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# Provenance Study of Selected Chalcolithic and Early Bronze Age I Pottery from Sha'ar Efrayim

Anat Cohen-Weinberger

Fifteen Chalcolithic and Early Bronze Age I clay artifacts from the burial caves at Sha'ar Efrayim (see van den Brink, this volume) were examined petrographically, with the aim of gaining a better understanding of the cultural interaction of the site with other regions. The present study includes Chalcolithic pottery vessels and ceramic ossuaries, EB IA Gray Burnished Ware (GBW) bowls and EB IB vessels. As the petrographic method is based on the assumption that the ancient potter used local clay and temper, which would, therefore, reflect the geology of the site's vicinity, the geological setting of the excavated site was assessed. The analyzed pottery samples are arranged in petrographic groups, according to the characteristics of the raw material (Table 1).

*Geological Setting*

The site of Sha'ar Efrayim is situated on alluvial sediments at the foot of the Efrayim Hills. Several geological formations are exposed near the site, including the Turonian limestones of the Bi'na Formation and the Senonian chalk and marl of the Mount Scopus Group. Outcrops of Neogene and Quaternary conglomerates are

**Table 1. Inventory and Results of the Petrographic Study**

| Sample No. | Locus | Basket | Cave | Type | Fig. in van den Brink, this volume | Date | Petrographic Group |
|---|---|---|---|---|---|---|---|
| 1 | 111 | 1022/1030 | 2 | Ossuary | 22:1 | Chalcolithic | B |
| 2 | 122 | 1081 | 1 | Tall cup | 14:1 | Chalcolithic | B |
| 3 | 122 | 1087 | 1 | Small, multiple-handled jar | 15:10 | Chalcolithic | B |
| 4 | 125 | 1097 | 1 | Small V-shaped bowl | 13:5 | Chalcolithic | B? |
| 5 | 127 | 1132 | 3 | Ossuary | 25 | Chalcolithic | B |
| 6 | 146 | 1226 | 5 | Ossuary | 33 | Chalcolithic | B |
| 7 | 124 | 1106 | 1 | GBW bowl . | 17:4 | EB IA | A |
| 8 | 128 | 1140.8 | 1 | GBW bowl | 17:6 | EB IA | A |
| 9 | 128 | 1112.3 | 1 | GBW bowl | 17:3 | EB IA | A |
| 10 | 128 | 1129.3 | 1 | GBW bowl | 17:2 | EB IA | A |
| 11 | 116 | 1063 | 1 | High loop-handled jug | 20:1 | EB IB | C |
| 12 | 116 | 1084 | 1 | Hemispherical bowl with single lug handle | 19:1 | EB IB | C |
| 13 | 116 | 1086 | 1 | Amphoriskos | 20:7 | EB IB | C |
| 14 | 128 | 1120 | 1 | Amphoriskos | 20:6 | EB IB | C |
| 15 | 128 | 1125.4 | 1 | Small, red-striped jar | 21:1 | EB IB | B |

also exposed in Naḥal Te'enim to the north of Sha'ar Efrayim, and in several isolated outcrops within a few kilometers to the east. The area between the site and the Mediterranean shore is characterized by Quaternary beds of red sand and loam (*ḥamra*), sand dunes and calcareous sandstones (*kurkar*; Ilani 1985). The area of the site is also characterized by *rendzina* and grumosolic soils (*Ministry of Agriculture* 1974).

*Results*

*Group A.*— The matrix is calcareous and rich in foraminifera, which constitute as much as 20% of the groundmass. Where identification is possible, the foraminifera belong to the Senonian–Eocene ages and include the planktonic genii *Hetrohelix*. The non-plastic components present in the clay are grog and crushed calcite. The clay is identified as marl. The exact source of the clay has not yet been determined and the inclusions cannot be used as provenance indicators. The general petrographic assemblage indicates that these vessels could have been produced locally in the vicinity of the site, but other provenances cannot be excluded.

*Group B.*— The matrix is calcareous, silty (about 10%) and rich in foraminifera. The non-plastic components (f:c ratio$_{\{0.062mm\}}$ = ~80–70:20–30)[1] include rounded, poorly sorted, silt- to sand-sized grains of chalk (up to 3 mm) and fine, sand-sized quartz grains of 200–300 µm. Some fine chert fragments and feldspar grains also appear. The clay is most probably *rendzina* soil. The abundant quartz inclusions accompanied by some feldspar grains indicate an aeolian contribution from the coast. As with Group A, the general petrographic assemblage indicates that these vessels could have been produced locally in the vicinity of the site, but other provenances cannot be excluded.

*Group C.*— This group is characterized by the use of argillaceous, ferruginous clay that is remarkably optically oriented, containing some ferruginous shales and ooliths. The shales include ferruginous black or red fragments, while other shales are rich in clay minerals and often have a preferred orientation. In some of the shales, silty quartz grains are embedded. The ooliths appear as opaque, black, rounded grains of about 200 µm, having a concentric structure of numerous thin bands. The non-plastic components (f:c ratio$_{\{0.062mm\}}$ = ~97:3) include some siltstone, fine quartz grains and coral fragments. The geological formations that best suit the components of this clay are of the Lower Cretaceous lithological section (whose raw materials have been described in detail, see Greenberg and Porat 1996; Cohen-Weinberger and Goren 2004:75; Goren, Finkelstein and Na'aman 2004:103–105), and many of these components are unique to Lower Cretaceous formations (Mimran 1969; 1972; Shaliv 1972; Rohrlich and Metzer 1980). These formations outcrop widely in the Lebanon Mountains and less frequently in the Anti-Lebanon and Hermon Mountains, as well as on the eastern slopes of the Galilee Hills, in Transjordan (south of Wadi Zarqa), eastern Samaria (Wadi el-Malikh and Wadi Far'ah), and in the Negev. The most relevant for us are the Lower Cretaceous formations exposed in eastern Samaria. Lower Cretaceous clay is usually considered to be of superior quality for pottery production and was widely used as early as the Pottery Neolithic period in Israel (e.g., Goren 1991a:113–114; Glass et al. 1993; Greenberg and Porat 1996).

*Summary and Discussion*

The analyzed pottery can be divided into three petrographic groups: all the Chalcolithic pottery and the EB IB red-striped jar belong to Group B; all the EB IA GBW vessels belong to Group A; and the remaining EB IB vessels are related to Group C.

*The Chalcolithic Period.*— The same raw material (Group B) was used for manufacturing both the Chalcolithic ossuaries and the vessels. This is in accordance with a previously conducted comparison between the raw

materials used for ossuaries and vessels for funerary purposes (Goren 1991b).

*Early Bronze Age IA.*— The general production regions of the EB IA GBW vessels have been well established in previous studies (Goren 1991a; Fischer 2000:204; Goren and Zuckerman 2000:174–175), and the results of this study correspond with those findings. Although the exact source of the vessels made of foraminiferous marl (Group A) has not yet been determined, based on the spatial distribution of this petrographic group, the Senonian marl of the Galilee has been suggested (Goren and Zuckermann 2000:169).

*Early Bronze Age IB.*— The petrographic results indicate that the EB IB amphoriskoi (characterized by the 'dual mode' production technique of a hemispherical bowl joined with an upper body), the jug and the hemispherical bowl were manufactured in the region of Tell el-Far'ah (N) in eastern Samaria (Group C, the Lower Cretaceous clay). Petrographic analyses of similar EB IB vessels from several sites in the Sharon plain indicate that while some were produced locally, others were imported from eastern Samaria (Yannai and Grosinger 2000:160; Cohen-Weinberger 2003; 2004). Apparently, large quantities of vessels were exported from this region to sites located as far as 50 km from the source of production.

The results of this study contribute to the growing data base of analyses of these wares from recent excavations, thus providing material for further disscussions and insights regarding their production, chronology and trade patterns.

## NOTE

[1] The f:c ratio expresses the relative proportions of fine (f) and coarse (c) components of a fabric. The boundary between these two components in this case is 0.062 mm (which is the boundary between silt to sand size; Kemp 1985:22).

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