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CLAY BUILDING INDUSTRY IN UAR [1/]

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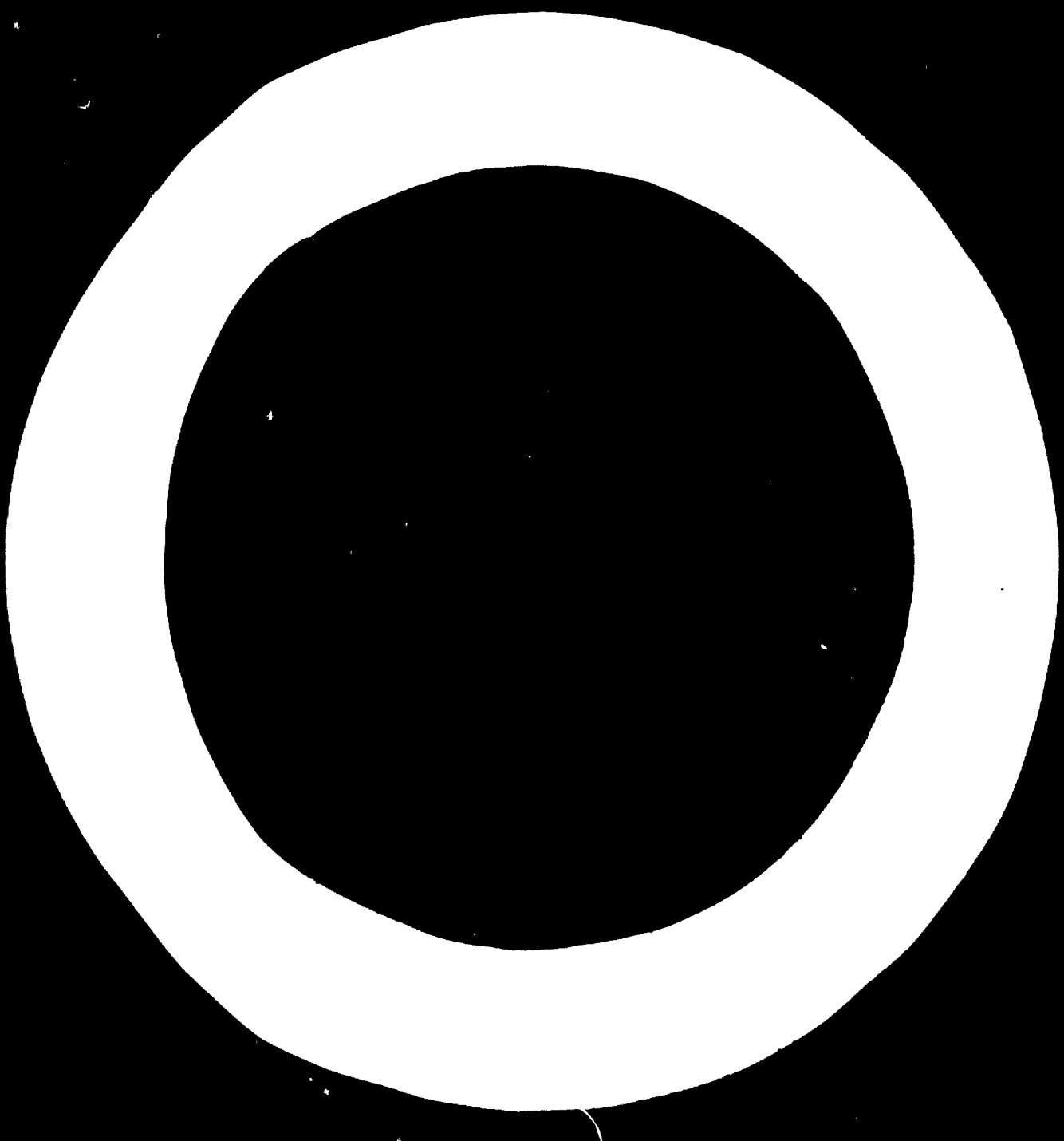

CLAY BUILDING INDUSTRY IN UAR.

FOREWORD:

1. The scope of this paper is to analyse the problems that arisen, after the execution of the Aswan High Dam, i.e., the retention of a great proportion of the silt carried by the Nile during the flood season (July - November). The silt is particularly used in brickmaking to satisfy the need of almost 95% of red brick buildings all over the Republic. The study will include the following items:

   a. A historical background of the development of clay use in brickmaking,
   b. Red brick industry in UAR.,
   c. Alternative materials for the production of various kinds of bricks,
   d. The possibility of using deposited clay in brickmaking.

THE USE OF CLAY IN BRICKMAKING:

2. Clay is one of the oldest materials ever used by man for building and construction. Man first used plants and tree branches to build simple huts in which to live and protect against climate and wild animals. we, however, have in the ancient Egyptian monuments evidences insuring that the Ancient Egyptian did build huts of clay for a residence. Other monuments throughout the world, a thousands years later than Ancient Egyptians, show that inhabitants of those areas adopted the same way of building simple living huts.

3. When people of the Nile Valley had firmly settled therein, began to grow the land and made use of the abundant Nile water, they found out in the Nile silt a material available to building and tended to use the silt that extended all long the sides of the River to render the simple huts with a clay plater, first outside then later both out and inside, to provide further strength against weather and to wear longer. Egyptians gradually used clay to build rammed earth walls that are still in use in simple village houses, especially near the desert where clay is mixed with a big proportion of sand and lime which helps to form the walls and protect against climatic forces.

4. Clay as a building material then progressed as building units in the form of casts could be made, thus enabling Egyptian to construct solid and strong buildings and huge walls round their towns to defend them against attacks. The earliest adobe brick buildings were excavated in the civilization of NAGADA, Upper Egypt.

5. From the drawings on Ancient Egyptian tombs and temples, a study can be drawn of brickmaking. The drawings show the steps of the production, which starts with a big hole dug in the ground, in which water is poured, clay is mixed and turned with an axe. Labourers then carry the paste, already ferment, to a brickmaker who gives it the shape of units which are stacked in rows until dry. In certain temples, the wooden formats used in shaping bricks of different sizes, from the study of which we could conclure that: 23 x 11.5 x 7.5 cms bricks were in building houses where as 95 x 45 x 30 cms for public buildings and walls. We thus see that Egyptians were not bound to one size brick but sizes differed according to both locality and purpose of manufacture.

CLAY BRICKMAKING IN UAR

6. Clay available to UAR is rock fragments resulting from natural processes of weathering and rain in Ethiopia region. The particles are carried by the Nile water during flood season. Through this carriage together with long stay in water until sedimented, the particles of clay lose some of its original components and their constitution somewhat differ from the rocks they came from.

7. Brick factories in UAR, spread on the Nile banks from Aswan to Alexandria, get their clay need by artificial sedimentation of the Nile water. This is done by making large basins through which Nile water passes, sedimenting part of its mud content. The basin is an area of the bank encountered on both sides with two vertical walls along the Nile course and higher than the normal water level in times other than flood. Water is allowed to enter on one side and exit on the other side of the basin.

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8. When the Nile water, as it runs dashes against this vertical wall, its direction stumbles inside the basin, this lessening its velocity and weakening its power to carry suspensions, first depositing coarse granules, then medium and later fine ones, until the water comes out of the basin. By continuous entry and exit of water into and out of basin, mud is sedimented in three regions in which mud ramges from coarse sand at the entrance to the basin, to medium then fine mud on the other side where the water gets back to the Nile. Sediments in one season mount up to several meters, almost ten high in high floods. After flood and drop pf water level, for a time enough to allow leakage of water carrying the mud, the basin is covered with a fine sand layer to preserve the dampness of the mud so that this may not dry or harden, otherwise it would cost much labour to cut and use in brickmaking.

9. Analysis of various samples of full dry Nile mud at 110 C the following data are concluded:

Temperature lost	4.4	-	3.3 %
Silica $Si\ O_2$	59.2	-	65.9
Alumina Al_2O_3	21.4	-	17.5
Ferrous Oxide Fe_2O_3	1.2	-	0.1
Calcium Oxide $Ca\ O$	3.1	-	4.3
Total :	98.7	-	96.5 %

From this clemical analysis, there appears that the Nile mud has great absorbability of water and high sensitivity when dry. It is hence unfit for making high quality of bricks, and other kinds of clay need be added. To improve the properties of the Nile mud, a percentage, mounting to 20% of wheat or beans straw or rice husks is added. Such additions help;

a. To lessen shrinkage of brick when dry,
b. Regular dryness inside and outside of brick, thus prevent cracking,
c. To increase consistence of brick, thus resisting breakage when transported,
d. Regular burning, since such materials inside the brick allows distribution of heat on all parts.

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10. Clay bricks in UAR are hand - made, without the use of machine in manufacture. They are almost made in the same simple way as adopted thousands of years ago, with little or no change. Cutting and transport processes are performed manually, during which are added the materials that improve the properties of olay. In big factories such additions are made inside simple mechanical mixers of the Pug-mills, or Pan-mills type. Bricks are then shaped by wooden forms, pressing the olay paste manually.

11. Due to the temperature weather over the Republic, all the year round, bricks dry without need for artificial methods. But as a result of the varying range of temperature between night and day, which mount to 20°C, temperature in summer rising to 38° C in Cairo by day dropping to 18°C at night, together with a drop of humidity and wind speed, bricks are usually stacked below shades of straw to protect them until dry, at a rate that prevents cracking and crumbling of edges. As weather conditions suitable for dryness cannot be controlled, this method of natural drying does not give certain results, and waste bricks mount to 10% to 15% of production.

12. Dry brioks are then burnt in simple kilns that vary in size according to the quantity of bricks produced by the factory. A kiln is usually a manifold of fifty thousand brick; capacity may mount to a million unit in bigger factories. Fuel now in use is coal, though smaller factories use wood because of its cheapness.

13. After World War I, some bigger factories started to burn bricks inside rectangular furnaces of the Hoffmann type, due to their cheaper construction and easier filling of chambers.

14. Fire-burnt olay bricks produced in the UAR are of three grades: common bricks, building bricks and engineering bricks. All the three grades of bricks conform to the Egyptian Standard Specifications.

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15. Common bricks produced by hand mixing and shaping are of ordinary quality, uneven in shape and colour, unfit for being used as load-bearing walls.

Building bricks produced by mechanical mixers, wire-cut in shaping, are of good quality, even, uniform in shape and colour, well burnt, hard and sound.

Engineering bricks produced mechanically are of hard, sound square well burnt, even and uniform in shape and colour, free from cracks and other defects, giving clear ring when stuck.

16. The three grades of bricks shall conform to the following standard specification:

	Common Bricks	Building Bricks	Engineering Bricks
Dimensions, in cm.	25x13x8	25x12x6.5	25x12x6
Average compressive strength, in kg/cm2 not less than.....	25	150	450
Average absorption of boiling water, per cent weight, not greater than	27	15	8

17. Fire-burnt clay bricks are used in carrying out 95% of buildings constructed in UAR. They are used in building walls, partitions with concrete framework which form columns, beams, girders and slabs of reinforced concrete. Production of factories all over UAR, in which more than 25 workers are employed, is shown in million bricks in the following table :

	1966	61	62	63	64	65	66	67	68	69
Burnt clay bricks:	800	820	905	1025	1135	913	815	619	619	700
lime sand bricks:	15	10	13	16	19	22	23	21	15	15

This does not include production of smaller factories that employ less than 25 workers and which represent about 10% to 15% of the figures in the table above.

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ALTERNATIVE BUIDING MATERIALS FOR BRICKMAKING:

18. In UAR, there are four big factories to produce various kinds of Portland cement that conforms to International sepcifications. Production of these factories during the last decade 1968 / 1969 inclusive, is shown in thousand tons in the following table:

	1960	61	62	63	64	65	66	67	68	69
Ordinary port cement :	1844	1838	1949	1697	1672	1754	1850	1746	2038	2400
Blqst furnace cement:	-	216	350	654	720	615	652	1130	822	850
White cement:	-	13	21	28	42	40	40	39	42	45

A part of this production is exported to African and Asian countries and to the Middle East Region, mounting to one million tons annually. The rest is consumed in building works of various projects in UAR.

19. In many areas there exist quaries that supply sand and gravel to be used in concrete and building works, also limestone quarries round Greater Cairo, with abundant quantities of such materials, in addition to huge amounts of solid limestone aggregate left over in the quarry of Helwan Steel Factory. Such amounts are available for use.

20. From the three materials; cement, sand and limestone aggregates, various kinds of concrete blocks and cement bricks are made but in relatively small quantities as a result of the insufficient amounts of Portland cement to construct big factories to produce such kinds of bricks, due to the fact that the economic development plan recommends exporting as much cement as possible for foreign exchange. Economic studies carried out by the Building Research Center, Cairo, showed the possibility of producing certain kinds of solid or hollow concrete blocks of various dimensions, of which to mention 40x20x20 & 40x20x15 cms. at a cost not any higher than fire burnt clay ones, not to mention the great advantages of such bricks, with view to weight, heat insulation and needless plastering.

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21. Round Greater Cairo zone, Alexanderia and Suez, there are big quantites of limestone fit for lime production, together with quarries to dig sand. Hence two factories were established in Cairo making 23 million bricks in 1966, though production dropped at present to 15 million because the machines are 45 years old. Studies carried out by the Ministry of Industry show that production of such kind of brick costs no more than burnt clay ones. For this reason, a contract has been concluded for the establishment of three factories to produce 540 million bricks of the ordinary solid or hollow types and light-weighted ones as well, provided that production be done mechanically in all steps. The first factory is now under construction in Cairo zone to produce 200 million bricks. It is expected that production starts by mid 1971. The other two factories will be installed before 1975.

22. In various between Cairo and Aswan, in the Suez Canal zone as well, there exist big quantities of solid limestone fit for building ptrposes. The Building Research Center, has, in collaboration with Soviet experts, studied the possibility of quarrying and making limestone building units of uniform sizes, to be used in building walls, but not so much over weighing burnt clay bricks. The preliminary economic studies shows that production of such units will not exceed the cost of bricks, taking into account their resistance to climatic conditions, their needless plastering and lower cost of maintenance, besides their architectural beauty for their various usage. The Building Research Center is now studying the execution of a pilot plant unit in Cairo zone to determine the actual cost of producing such limestone units and to study the various methods of using them in bearing walls or in filling R.C. frames in the same way as employed at present.

SEDIMENTED CLAY BRICKS:

23. Geological studies carried out in zones round Greater Cairo, shows that there are several quarries that contain large quantities of sedimented clay. The Building Research Center, in collaboration with the Ministry of Industry, is now carrying out a series of researches and economic studies to benefit from the sedimented clay in the quarries that scatter from Aswan to Alexandria in producing various kinds of solid,

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hollow and light-weighted bricks. Primary studies carried out in the quarries round Greater Cairo show that the clay in the quarry near Meadi (South-east Cairo) is approximately 0.50 to 1.50 meter thick and grey in colour. The various samples of such clay, taken from the visible surface, after removing the layers exposed to atmospheric forces, and which considered picking samples, were chemically analysed and the following results were concluded:

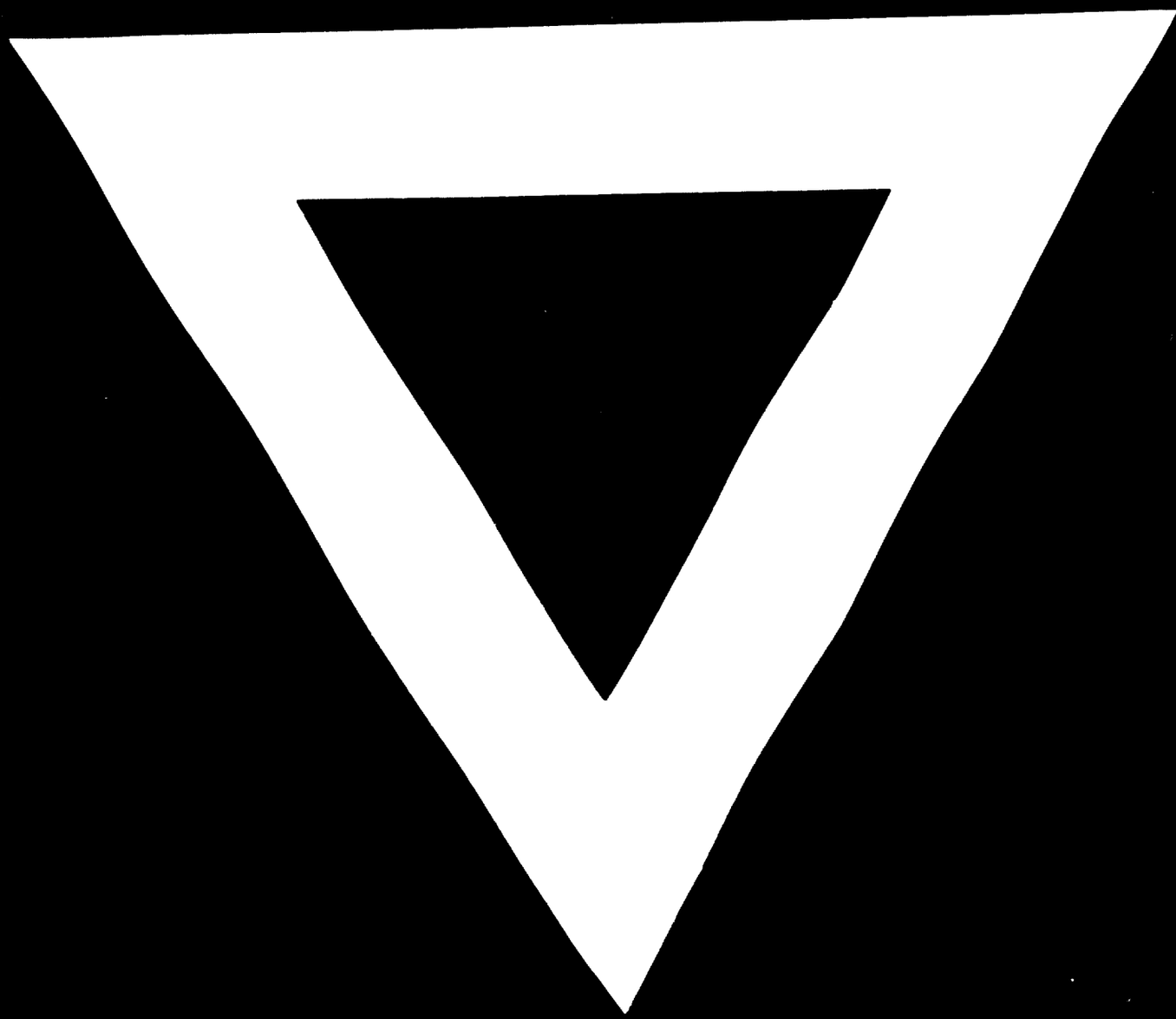
Humidity at 110 C		5.90	- 4.80 %
Temperature lost at 100 C		9.15	8.63
Silica Oxide	Si O2	55.13	51.29
Alumina	Al2 O3	17.28	16.48
Ferrous Oxide	Fe_2 O_3	3.78	5.50
Calcium Oxide	Ca O	1.47	5.10
Magnesium Oxide	Mg O	1.51	0.87
	Total :	79.17	- 80.24 %

24. X-ray analysis for the study of metal components, has proved that it contains a Quarts base mixed with small proportion of Montmorillinite and Illita. The Quarts proportion was greater before separating the Argil powder. After separation and X-ray analysis, the Argil showed that it contains Monymorillinite and traces of Kaolonite, in addition to Hematite.

25 The economic studies carried out to produce various kinds of sedimented clay bricks by mechanical methods in all steps of production, with view to winning, transporting to factory fragmentation and grinding of clay, processes of mixing, shaping and drying by artificial dryers, burning in ovens with self-regulating apparatus, show that cost of brick production mounts to double the cost of Nile clay bricks. This is due to the high cost of apparatuses and machines of manufacture, beside maintenance and other factors.

26 The Building Research Center is at present studying the possibility of producing good quality of bricks without using mechanical instruments in all steps except for mixing and shaping, dispensing with machines of cutting, transporting and drying. Burning of bricks will be done in same ovens now in factories of bricks from Nile silt, after introducing certain modifications to lessen the proportion of waste bricks. It is expected that cost of such method will be a bit higher than the cost of bricks at present.

27 To determine the actual cost of producing such kind of brick, an experimental factory will be established beside one of the existing ones, to produce about 60 million bricks annually. In the light of such experiment it would be possible to determine the best methods to benefit from the big quantities of sedimented clay that exists in different regions of the Republic, particularly in those regions near the desert.



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