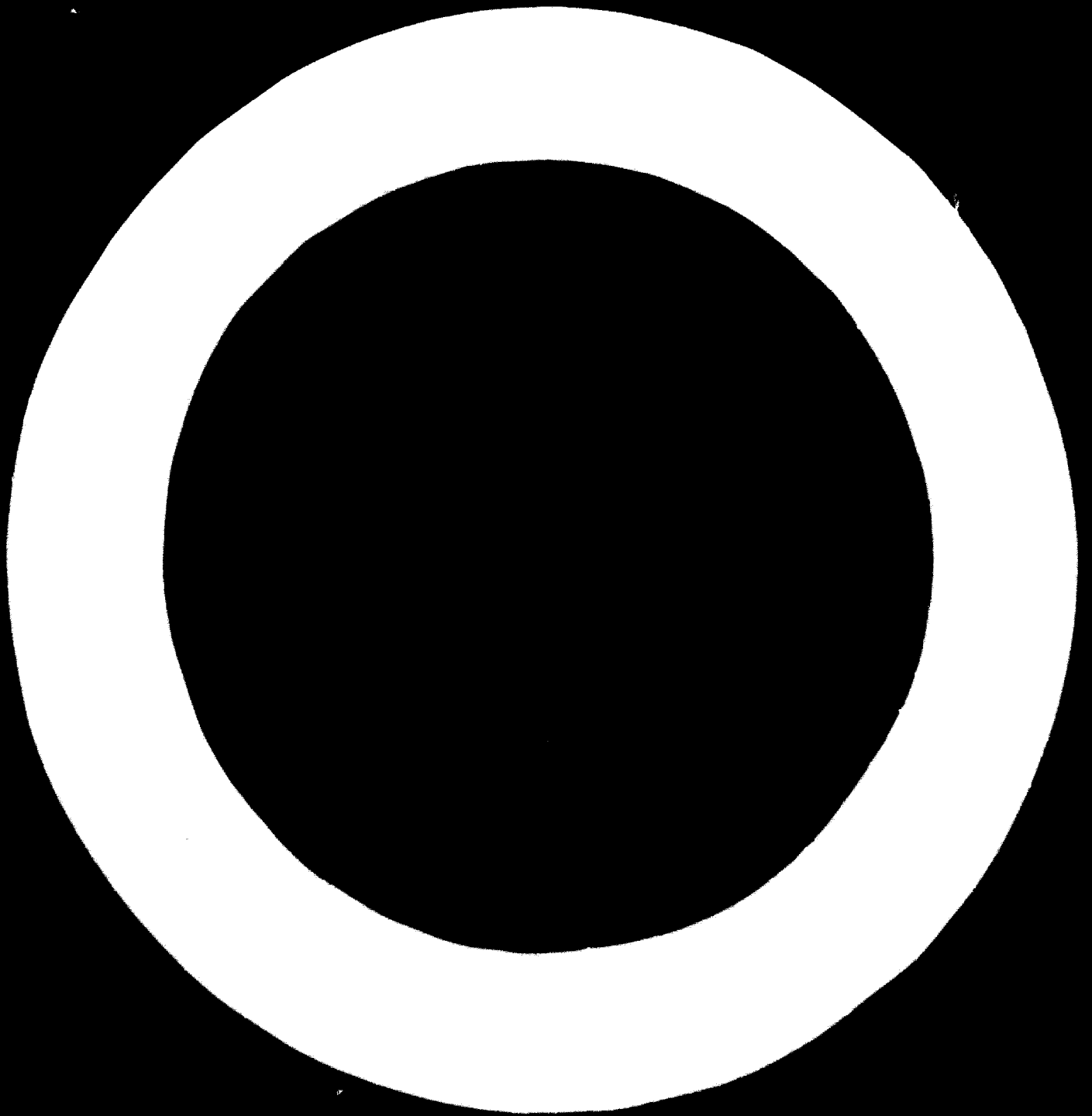
Expert Working Group Meeting on the Modernization
and Mechanization of the Salt Industries
Based on Sea-water in the Developing Countries

NOTE ON ETHIOPIAN SALT PRODUCTION AND EXPLORATION^{1/}

by

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^{1/} The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO.



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SHORT DESCRIPTION OF MARINE SALT PRODUCTION

1. The choice of the site to create a solar salt-works is determined first by economic and second by technical considerations.
 - (a) The site must be near a harbour or must offer reasonable sailing and berthing possibilities. If the venture is to be successful, international competition must be considered in planning its location.
 - (b) The surfaces to be used should be reasonably flat, near the sea and with a light slope in order to facilitate the flow of the concentrated waters toward the producing ponds.
 - (c) The ground of the works must be watertight. If it is not, clay must be put over it and levelled in order to obtain impermeability.
 - (d) The sea-water is pumped into a main canal and distributed in a set of evaporation ponds in order to bring the concentration of the water from 3.5° Baumé in the sea to 25.4° Baumé when the salt is crystallizing from the saturated water.
2. During this concentration the sea-water deposits Ca SO_4 , and the brines obtained are poured into the crystallization ponds for deposit of the salt. Over 28.5° Baumé, the mother liquor contains magnesium (Mg) and potassium (K) and some other chemicals that are difficult to separate from the small quantities of salt still contained in the mother liquor.
3. It should be noted that 1 m^2 of sea-water contains about 29 kg of NaCl but, owing to the loss of water during the process, permeability of the soil etc., the average obtained is 18 kg of NaCl/ 1 m^2 .
4. The pumping equipment should be calculated on the basis of the production of NaCl to be reached, the loss of water, the area of the surfaces evaporation etc. At Assab, the pumping capacity is $6,000 \text{ m}^3/\text{hour}$.
5. Harvesting necessitates heavy mechanical equipment if the salt-works is to produce a large tonnage of salt. In Assab, for example, for a yearly production of 100,000 to 120,000 tons, the mobile equipment for harvesting includes:
 - 3 Barber Greene A.82 bucket loaders specially fitted for salt harvesting
 - 10 FIAT tractors (5 80.R and 5 615)
 - 10 tipping trailers of 7/8 tons capacity each
 - 1 Allis-Chalmers grader
 - 3 Rotavators (clod- or earth-breaking machines)
 - 2 CAT D7 type bulldozers
 - 2 mechanical shovels of 1/2 ton capacity each.

6. The storage installations can handle 200 tons per hour. There are on-site facilities for the storage of 250,000 tons of finished salt.
7. The Assab Salt-works has an electrical power plant (800 hp, 588 kW) now kept in stand-by, since the works are connected with the electrical power plant of the Assab refinery.
8. The works include a mechanical workshop, a carpentry shop, a forge, an electrical workshop, a washing station, weighing bagging installations and the ropeway.
9. Similar information about Massawa Salt-works is not available.

LOADING CAPACITY AND EQUIPMENT

Assab

10. A ropeway of 1,600 m has been completed with a terminal installation and mooring set for anchorage, with a per hour capacity of 150 metric tons. However, considering the necessary moves of the ship to bring the hatches under the mobile conveyor belt, time lost in manoeuvres and so on, the average loading capacity is 120 tons/hour.
11. Assab can receive ships of up to 32-foot draft. Water depth at the mooring station is 33 feet over a length of 155 to 160 m. Ships of up to 15,000 burden have already been loaded without difficulty. There is a maximum free-board of 10.5 m above sea-level under the conveyor belt.

Massawa

12. Equipment for loading is beside the salt-works, in the harbour. The capacity of the conveyor belt (no ropeway) is probably 850 tons/hour.
13. Draft is limited to about 30 feet because of the shallowness of the Massawa harbour approaches. Length at the mooring is about 150 to 155 m.
14. For Assab, we have contemplated the possibility of berthing ships of up to 25,000 tons, as Japanese clients insist on sending bigger ships than those that have called up heretofore.
15. For such berthing, all mooring facilities must be reinforced and modified, and the berthing will have to be re-oriented. Moreover, although an approach channel should be dredged, such dredging would be so expensive that the company, in its actual state of affairs, cannot afford to invest in such an operation.

PROSPECTS FOR THE EXPORTATION OF ETHIOPIAN SALT

16. Salt in the world is in a buyer's market, the only client buying large quantities is Japan. Competition is very heavy, and many salt-works engaged in export are subsidized by their governments, directly or indirectly. This is not the case for Ethiopian salt-works.
17. Japanese salt importers (largely the chemical industries) are only interested by the price CIF Japan, which means that the geographical position of the salt-works is a great competitive factor. The FOB price obtained will be adjusted in terms of the sea freight to be paid from the production site to the port of delivery.
18. The prospects for exporting Ethiopian salt to Japan are reasonably good, at least until the large salt-works under construction in Australia comes into operation.
19. Société des Salines d'Assab is ready to start a development scheme that will bring its yearly production to between 200,000 and 220,000 tons, and the Massawa salt-works has a plan to expand its production probably up to 130,000 tons yearly.
20. As the balance of payments between Japan and Ethiopia is largely unbalanced in favour of Japan, that country will certainly be ready to purchase larger quantities of salt if Ethiopia can supply them, but of course on the basis of world price, and with an acceptable standard chemical quality.
21. The other factors are the capacity to load the ships at a good rate and the ability to berth as large ships as possible.

Table 1

Chemical analysis of Assab salt exported to Japan

	<u>1961-1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>
NaCl	95.60	95.06	95.01	94.58	95.20	95.36
H ₂ O	2.50	2.91	3.04	3.25	2.92	2.67
INSOLUBLES	0.11	0.06	0.06	0.10	0.05	0.06
Ca	0.20	0.22	0.20	0.19	0.21	0.20
Mg	0.16	0.20	0.20	0.24	0.18	0.16
SO ₄	0.72	0.81	0.76	0.80	0.74	0.73

Table 2

Salt production in Ethiopia (1,000 tons)

	<u>1953</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>
SALINES D'ASSAB	80	20	80	100	100	108	120	115	114
SALINE DI MASSAWA	80	90	90	95	95	90	90	90	95
NATIVE SALT-WORKS IN ASSAB DISTRICT	2	10	12	12	15	18	18	20	25
ROCK SALT IN DALLOL	-	-	-	-	-	5	5	10	5
OTHERS	2	2	3	3	3	3	3	2	2
	<u>164</u>	<u>122</u>	<u>185</u>	<u>210</u>	<u>213</u>	<u>224</u>	<u>236</u>	<u>237</u>	<u>241</u>

Table 3

Salt exported by Ethiopia (1,000 tons)

	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>
SALINES D'ASSAB	-	65	140	130	66	77	100	102
SALINE DI MASSAWA ^{1/}	50	60	60	65	55	52	53	69
	<u>50</u>	<u>125</u>	<u>200</u>	<u>195</u>	<u>121</u>	<u>129</u>	<u>153</u>	<u>171</u>

^{1/} Massawa exports are known exactly only for 1965, 1966 and 1967.

Table 4

Sales in Ethiopia (domestic market) of Salines D'Assab and others
(1,000 tons)

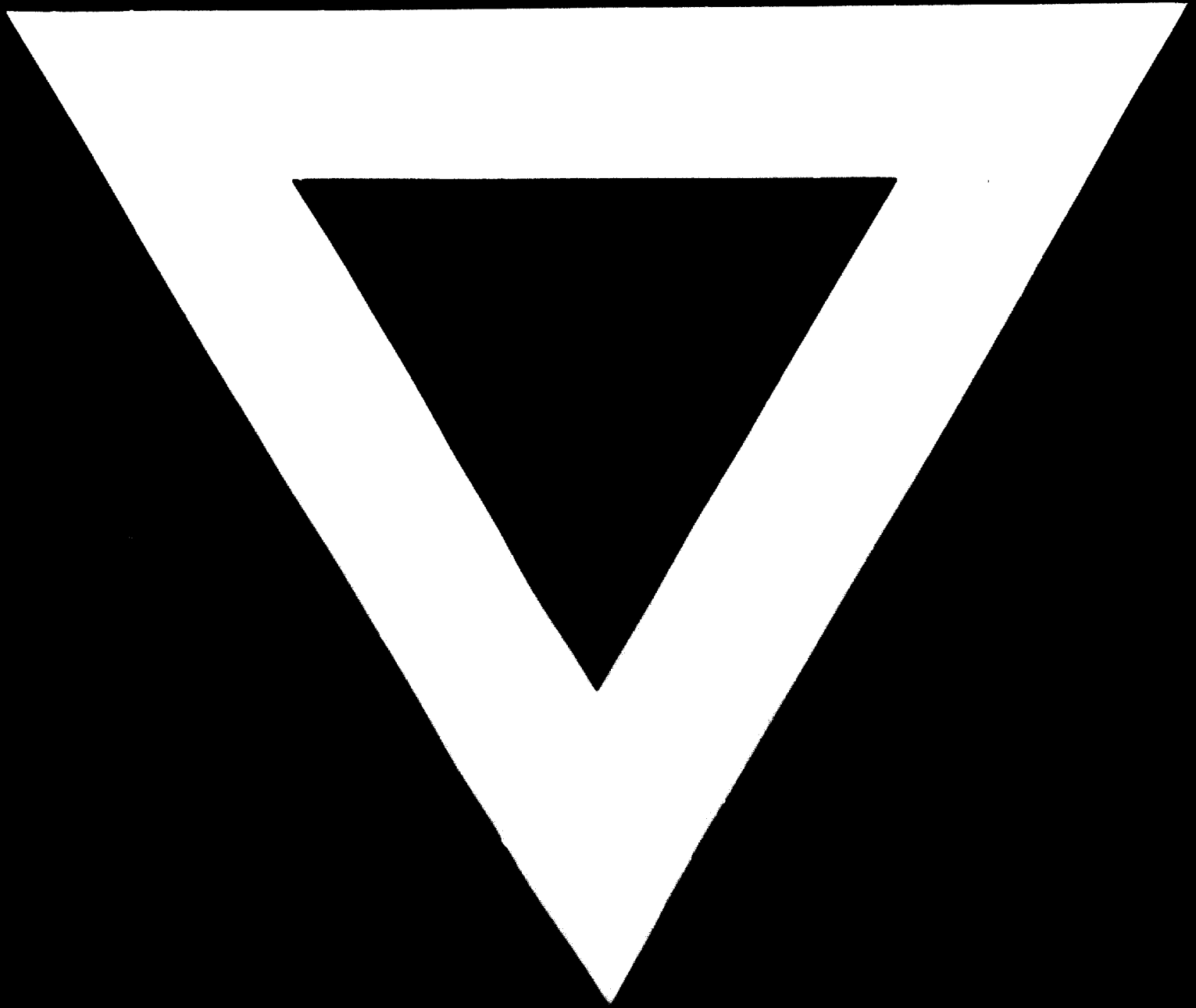
	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>
SALINES D'ASSAB	33	32	40	29	26	29	26	22
SALINES DE MASSAWA	23	24	21	25	24	26	19	23
OTHERS ^{1/}	12	15	15	18	26	26	32	32
	<u>68</u>	<u>71</u>	<u>76</u>	<u>72</u>	<u>76</u>	<u>81</u>	<u>77</u>	<u>77</u>

^{1/} Estimated

Table 5

Salt importation by Japan
(January - December 1967)

	<u>Metric tons</u>
Mexico	1,824,027
China (mainland)	982,770
United States of America	496,989
India	355,249
Chile	154,662
Ethiopia	153,720
Yemen	101,983
Pakistan	87,153
Australia	67,707
United Arab Republic	51,563
Venezuela	48,224
Aden	46,521
Tunisia	32,539
Spain	31,262
Rumania	23,422
Indonesia	17,153
Turkey	6,800
China (Taiwan)	5,001
Union of Soviet Socialist Republics	4,939
<u>Total</u>	<u>4,431,666</u>



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