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The contents of unusual cone-shaped vessels (cornets) from the Chalcolithic of the southern Levant

Dvory Namdar [a,c], Ronny Neumann [b], Yuval Goren [c], Steve Weiner [a,d,*]

[a] Kimmel Center for Archaeological Science, Weizmann Institute of Science, Rehovot 76100, Israel
[b] Department of Organic Chemistry, Weizmann Institute of Science, Rehovot 76100, Israel
[c] Department of Archaeology and Ancient Near Eastern Cultures, Tel Aviv University, Ramat Aviv 69978, Israel
[d] Department of Structural Biology, Weizmann Institute of Science, Rehovot 76100, Israel

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ABSTRACT

Cornets are cone-shaped ceramic vessels, characteristic of the Chalcolithic period (*ca.* 4700–3700 BC) in Israel and Jordan. Their contents and use are unknown. Gas chromatography with flame ionization and mass-selective detection, showed that extracts of cornets from five different sites with different related activities (domestic, habitation cave and a cultic complex) all contain the same assemblage of mainly *n*-alkanes adsorbed within their walls. This assemblage differs from those found in other types of ceramic vessels from the same sites, as well as from the residues found within the associated sediments. The assemblage of odd and even-numbered *n*-alkanes found in the cornets is almost identical to that found in the residues of beeswax heated on modern ceramic fragments, as well as in a beehive from the Iron Age IIA strata at Tel Rehov, Israel. Thus the cornets are most likely to have contained beeswax. The presence of beeswax in the cornets contributes to our understanding of the Chalcolithic period; a time when secondary products such as milk, olive oil and wine are thought to have come into use.

1. Introduction

The Chalcolithic period (∼4700–3800/3700 B.C.E.) in the Levant represents a marked material cultural shift from the preceding Neolithic period, with the emergence of metallurgy (hence the term "Copper-Stone age" or Chalcolithic), as well as the production of olive oil, wine, milk and other secondary products (Sherrat, 1981). This was also a period when ceramic vessels with novel shapes were produced. One of the most enigmatic ceramic vessel types found only in the Ghassulian culture of the southern Levantine Chalcolithic period is the cornet, namely a cone-shaped vessel (Commenge, 2006; Gilead, 1995) (Fig. 1A). Early forms of these vessels are parabola-shaped, while later forms are longer and have an attached solid cigar-shaped extension of their base. Though unevenly distributed among sites, cornets constitute a characteristic component of the Chalcolithic Ghassulian culture of the southern Levant. The relative abundance of cornets varies in different sites (Gilead, 2001). Because of their abundance in public structures, often with religious attributes (Teleilat Ghassul, En Gedi shrine, Gilat sanctuary), it was suggested that they were used for some ritual function (Alon and Levy, 1989; Amiran, 1981; Gilead, 2001; Levy, 2006; Levy et al., 2006). They are however also present in other, apparently domestic contexts, such as at the sites of Grar (Gilead, 1995), Nahal Besor (site O) (Macdonald, 1932), Horvat Hor (Govrin, 1987) and Arad (Amiran, 1978). Their functions are not known.

This study presents analyses of the lipid assemblages extracted from the ceramic walls of cornets from selected sites, using gas chromatography (GC) and GC/mass spectrometry (GC/MS). The sites from which the vessels were obtained represent different archaeological contexts: the En Gedi shrine in the Judean Desert (Ussishkin, 1980), the Moringa cave near the En Gedi shrine, which was possibly used for habitation (Lisker et al., 2007), the habitation site of Grar in the northern Negev (Gilead, 1995), the habitation site of Nahal Qomem (Gat-Guvrin; Wadi Zeita) in the Shephelah lowlands of central-western Israel (Fabian, in press; Perrot, 1955), and the recently excavated cemetery of Horvat Qarqar located in the same region (Fig. 2). The study also includes samples of two other vessel types from the same sites in order to examine the possibility of post-depositional contamination and/or diagenesis. These include bowls on high fenestrated pedestals and holemouth jars (Fig. 1B, C respectively). Sediments from around the items were also analyzed for the same purpose.

* Corresponding author. Department of Structural Biology, Weizmann Institute of Science, Rehovot 76100, Israel.
E-mail address: steve.weiner@weizmann.ac.il (S. Weiner).

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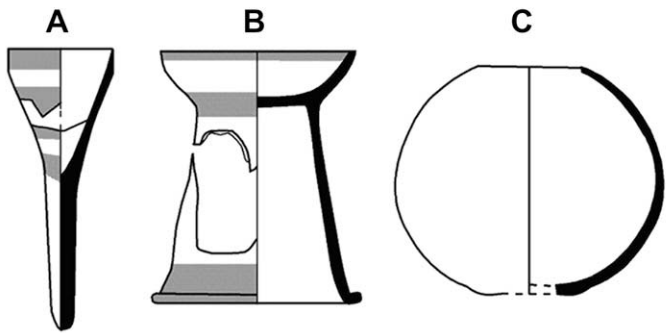

Fig. 1. Schematic illustration of the sampled items. (A) cornet, (B) fenestrated pedestal bowl, (C) holemouth jar. The right side depicts the inside of the item and the left side the outside surface. The black line describes the wall section. The dotted line depicts the red paint on the vessel surface.

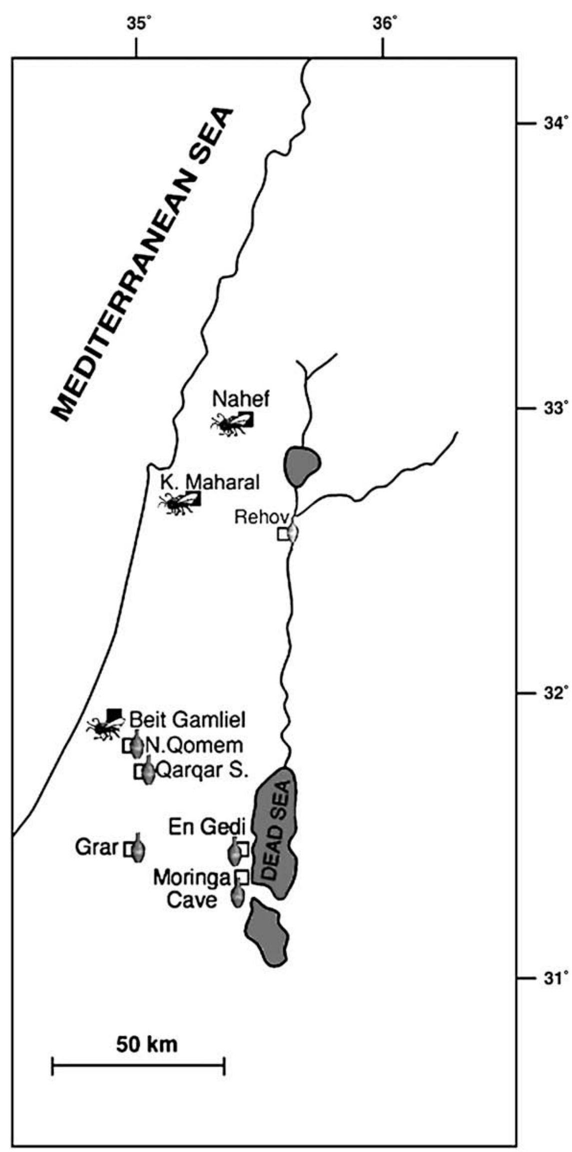

Fig. 2. Schematic map of Israel and its surroundings. Modern beeswax sample sites are marked with a bee; archaeological sites are marked with a jar.

2. Material and methods

2.1. Materials

Analyses were performed on the following vessels: six cornets, two bowls on high fenestrated pedestal and two holemouth jars from the En Gedi shrine; two cornets and two bowls on high fenestrated pedestal from the Moringa Cave; two cornets and two holemouth jars from Grar; six cornets from Nahal Qomem and four cornets from Horvat Qarqar (Fig. 2). Some of the samples from En Gedi and all the samples from Grar were washed after the excavation. For the cornets the lowermost part, closest to the base, was sampled. For the pedestal bowls, the part between the bowl and the leg was sampled. Body fragments of the holemouth jar were sampled. Sediments associated with the vessels were also sampled as controls at all the above sites except for Grar where the entire lot of vessels had been washed. A fresh soil sample from the site could not be obtained due to environmental changes resulting from repeated planting and the use of fertilizers. Fresh sediments were sampled as controls from the site of En Gedi. Wild bee combs were sampled; two from Kerem Maharal, one from Bet Gamliel and one from Nahef (Fig. 2). A purported ancient beehive composed of about 30 conical cylinders from the Iron Age stratum of Tel Rehov was also investigated (Mazar et al., 2008). Two different cylinders from this hive were analyzed as well as the sediments associated with it.

2.2. Methods

2.2.1. Residues extraction method

The extraction and analysis procedures of the lipids from the ceramic vessels followed Evershed et al. (1990) and Charters et al. (1993). All glasswares were pre-treated with 1 N HCl, soaked in fuming nitric acid, washed five times with distilled water, and then washed twice with acetone, followed by chloroform and dried under a heating lamp. Fragments were broken off the ceramic potsherds with pliers. They were cleaned under a stream of clean compressed air, fragmented with a hammer and then ground to a powder in an agate mortar and pestle. About 2 g of the powder was weighed and then split equally into clean glass centrifuge tubes. Duplicate blank samples composed of loess from the Negev heated to 600 °C for 24 h were analyzed with each batch of samples. 10 mL of chloroform and methanol (2:1, v:v) were added to each tube and the mixture was sonicated for 15 min. The tubes were centrifuged for 10 min at 3500 rpm. The supernatant was transferred to another glass centrifuge tube and solvents were evaporated using a CS110 Speed-vac Plus (ThermoSavant). *N*,*O*-bis(trimethyl)silyltrifluoroacetamide (BSTFA) (50–150 μL), containing 1% trimethylchlorosilane (TMC) were added to each tube and heated at 60 °C for 1 h. After derivatization, the samples were dried under a gentle stream of nitrogen and 100–150 μL of cyclohexane was added to each tube. Five microliters of each sample were injected into the gas chromatograph (GC) with either flame ionization (FID) or mass-selective (MSD) detectors. The amounts were calculated from the average peak areas of a series of seven *n*-alkane standards (nC_{26}–C_{32}) compared with the total peak area of compounds extracted from the ceramics and analyzed by the mass spectrometer.

2.2.2. Heat simulation experiment of beeswax on ceramic

Pieces of modern ceramic were washed with dichloromethane for two days. After drying and heating to 600 °C to remove all associated organic compounds, a known amount of modern beeswax was placed on a ceramic fragment and then heated in air to 400 °C for 2 h in an oven (Adam Mandel Company, Aerothermal 2416 controller). The organic residues adsorbed into the ceramic matrix were extracted and analyzed using the methods described