XI–1 X-RAY DIFFRACTOMETRIC STUDIES ON THE MUD BRICKS FROM HAMRIN AND BABYLON PRELIMINARY INVESTIGATION

(1) Samples

(i) Mud bricks collected on the top of the round wall CW 6 of the Tell Gubba Level VII, Hamrin.

(ii) Mud bricks collected in the room XXIV–20 situated on the east-south corner (lowest level of the west wall) of the Tell Songor A.

(iii) Mud bricks collected at the Nabu-Sa-hari Temple, Babylon.

(2) Preparation for Analyses on the Hamrin Mud Brick

Since the mud bricks of Hamrin contain much coarse grains, they were separated by elutriation in water. A small lump (10 grams) of the brick was dispersed in water (100 ml), and coarse grains precipitating immediately were separated from fine grains precipitating within 20 minutes. The amount of the former was about 1.5 g and that of the latter (fine grain) about 7 g. Mud bricks of the Songor A and Babylon were analyzed without separation of coarse grains.

(3) Fluorescence X-ray Analysis

Qualititative fluorescence X-ray analysis was carried out under the the following operating conditions:

X-ray used for excitation: Chromium. Voltage and current: 40 KV, 30 mA. Crystals for analysis: LiF and ADP. Counter: Scintillation counter and proportional counter.

Detected elements are listed in Table 17.

Table 17 Qualitative Elemental Analysis by Fluorescence X-ray Analysis

Sample	Al	Ca	Fe	K	Mg	S	Si	Sr	Ti
Harmin (fine gr.)	++	+++	+++	+	+	+	+++	+	++
Hamrin (coarse gr.)	+	+++	++	+	+	+++	+++	++	+
Songor A	+	+++	+++	+	+	+++	+++	++	+
Babylon	++	+++	+++	+	+	+	+++	+	++

+++: Large amount, ++ :small amount, +: minute amount

(4) X-ray Diffractometry

To identify the component minerals of the mud bricks powdered bricks were analyzed by X-ray diffractometry under following operating conditions: Target: Copper, Filter: Nickel, Voltage and Current: 35 KV, 15 mA, Scanning speed: 1° per min.

Detected minerals are listed in Table 18.

Table 18 Mineral components detected by X-ray diffraction

Sample	Quartz	Gypsum	Calcite	Feldspar	Kaolinite	Micas
Hamrin (fine gr.)	++	−	+++	+	+	+
Hamrin (coarse gr.)	+	++	++	+	−	−
Songor A	++	+	++	+	+	+
Babylon	++	−	++	++	+	+

+++: Large amount, ++: smafl amount, +: minute amount, −: absence

(5) Discussion on the Results

The results of fluorescence X-ray analysis agree with those of X-ray diffractometry. For example, gypsum, $CaSO_4 \cdot 2H_2O$, is not found in the fine grain part of the Hamrin mud brick, and only a minute amount of sulfur is found by X-ray fluorescence analysis.

The mineral compositions of fine and coarse parts of the Hamrin brick are different, but the whole brick is similar in composition with the brick of Songor A, and they contain both gypsum and calcite. On the other hand in the Babylon bricks no gypsum is found, and they are easily crushed. This is because gypsum in the bricks of Hamrin and Songor makes these bricks very hard. According to the view of the present author gypsum, $CaSO_4 \cdot 2H_2O$, loses a part of its water of crystallization upon heating. When thus heated gypsum is mixed with mud and water to make bricks, heated gypsum takes up water again and re-formed gypsum crystals make the brick very hard.

As this is a preliminary investigation, a more deteiled investigation of these mud bricks collected at three areas is to be carried out in future.

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