‘Atiqot 89, 2017

Petrographic Examination of Intermediate Bronze Age Storage Vessels from Murḥan, a Site in the Ḥarod Valley

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Geology and Lithology of the Site

The site of Murḥan is situated next to Kibbutz Tel Yosef on the southeastern flank of Giv‘at Qumi, a hill that rises about 100 m above sea level, and about 150 m above the Ḥarod Valley (see Covello-Paran, this volume: Fig. 1). Geologically, Giv‘at Qumi can be divided into two almost equal halves (Hatzor 2000). In the northeastern half, Eocene formations of the ‘Avedat Group are exposed and represented by hard limestone and chalky limestone, sometimes with gravel, quartzolite and vugs. The southwestern half of the hill is Pliocene cover basalt of an alkali-olivine composition (Segev 2005:568–570). A small outcrop of the same basalt can be found about 400 m south of the excavated squares. North–northeast of the site, at a 1.5–2.0 km distance, are small upraised outcrops of Miocene lower and intermediate basalt. The lowlands around Giv’at Qumi are covered with the same Quaternary alluvium that fills the Ḥarod Valley (Hatzor 2000).

The pedology of the vicinity of the site is characterized by brown basaltic and brown Mediterranean forest soils—both of which are calcareous—covering the hills, and by brown alluvial vertisoils covering the valleys (Ravikovitch 1969).

Petrographic Data

Eight samples were selected for petrographic examination. These form two petrographic groups. An inventory of the thin sections is represented in Table 1.

Group 1

This group includes six storage jars (Fig. 1). These are characterized by a light brown isotropic matrix. The only exception is Sample 1.1, the cross section of which is characterized

Table 1. Inventory of the Examined Samples

Sample No.	Vessel	Locus	Basket	Illustrated in Covello-Paran, this volume	Petrographic Group	Provenance
1.1	Storage jar	300	3014/24	Fig. 8:11	1	Central Jordan Valley
1.2	Storage jar (metallic)	300	3000	Fig. 8:10	1	Central Jordan Valley
1.3	Storage jar handle	300	3014/16	Fig. 8:15	1 (Fig. 1)	Central Jordan Valley
1.4	Holemouth	300	3014/22	Fig. 8:5	2 (Fig. 2)	Jezreel Valley
1.5	Holemouth	300	3014/50	Fig. 8:3	2	Jezreel Valley
2.1	Storage jar	1000	10/1	Fig. 10	1	Central Jordan Valley
2.2	Jug	1000	10/2	Fig. 9:5	1	Central Jordan Valley
2.3	Storage jar	1000	10/4	Fig. 9:4	1	Central Jordan Valley

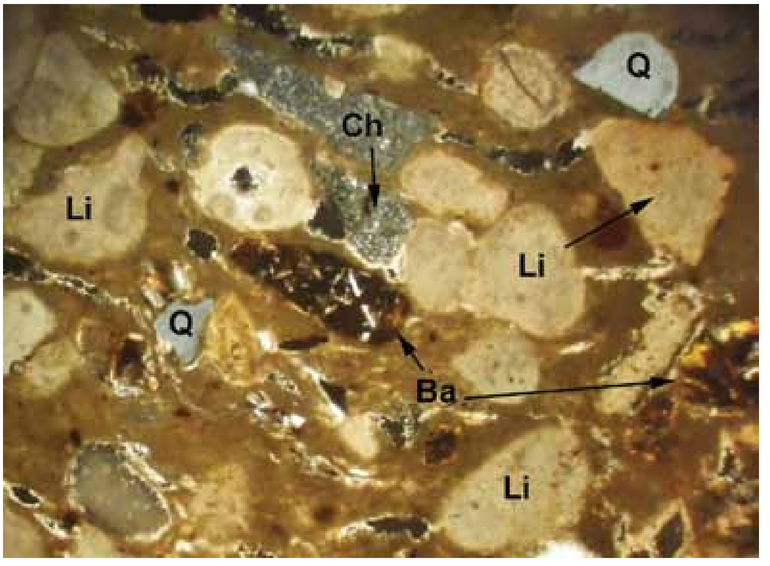

Fig. 1. Sample 1.3 (3014/16). Magnification × 20, crossed nicols, field size 2.5 mm. Q = quartz, Li = limestone, Ch = chert, Ba = basalt.

by a relatively thin (about 1 mm) layer of brown material, while the rest of the sherd is gray to dark gray with optically active clay minerals.

Non-plastic material composes 20–25% of the sherd volume for all the jars, except in Sample 1.1, for which the quantities of coarse inclusions do not exceed 12%. In all the samples, the non-plastic grain size ranges between 0.2 and 0.5 mm, although some elongated fragments reach 1.0 mm in length. The samples contain the following: ~70% carbonate rocks, ~20% basalt and ~10% chert and quartz. Some of the carbonate grains preserved traces of the original foraminifers' structure; quartz and alkali-olivine basalt grains are rounded to sub-rounded, and chert grains are sub-rounded to angular. The grains of carbonate rocks, all of which are milky, are mostly rounded (limestone or chalk), although some are elongated (possibly fossiliferous aquatic shells' fragments). Relatively large, 1.5–2.0 mm lumps of matrix material are sporadically present in the thin sections. In Sample 1.1, limestone, foraminiferous chalk and fossiliferous aquatic shell fragments all have a clear inner structure. Tiny cracks are numerous within the cross sections of all the examined sherds. These are oriented parallel to the surface of the vessels, and possibly occurred due to over-tempering of the ceramic paste.

Discussion.— The isotropic matrix of the discussed samples, together with the milky appearance of the carbonate materials (both rocks and shells), point to a high firing temperature, estimated to have been above 800ºC. The high firing temperature also caused the "metallic" appearance of Sample 1.2. The only exception is Sample 1.1, the cross section of which shows evidence of a lack of oxygen in the kiln during firing. This can also happen to the bodies of closed vessels (e.g., jars, jugs, etc.), whose narrow rims can stop oxygen from entering during firing when vessels are packed tightly into a kiln. The firing temperature for Sample 1.1 was estimated to have been no higher than 750ºC, as the clay minerals of the matrix and carbonate material of coarse inclusions maintained their optical properties.

The inclusions are uniformly rounded and fine-grained, suggesting that they were rolled while being transported by water, and should therefore be considered river (wadi) sand.

The non-plastic material is the characteristic feature of the jars in petrographic Group 1. This material is fine sand that was possibly collected from the riverbed and sieved by the potter, and then used to temper the ceramic paste. While this was meant to improve the quality of the clay, over-tempering frequently occurred. This sand is an assemblage of rounded or nearly rounded fragments of a number of rocks and minerals, mostly limestone, basalt, chert and quartz. Given that the limestone decomposed during firing, leaving only weak traces of its original structure, and that it is, moreover, a common component in pottery, the discussion here will center on the other rocks and minerals.

There are two types of alkali-olivine basalt present. One—with fresh olivine phenocrysts—is characteristic of the young Quaternary basalt covering the Golan Heights and part of the Bashan (Basan) area in southern Syria. The other—with olivine altered to iddingsite—is characteristic of the Neogene-Pleistocene alkali-olivine basalt (Burdon 1959:39–42; Horowitz 1975–1977:51–53; Keller 1983:328; Williams-Thorpe et al. 1991:34; Philip and Williams-Thorpe 1993:56), which is found in flows in the eastern Upper Galilee, the Golan Heights, the Jezreel Valley and northward, and the Central Jordan Valley from Bet She'an to the Sea of Galilee (Sneh, Bartov and Rosensaft 1998). Other important components of the temper are chert and quartz. In northern Israel, chert is usually associated with the Turonian Bina formation, Upper Santonian Mishash formation or the Eocene formations, all of which could also be sources of limestone. The quartz is mature (i.e., rounded and devoid of any unstable accessory minerals) and some of its grains bear an iron oxide coating; hence, it is derived from quartzitic sandstones. In areas with younger basalt outcrops, such sand can only be related to the lower formations of the Lower Cretaceous lithological section. These formations widely appear on the slopes of Mt. Hermon, as well as in some limited exposures in the Manara-Ramim ridge (Mor 2006; Sneh and Weinberger 2014 respectively) and in the western Galilee (Bogoch and Sneh 2008; Levitte and Sneh 2013).

In short, the mineralogical characteristics and granulometry of the sand indicate that it was mined from a riverbed that drained an area where Quaternary and Neogene-Pleistocene basalt and limestone are exposed. In the eastern Galilee and the Central Jordan Valley there are very few streams that could potentially drain an area large enough to include such a rich variety of rock types. One such stream is a conduit of the Yarmuk River that cuts the basalt of the southern Golan Heights and the underlying chalk of the Miocene Hordos formation and Eocene 'Adullam formation. Another, is the Jordan River, which collects sediments from the entire area between Mt. Hermon and the Bet She'an Valley (Orni and Efrat 1971:83–94; Sneh, Bartov and Rosensaft 1998). There are several reasons why the area of possible provenance of the discussed petrographic group should be reduced to the central Jordan Valley, between the Sea of Galilee and Bet She'an: (1) Eocene chalk, a possible source of chert, is not found north of the Sea of Galilee; (2) travertine, which is a characteristic feature of the Bet She'an area (Rozenbaum et al. 2005:1), is absent from the thin sections; and (3) the Eocene era in the vicinity of Tel Yosef is represented by limestone formations.

Comparison to the existing pottery collection reveals that vessels that are petrographically identical (i.e., manufactured at the same pottery workshop) and dated to the same period were unearthed at 'Ein el-Hilu (Goren and Shapiro, in prep.: Sample A-3.10, holemouth jar) and Tel 'Afula (Shapiro, in prep.: Samples 6, 8, jars). Additionally, this petrographic group is dominant in Intermediate Bronze Age ceramic assemblages of the central Jordan Valley, including the ceramic assemblage of Tel 'Amal (Goren 1991).

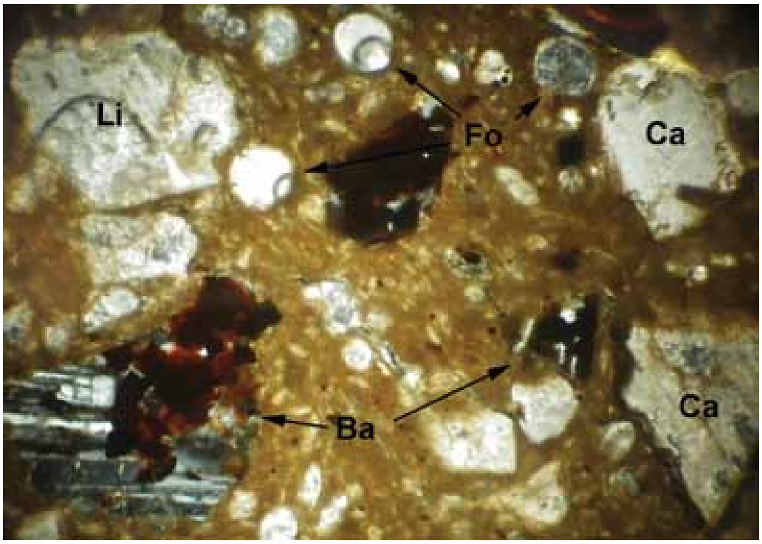

Fig. 2. Sample 1.4 (3014/22). Magnification × 50, crossed nicols, field size 1.5 mm. Ba = basalt, Li = limestone, Ca = calcite, Fo = foraminifera.

Group 2

This group is represented by two vessels (Fig. 2). These are characterized by a slightly ferruginous foraminiferous matrix containing rare silt-size grains of quartz- and basalt-derived minerals. The identifiable foraminifers are dated to the Eocene (Globigerina) and Paleocene (*Subbotina*) eras.

Non-plastic material comprises about 15% of the sherds' volume. It is represented mostly by poorly sorted angular and sub-angular grains of crystalline limestone or dolomite that decomposed during firing (larger grains 1–2 mm), and angular and rhombic calcite crystals (0.2–0.5 mm) that most likely originated because of the mechanic destruction of crystalline limestone. In addition, there are sub-rounded to rounded grains of alkali-olivine basalt ranging between 0.2 and 1.0 mm, with the olivine partially altered to iddingsite.

Discussion.— The optical properties of the clay and carbonate material indicate that Sample 1.4 was fired at 700–750ºC, and that the temperature briefly rose to about 800ºC at the end of the firing process. As a result, such vessels, characterized by relatively thick walls, were baked properly and no charred organic traces remained. Moreover, the 2 mm of the surface layer in the sherd's cross section shows signs of the first stages of vitrification, i.e., the clay almost lost its optical properties and the carbonate material is somewhat milky. Sample 1.5 was fired at a temperature above 800ºC. As a result, the clay turned isotropic and milky and took on a greenish-tan color, and all the carbonate material turned milky and even began disappearing, leaving only voids.

The lithological assemblage of the samples forming petrographic Group 2 points to an area where foraminiferous marl (most of which matches the Taqiye marl of the Paleocene), biogenic chalk of the Eocene-Paleocene, crystalline limestone or dolomite, and olivine basalt are exposed.

The basalt is holocrystalline and belongs to the alkali-olivine category in which olivine phenocrysts altered into iddingsite. This is typical of Miocene and Pliocene basalt (Williams-Thorpe et al. 1991), which crops out all over the Jezreel Valley, and in the close vicinity of the site (Hatzor 2000). The crystalline limestone, which was crushed and added to the ceramic paste, can easily be found in the places mentioned above, where the Eocene Yizra‘’el Formation crops out.

Comparison with the existing thin section collection amassed from my own previous research reveals that petrographically identical vessels dated to Intermediate Bronze Age were unearthed at ‘Ein el-Hilu (Goren and Shapiro, in prep., Group 1). The frequent use of Taqiye marl for pottery production is well-known from many ceramic assemblages in the Lower and western Galilee, but previous studies reveal that it is particularly characteristic of Jezreel Valley Intermediate Bronze Age assemblages (Goren 1990:40–41; 1992:334–337; Goren and Zuckermann 2000:179–182). Based on these facts, and since a pottery workshop containing this material has yet to be found elsewhere, it can be assumed that the vessels of petrographic Group 2 were produced in the Jezreel Valley.

REFERENCES

Bogoch R. and Sneh A. 2008. *Geological Map of Israel 1:50,000. Sheet 4-I (Arbel)* (GSI). Jerusalem. http://www.gsi.gov.il/_Uploads/ftp/GeologicalMap/arbel.html (accessed January 6, 2015).

Burdon D.J. 1959. *Handbook of the Geology of Jordan*. Amman.

Covello-Paran K. This volume. Murḥan: An Intermediate Bronze Age Site in the Ḥarod Valley.

Goren Y. 1990. Petrographic Analyses of Several Wares from Kabri. In A. Kempinski and W.-D. Niemeier eds. *Excavations at Kabri: Preliminary Report of 1989 Season 4*. Tel Aviv. Pp. XL–LII.

Goren Y. 1991. Petrographic Examination of the Ceramic Assemblage from Tel ‘Amal. *‘Atiqot* (*ES*) 20:129–130.

Goren Y. 1992. Petrographic Study of the Pottery Assemblage from Munhata. In Y. Garfinkel. *The Pottery Assemblages of the Sha‘ar Hagolan and Rabah Stages of Munhata (Israel)* (Les Cahiers du CRFJ 6). Paris. Pp. 329–360.

Goren Y. and Shapiro A. In preparation. Petrographic Analysis of Intermediate Bronze Age, Middle Bronze Age, and Iron Age Pottery Assemblages: From the Two Seasons of Excavations at ‘Ein El-Ḥelu.

Goren Y. and Zuckermann S. 2000. An Overview of the Typology, Provenance and Technology of the Early Bronze Age I ‘Gray Burnished Ware.’ In G. Philip and D. Baird eds. *Ceramics and Change in the Early Bronze Age of the Southern Levant*. Sheffield. Pp. 165–182.

Hatzor Y.H. 2000. *Geological Map of Israel 1:50,000. Sheet 6-I, II (Bet She’an)* (GSI). Jerusalem. http://www.gsi.gov.il/_Uploads/ftp/GeologicalMap/Bet_shean.html (accessed January 6, 2015).

Horowitz A. 1975–1977. The Quaternary Stratigraphy and Paleogeography of Israel. *Paléorient* 3:47–100.

Keller J. 1983. Potassic Lavas in the Orogenic Volcanism of the Mediterranean Area. *Journal of Volcanology and Geothermal Research* 18:321–335.

Levitte D. and Sneh A. 2013. *Geological Map of Israel 1:50,000. Sheet 2-III (Zefat)* (GSI). Jerusalem. http://www.gsi.gov.il/_Uploads/ftp/GeologicalMap/Zefat.html (accessed January 6, 2015).

Mor D. 2006. *Geological Map of Israel 1:50,000. Sheet 2-II E (Merom Golan)* (GSI). Jerusalem. http://www.gsi.gov.il/_Uploads/ftp/GeologicalMap/MeromGolan.html (accessed January 6, 2015).

Orni E. and Efrat E. 1971. *Geography of Israel*. Jerusalem.

Philip G. and Williams-Thorpe O. 1993. A Provenance Study of Jordanian Basalt Vessels of the Chalcolithic and Early Bronze Age I Periods. *Paléorient* 19/2:51–63.

Ravikovitch S. 1969. *Soil Map 1:250000, North* (Survey of Israel). Jerusalem.

Rozenbaum A.G., Zilberman E., Bar-Matthews M., Ayalon A. and Agnon A. 2005. *Tufa Deposits in the Bet She’an Valley—Stratigraphic Analysis of the Tufa Plateau* (GSI). Jerusalem.

Segev A. 2005. Phanerozoic Magmatic Activity Associated with Vertical Motions in Israel and the Adjacent Countries. In J.K. Hall, V.A. Krasheninnikov, F. Hirsch, C. Benjamini, and A. Flexer eds. *Geological Framework of the Levant* II: *The Levantine Basin and Israel*. Jerusalem. Pp. 553–577.

Shapiro A. In preparation. Petrographic Examination of the Selected Vessels Excavated at Tel ʻAfula. *ʻAtiqot*.

Sneh A. and Weinberger R. 2014. *Geological Map of Israel 1:50,000. Sheet 2-II (Metulla)* (GSI). Jerusalem. http://www.gsi.gov.il/_Uploads/ftp/GeologicalMap/Metulla.html (accessed January 6, 2015).

Sneh A., Bartov Y. and Rosensaft M. 1998. *Geological Map of Israel 1:200,000. Sheet 1* (GSI). Jerusalem.

Williams-Thorpe O., Thorpe R.S., Elliott C. and Xenophontos C. 1991. Archaeology, Geochemistry, and Trade of Igneous Rock Millstones in Cyprus during the Late Bronze Age to Roman Periods. *Geoarchaeology* 6:27–60.